

FLORA OF EGYPT

Volume One

Azollaceae - Oxalidaceae

Loutfy Boulos

Al Hadara Publishing
Cairo, Egypt

1999

Cover photographs by the author
Maerua crassifolia (left)
Astragalus kahiricus (background)

First published 1999

All rights reserved.

Copyright © 1999 by
Al-Hadara Publishing
7 Abou El-Seoud Street,
Dokki 12311
Cairo, Egypt

Tel. 20-2-3619439
Tel. & Fax 20-2-3605898
E-mail: hadara@ritsec1.com.eg

No part of this book may be
reproduced, stored in a retrieval
system or transmitted in any form or
by any means, electronic,
mechanical, photocopy, recording
or otherwise, without the prior
written permission
of the copyright owner.

Dar El Kotub No. 2419/1999
I. S. B. N. 977-5429-14-5

Printed in Egypt

dedicated to the memory of

Vivi Täckholm (1898-1978)

and

Mohammed Drar (1894-1964)

obeyikandi.com

obeikandi.com

Contents

Foreword	vii	Portulacaceae	49
Preface	ix	Caryophyllaceae (incl. Illecebraceae)	50
Acknowledgements	xi	Chenopodiaceae	92
Phytogeographical regions	xii	Amaranthaceae	129
Endemic taxa	xiii	Ranunculaceae	142
New combination	xiii	Berberidaceae (incl. Leonticaceae)	151
Abbreviations	xiv	Menispermaceae	151
References	xv	Nymphaeaceae	152
Azollaceae	1	Ceratophyllaceae	153
Equisetaceae	2	Aristolochiaceae	155
Ophioglossaceae	2	Guttiferae	156
Adiantaceae	3	Papaveraceae	157
Actiniopteridaceae	6	Fumariaceae (incl. Hypecoaceae)	164
Aspleniaceae	6	Capparaceae (incl. Cleomaceae)	170
Marsileaceae	7	Cruciferae	181
Cupressaceae	10	Resedaceae	231
Ephedraceae	10	Moringaceae	238
Salicaceae	13	Crassulaceae	238
Moraceae	14	Vahliaceae	243
Urticaceae	16	Rosaceae	244
Santalaceae	20	Neuradaceae	249
Loranthaceae	21	Leguminosae	249
Polygonaceae	21	Podostemaceae (incl. Tristichaceae)	372
Nyctaginaceae	35	Oxalidaceae	373
Molluginaceae (incl. Gisekiaceae)	39	Colour photographs	377
Aizoaceae	44	Index to scientific names	401

obbeikandi.com

Foreword

Egypt is part of the Sahara (North African Desert). Its area is about one million km² divided by the River Nile into a Western (Libyan) Desert of about 681,000 km² and an eastern part comprising the Eastern (Arabian) Desert (c. 223,000 km²) and the Sinai Peninsula (c. 61,000 km²). The Nile Valley including the Delta forms a riparian oasis (c. 40,000 km²) that is the densely inhabited farmlands of Egypt. Arid climate prevails and together with the long history of human exploitation may have impoverished biotic diversity, but the geographical position and habitat diversity impart interesting attributes on the biota.

With its position at the northeast corner of Africa, Egypt forms a bridge between Asia and Africa. The Sinai Peninsula is part of Asia, the rest of the country is part of Africa. It is also part of the Mediterranean Basin (c. 1,200 km coastal front), and it embraces two biogeographic corridors that link the tropics in the south and the palaearctics in the north: the Red Sea links the tropical seas of the Indian Ocean with the temperate Mediterranean; the River Nile links equatorial Africa and monsoonal Ethiopian highlands with the Mediterranean basin. The Red Sea and the River Nile are also two principal highways along the migratory routes of the palaeartic-tropic journeys of birds. The history of climate during the Quaternary (Pluvials and Interpluvials) and the history of the River Nile that acquired its present form and hydrological rhythm in recent times (10-20 thousand years), are aspects of the history of the present biota.

This geographical position is associated with a series of biogeographical belts: the Mediterranean, the Saharo-Arabian and Sudano-Deccanian; the highlands of southern Sinai represent an outpost of the Irano-Turanian biota; and the highlands of the southeastern corner of Egypt (the Elba region) represent the northeast outpost of the biota of the Ethiopian highlands.

Habitat diversity relates to the geographical position and to landform diversity. The wetlands of the northern lakes (Bardawil, Manzala, Borollos, Idku and Mareotis) and the inland lakes including Qarun and Rayyan (Faiyum Governorate) and the extensive man-made lake of the Aswan High Dam, provide wetland habitats of international importance and ecological significance. The coastal lands of the Mediterranean and the

Red Sea with their associated littorals are habitats of rich biota. The highlands of southern Sinai, including the St. Catherine Mountain (highest summit in Egypt, 2,641 m) intercept orographic precipitation, including snow and ice during winter, and provide home for a rich biota including numerous endemic plant species. These highlands provide the Gulf of Aqaba with shelter against the cool northerlies and make it a warm environment that brings tropical biota (corals, mangroves, etc.) to their world northernmost latitudinal limit. A series of limestone hills that stud the plains of northern Sinai (El-Maghara, Yelleg, Halal, etc.) provide refugial sites of a number of species that are apparently relicts of once rich growth of *Juniperus phoenicea* woodlands. The Nile valley and its farmlands are habitats for a rich variety of weeds including numerous naturalized exotics. The oases of the Western Desert provide refugial habitats for a variety of plant species.

Interest in the flora of Egypt has been sustained since the eighteenth century and especially in the twentieth century when the University of Cairo and the Ministry of Agriculture initiated the establishment of two herbaria that became seats of studies on the plants of Egypt and neighbouring countries. Vivi Täckholm and Mohammed Drar stand as figures of special stature in this endeavour; they collaborated in the writing of volumes of the encyclopedic *Flora of Egypt* that covered part of the flora. Revived interest in the biodiversity studies was inspired by the world Biodiversity Convention, a nationwide plan of action on biodiversity (scientific inventories and programmes for conservation) was initiated in 1992. Loutfy Boulou contributed to these studies by producing in 1995 his *Flora of Egypt Checklist*. The present volume is the first of a series of *Flora of Egypt* that will provide a revised and updated systematic treatment of the vascular plants in Egypt. In writing this *Flora*, Loutfy Boulou, a remarkable Egyptian botanist by all measures of excellence, has combined a life long experience in studies of the floras of Egypt and the Middle East and herculean zeal that enabled him to accomplish this most welcome work.

Cairo, January 1999

M. Kassas
Emeritus Professor of Botany
University of Cairo

Preface

The major works on the flora of Egypt which deal with the entire flora of the country or partly in their context are those of Forsskål, *Flora Aegyptiaco-Arabica* (1775); Delile, *Description de l'Égypte, Histoire Naturelle* (1814); Ascherson & Schweinfurth, *Illustration de la Flore d'Égypte* (1887-1889); Muschler, *Manual Flora of Egypt* (1912); Ramis, *Bestimmungstabellen zur Flora von Ägypten* (1929); Täckholm & Drar, *Flora of Egypt* (1941-1969, 4 vols. covering the Monocots and the beginning of Dicots); Täckholm, *Students' Flora of Egypt* (1974); Greuter, Burdet & Long (eds.), *Med-Checklist* (1984-1989, vols. 1, 3 & 4).

The nomenclature adopted by Täckholm (1974) is updated by Boulos (1995) in the *Flora of Egypt Checklist*; new records, the results of taxonomic revisions affecting the flora of Egypt during the period of 1974-1995 are also included. Evidently, there is a need for a modern Flora of Egypt, with precise descriptions and keys for the identification of taxa, as well as illustrations of as many species as possible.

In countries having large areas of deserts, like Egypt, the limited number of species, whose habitats are generally at risk, is a better reason for enumeration, description, and conservation. This is because desert plants are hardy and have developed over millennia adaptational mechanisms, including the production of a host of secondary metabolites, to protect themselves from physical and biotic aggressions. These metabolites are the stuff of the medicinal uses of these plants. Conservation of desert plants for medicinal uses is therefore a must and requires a thorough knowledge of their morphology, taxonomy, ecology, physiology, and biochemistry. To avoid mistakes, such knowledge can only be obtained starting with a correct identification, by relying on well-written floras. Without such floras, we will never know what we exactly have, and the species may be lost before we even know about their existence. And this *Flora of Egypt* is hopefully the one for our country, that would help in the rational utilization of our valuable biodiversity resources.

The present volume is the first of three volumes of *Flora of Egypt*. It covers the native and naturalized vascular plants; cultivated plants are not covered. This volume includes 42 families (Azollaceae-Oxalidaceae), 237 genera, 719 species and 78 subspecies or

varieties. The sequence of taxa is more or less like that in Täckholm's *Students' Flora of Egypt* which is based on Engler's System.

The largest families in Volume 1: Leguminosae 228 species; Cruciferae 102, Caryophyllaceae 87 and Chenopodiaceae 76 species. The largest genera are: *Astragalus* 32 species; *Silene* 29; *Trifolium* 19; *Atriplex*, *Lotus* and *Medicago* 18 species each; *Vicia* 14, *Indigofera* 13 and *Salsola* 12 species. Endemic taxa are 24 (21 species and 3 varieties). The illustrations comprise original line drawings of 544 species in 67 plates by several artists and 96 colour photos by the author.

One new combination is made (see p. 313).

Families and genera are described in some detail. Keys to the genera and species are provided. For every species, full citations are given for the accepted name and synonyms, a concise description, distribution in Egypt, habitat and general distribution. Sinai, being an Asiatic territory, is treated as a part of Asia. On the other hand, mainland Egypt is treated as a part of North Africa. Palestine is treated in the geographical sense as adopted by *Flora Palaestina*, comprising Jordan, Israel and the Palestinian territories. Notes on the economic uses, geographical distribution or a taxonomic discussion is provided for some species.

Volume 2 will include the remaining families of the Dicots from Geraniaceae to Compositae, and vol. 3 the Monocots.

Cairo, January 1999

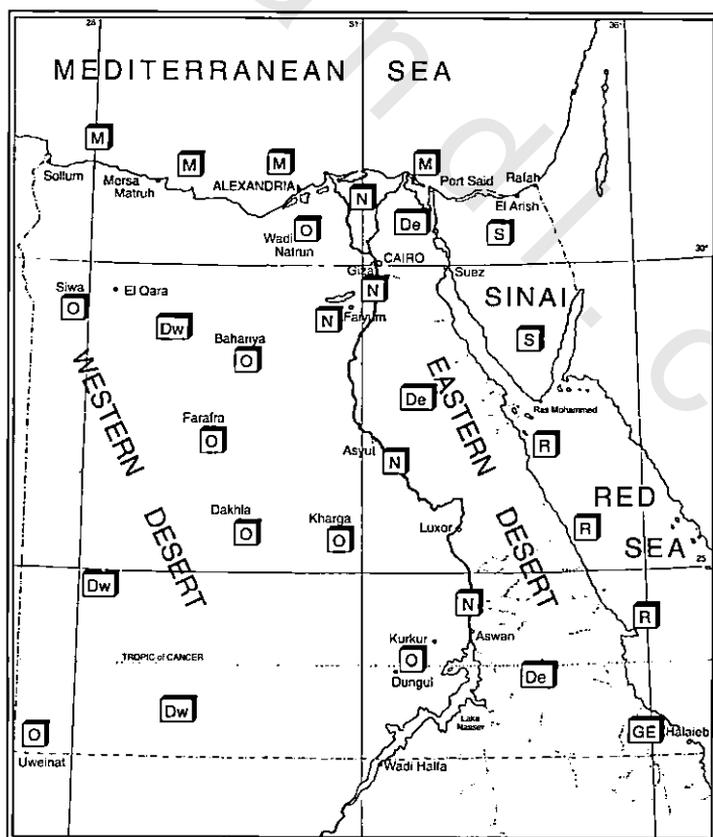
L. Boulos

Acknowledgements

Most of this volume was written and the line drawings were produced at the Herbarium, Royal Botanic Gardens, Kew, U. K, during the summers of 1996-1998 and I wish to thank the Director, Professor Sir Ghilleen Prance and the Keeper of the Herbarium, Professor Simon Owens, as well as all the members of staff of the Herbarium and Library for the use of facilities and their kind help; without their support this work would have never appeared in its present shape. The following colleagues at Kew kindly revised manuscripts - Polygonaceae: Richard Brummitt; Ferns and fern allies: Peter Edwards; Loranthaceae: Roger Polhill; *Indigofera*: Brian Schrire; *Ceratophyllum* and *Salix*: Melanie Wilmot-Dear. I am particularly indebted to Thomas Cope for his continuous help and support over the years. I am most grateful to John Akeroyd, who carefully read the entire manuscript and contributed many corrections. The great skill and patience of the botanical artists Magdy El-Gohary, Margaret Tebbs, Camilla Speight, Judi Stone and Linda Gurr, who produced the line drawings, is most appreciated. I also wish to thank Professor Mohamed Kassas who encouraged me in this work. To the following colleagues my sincere thanks for facilities and kind hospitality during field trips: Adel El-Gazzar, Sinai; Kamal Shaltout and Ahmed Sharaf El-Din, Nile Delta; Salah S. Ahmed and Mohamed El-Sayed, Eastern Desert and Gebel Elba. I am indebted to H. E. Professor Y. A. Wali, Deputy Prime Minister and Minister of Agriculture and Land Reclamation, for a research grant which supported my travel to Kew.

Phytogeographical regions

- N:** The Nile region including the delta, valley and Faiyum.
- O:** The oases of the Western Desert: Wadi Natrun, Siwa, Farafra, Bahariya, Kharga, Dakhla, Kurkur, Dungul and Uweinat.
- M:** The Mediterranean coastal strip from the border with Libya near Sollum to Port Said.
- D:** All the deserts of Egypt except that of Sinai.
- De:** Desert east of the Nile except that of Sinai.
- Dw:** Desert west of the Nile.
- R:** The Red Sea coastal strip.
- GE:** Gebel Elba and the surrounding mountainous region.
- S:** The entire Sinai peninsula including the coastal Mediterranean strip and El-Tih Desert east of Suez Canal.



Endemic taxa in this volume

- Astragalus camelorum* Barbey S.
Astragalus fresenii Decne. S.
Biscutella didyma L. var. *elbensis* (Chrtek) El-Naggar GE.
Brassica deserti Danin & Hedge S.
Bufonia multiceps Decne. S.
Dianthus guessfeldtianus Muschl. De.
Fumaria microstachys Hausskn. M.
Glinus runkewitzii Täckh. & Boulos N (Luxor, Khizam Island).
Lupinus digitatus Forssk. N.
Melilotus serratifolius Täckh. & Boulos O (Dakhla).
Persicaria obtusifolia (Täckh. & Boulos) Greuter & Burdet N (Faiyum).
Rorippa integrifolia Boulos S.
Rosa arabica Crép. S.
Rumex aegyptiacus L. N.
Silene leucophylla Boiss. S.
Silene odontopetala Fenzl var. *congesta* Boiss. S.
Silene oreosinaica Chowdhuri S.
Silene schimperiana Boiss. S.
Sinapis allionii Jacq., N, M.
Tephrosia kassasii Boulos N (Nubia).
Thesium humile Vahl var. *maritima* (N. D. Simpson) Sa'ad M.
Trigonella media Delile N.
Trigonella oculata Ser. N, M, Dw.
Vicia sinaica Boulos S.

New combination

- Indigofera trita** L. f., Suppl. Pl. 335 (1781) subsp. **subulata** (Vahl ex Poir.) Ali
var. **nubica** (J. B. Gillett) Boulos & Schrire, comb. nov.
Basionym: *Indigofera subulata* Vahl ex Poir. in Lam., Encycl., Suppl. 3: 150
(1813) var. *nubica* J. B. Gillett, Kew Bull., Add. Ser. 1: 100 (1958).

Abbreviations

auct.	<i>auctorum</i> : of authors.
auct. mult.	<i>auctorum multorum</i> : of many authors.
c.	<i>circa</i> : around.
comb. inval.	<i>nomen non rite publicatum</i> : name not validly published.
comb. nov.	<i>combinatio nova</i> : nomenclatural new combination.
l. c.	<i>loco citato</i> : on the page perviously cited.
nom. ambig.	<i>nomen ambiguum</i> : ambiguous name.
nom. confus.	<i>nomen confusum</i> : confused name.
nom. conserv.	<i>nomen conservandum</i> : conserved name.
nom. illeg.	<i>nomen illegitimum</i> : illegitimate name.
nom. nud.	<i>nomen nudum</i> : name unaccompanied by a description.
op. cit.	<i>opere citato</i> : in the work previously cited.
p. p.	<i>pro parte</i> : in part.
s. l.	<i>sensu lato</i> : in a broad sense.
syn.	synonym.
syns.	synonyms.

Abbreviations of the authors' names follow those proposed by Brummitt & Powell, *Authors of Plant Names* (1992).

References

(Basic floras)

- Ali, S. I., Jafri., S. M. H. & El-Gadi, A. (eds.). 1977-1989. Flora of Libya. Al Faateh Univ. Tripoli.
- Boissier, E. 1867-1888. Flora Orientalis, vols. 1-5 & Suppl. Genève. Bâle, Lyon.
- Boulos, L. 1995. Flora of Egypt Checklist. Al-Hadara Publishing. Cairo.
- Boulos, L. & El-Hadidi, M, N. 1994. The Weed Flora of Egypt. American Univ. Press. Cairo.
- Davis, P. H. *et al.* (eds.). 1965-1972. Flora of Turkey and East Aegean Islands, vols. 1-4. Edinburgh.
- Greuter, W., Burdet, H. M. & Long, G. (eds.). 1984, 1986, 1989. Med-Checklist, vols. 1, 3, 4. Genève.
- Hedberg, I. & Edwards, S. (eds.). 1989. Flora of Ethiopia, vol. 3 Addis Ababa, Asmara, Uppsala.
- Maire, R. 1961-1987. Flore de l'Afrique du Nord, vols. 7-16. Le Chevalier. Paris.
- Mandaville, J. P. 1990. Flora of Eastern Saudi Arabia. Kegan Paul International Ltd. London, New York, Riyadh.
- Meikle, R. D. 1977, 1985. Flora of Cyprus, vols. 1, 2. Bentham-Moxon Trust, Royal Botanic Gardens. Kew.
- Miller, A. G. & Cope, T. A. (eds.). 1996. Flora of the Arabian Peninsula and Socotra. vol. 1. Edinburgh.
- Mouterde, P. 1960, 1970. Nouvelle Flore du Liban et de la Syrie, vols. 1, 2. Dar El-Machreq, Beirut.
- Nasir, E. & Ali, S. I. (eds.). 1970, in progress. Flora of Pakistan. Karachi.
- Polhill, R. M. *et al.* (eds.). 1949, in progress. Flora of Tropical East Africa. Rotterdam, Balkema.
- Strid, A. & Tan, Kit (eds.). 1997. Flora Hellenica, vol. 1. Koeltz Scientific Books. Königstein.
- Täckholm, V. 1974. Students' Flora of Egypt, ed. 2. Publ. Cairo Univ., Beirut.
- Thulin, M. (ed.). 1993. Flora of Somalia, vol. 1. Royal Botanic Gardens. Kew.
- Townsend, C. C. & Guest, E. (eds.). 1966-1980. Flora of Iraq, vols. 1-4. Ministry Agric. Baghdad.
- Tutin, T. G. *et al.* (eds.). 1964, 1968. Flora Europaea, vols. 1, 2 (vol. 1, ed. 2. 1993). Cambridge Univ. Press. Cambridge.
- Zohary, M. 1966, 1972. Flora Palaestina, vols. 1, 2. Israel Acad. Sci. Humanities. Jerusalem.

obeikandi.com

Key to the major divisions of vascular plants:

1. Vascular plants reproducing by spores, herbaceous **Pteridophyta**
+ Vascular plants reproducing by seeds, woody or herbaceous 2

2. Ovules not enclosed in an ovary, perianth absent, trees or shrubs **Gymnospermae**
+ Ovules enclosed in an ovary, perianth usually present, trees or shrubs **Angiospermae**

Division I. **Pteridophyta**

Key to the genera of ferns and fern allies:

1. Stems jointed; leaves reduced to a sheath at the nodes **2. Equisetum**
+ Stems not jointed; leaves (fronds) not reduced to a sheath 2

2. Plants free-floating on water **1. Azolla**
+ Plants rooted in the ground, aquatic or terrestrial 3

3. Fronds (leaves) with 4 pinnae (leaflets) on long stipes (petioles) **10. Marsilea**
+ Fronds not as above 4

4. Fronds not circinnate in bud **3. Ophioglossum**
+ Fronds circinnate in bud 5

5. Fronds fan- or wedge-shaped, dichotomously branching **8. Actiniopteris**
+ Fronds not fan- or wedge-shaped, not dichotomously branching 6

6. Sori elongate, placed along the veins 7
+ Sori marginal, covered by the deflexed leaf margins 8

7. Delicate small annual; fronds membranous, thin **5. Anogramma**
+ Perennials; fronds coriaceous **9. Asplenium**

8. Pinnae with flabellate venation, toothed or lobed **4. Adiantum**
+ Pinnae with pinnate venation, not toothed or lobed 9

9. Fronds parsley-like, dimorphic, irregularly pinnate, fertile and sterile **7. Onychium**
+ Fronds not parsley-like, all similar, regularly pinnate **6. Cheilanthes**

AZOLLACEAE

Description as for *Azolla*, the only genus in the family.

1. *Azolla* Lam.

Very small free-floating aquatic plants; stems slender, branching; roots simple; leaves small, 2 at each node, bilobed, upper lobe herbaceous, lower hyaline; sori 2 or 4 on the lower lobe of the first leaf of each branch, surrounded by an indusium, microspores in four clumps (massulae) per sporangium, usually covered by barbed hairs (glochidia), megasporangia with one megaspore. 6 species, tropical and warm regions.

1. Upper leaf-lobe obtuse, with a broad membranous margin
+ Upper leaf-lobe subacute, with a narrow membranous margin

1. **A. filiculoides**
2. **A. caroliniana**

1. **Azolla filiculoides** Lam., Encycl. 1: 343 (1783).

Annual, floating, elliptical, 1-8 cm diam., bluish-green or reddish, upper leaf-lobe 2.5 x 1-1.4 mm, obtuse, with a broad membranous margin; microsporangial sori 2 mm; massulae 5-8; glochidia not septate.

N (Delta); canals and ricefields; introduced and naturalized, replacing native *Lemna* species in stagnant water courses. North and South America, widely naturalized elsewhere.

2. **Azolla caroliniana** Willd., Sp. Pl., ed. 4, 5(1): 541 (1810).

Annual, floating; suborbicular, 0.7-2.5 cm diam., olive-green or brownish; upper leaf-lobe 1.5 x 0.7-1 mm, subacute, with a narrow membranous margin, massulae 3-6; glochidia septate.

N (Delta); canals and rice fields; introduced and naturalized, replacing native *Lemna* species in stagnant water courses. North and South America, widely naturalized elsewhere.

EQUISETACEAE

Description as for *Equisetum*, the only genus in the family.

2. *Equisetum* L.

Herbs with subterranean rhizomes; stems hollow, grooved, jointed, often with whorls of branches at the nodes; leaves reduced to a toothed sheath at each node; sporangia in compact terminal cone-like heads on the main stems and sometimes on the branches. 15 species, cosmopolitan, except Australasia.

1. ***Equisetum ramosissimum*** Desf., Fl. Atlant. 2: 398 (1799).

Syn. *Equisetum ramosum* DC., Syn. Plant. Fl. Gall. 118 (1806).

Rhizomes long, dark brown; stems to 1.2 m, grooves 10-22, sheath with acute teeth, branches hollow; cones terminal, on main stems and branches, ellipsoid, 0.8-1.6 cm.

O (Bahariya), S; moist sandy soils. Africa, Asia, South and Central Europe.

OPHIOGLOSSACEAE

Small rhizomatous herbs; rhizome short, fleshy, without scales; leaves solitary or few, without circinnate vernation, consisting of a sterile lamina and a fertile spike or panicle of spikes; sporangia large, thick-walled, without an annulus, opening by a transverse slit; prothallus subterranean, with mycorrhiza. 3 genera, 75 species, cosmopolitan.

3. *Ophioglossum* L.

Perennial herbs with fleshy corm-like rhizomes, without scales; fronds petiolate, not circinnate in bud, with fertile (sporophore) and sterile (trophophore) segments; fertile segments simple; sporangia in 2 rows on the upper part of the fertile segments. About 30 species, tropical and temperate regions.

1. *Ophioglossum polyphyllum* A. Braun in Seub., Fl. Azor. 17 (1844) emend. Pic. Serm., Webbia 9: 632, t. 2a (1954).

Glabrous, fleshy, perennial herb, 4-10 cm; leaves 1-2, with persistent leaf bases; petiole 1.5(-8) cm; sterile segment elliptic, cuneate at the base; fertile segment 3-8 cm, with 15-30 pairs of sporangia.

GE; sandy and silty soils, appearing after rain. Africa (extending to Portugal), Arabia, eastwards to northern India and Afghanistan.

ADIANTACEAE

Rhizome with opaque scales; stipes dark and lustrous; sori usually submarginal, often covered by the deflexed leaf-margin; spores tetrahedral or globose. 56 genera, 1150 species, cosmopolitan, especially tropical.

4. *Adiantum* L.

Rhizomes with very narrow brown scales; fronds spaced or tufted, 1-4-pinnate; pinnae with flabellate venation, toothed or lobed; stipes brownish to black, glabrous, lustrous; sori on the inner surface of the reflexed margin of pinnules. About 150 species, cosmopolitan, especially tropical America.

1. *Adiantum capillus-veneris* L., Sp. Pl., ed. 1, 1096 (1753).

Rhizome scales linear, brownish; fronds spaced; stipe blackish or brownish, glabrous; lamina bright-green, 1-2(-3)-pinnate, 10-30 x 2-10 cm; pinnules glabrous, shallowly to deeply lobed; soral flaps 2-4 x 0.8-1.8 mm.

N, O, M, D, R, GE, S; damp shaded cliffs, wells, ponds and seepages. Tropical and warm temperate regions worldwide.

5. *Anogramma* Link

Small annuals, rhizomes minute, rhizome-scales hair-like; fronds 2-3-pinnate, membranous, thin; sori spread along the veins, indusia absent. About 5 species, cosmopolitan.

1. *Anogramma leptophylla* (L.) Link, Fil. Sp. Berol. Cult. 1: 137 (1841).
Syns. *Polypodium leptophyllum* L., Sp. Pl., ed. 1, 1092 (1753).
Gymnogramma leptophylla (L.) Desv., Berl. Mag. 5: 305 (1811).

Sporophyte small, annual; gametophyte perennial in favourable habitats; fronds erect;

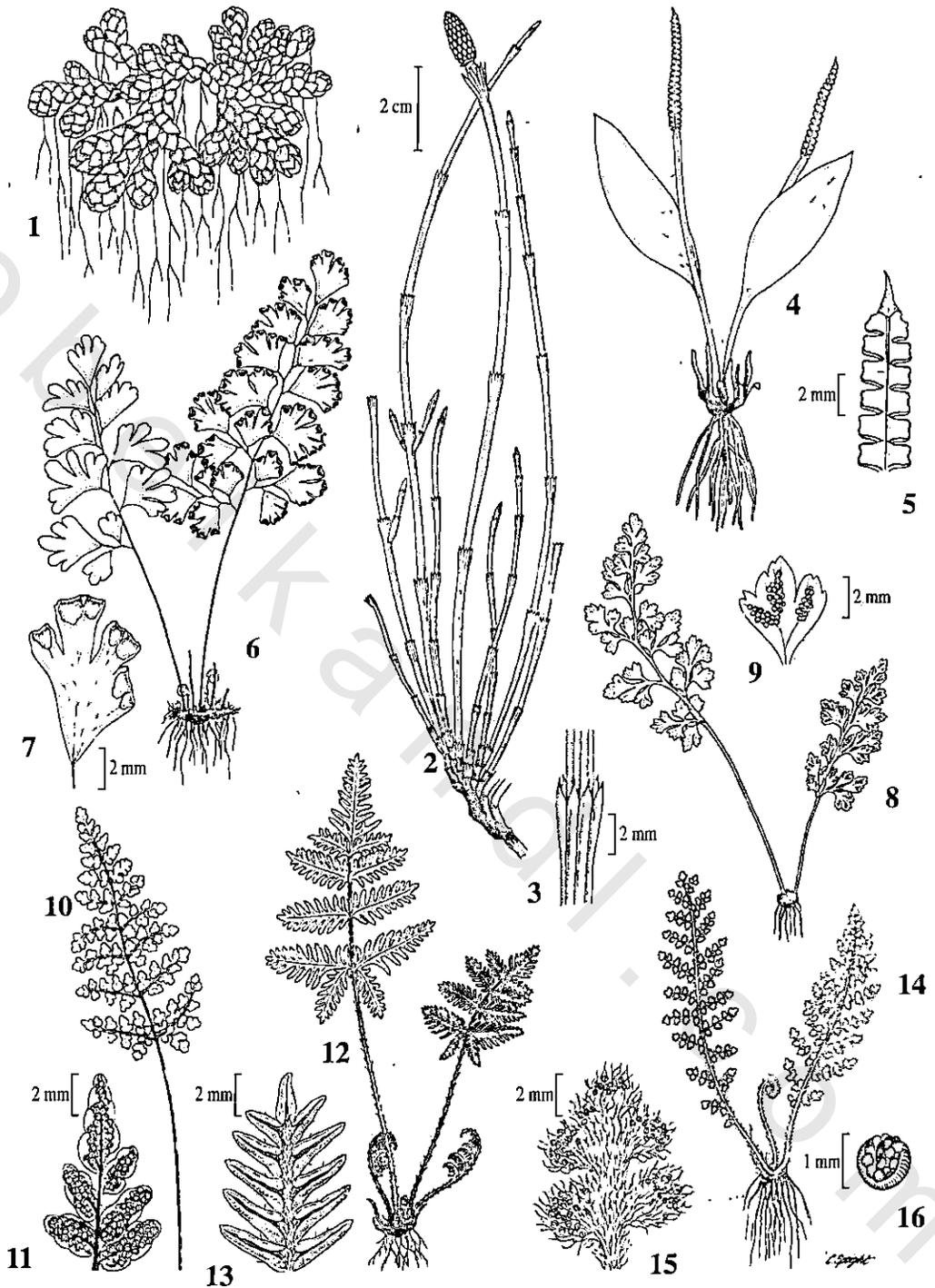


Plate 1. AZOLLACEAE: *Azolla filiculoides* 1, habit. EQUISETACEAE: *Equisetum ramosissimum* 2, habit, stem with a terminal cone; 3, node with a sheath of teeth. OPHIOGLOSSACEAE: *Ophioglossum polyphyllum* 4, habit; 5, sporangia. ADIANTACEAE: *Adiantum capillus-veneris* 6, habit; 7, pinnule with soral flaps. *Anogramma leptophylla* 8, habit; 9, pinnule with sori. *Cheilanthes pteridioides* 10, frond; 11, pinnules with false indusia. *Cheilanthes vellea* 12, habit; 13, pinnules with false indusia. *Cheilanthes vellea* 14, habit; 15, pinnules; 16, sorus. All drawings to the same scale except enlarged parts (scale given).

stipe reddish-brown, glabrous with few scales at the base; lamina membranous, 2-3-pinnate, 1-8 x 1-2.5 cm, ovate to elliptic; pinnae glabrous; pinnules fan-shaped, toothed or lobed; sori spread in lines along the ultimate veins.

GE; damp sheltered crevices. Widespread in temperate and warm regions worldwide.

6. *Cheilanthes* Sw., nom. conserv.

Rhizomes short-creeping or erect, rhizome-scales linear; fronds 1-3-pinnate, stipes wiry; sori marginal, false indusia narrow. About 200 species, cosmopolitan.

- | | |
|--|---------------------------|
| 1. Lamina glabrous on the lower surface | 1. <i>C. pteridioides</i> |
| + Lamina hairy or clothed with scales on the lower surface | 2 |
| 2. Stipe 5-15 cm; lamina triangular-ovate, basal pinnae with pinnatifid lower lobe | 2. <i>C. coriacea</i> |
| + Stipe 1-3 cm; lamina narrowly-elliptic, basal pinnae without pinnatifid lower lobe | 3. <i>C. vellea</i> |

1. ***Cheilanthes pteridioides*** (Reichard) C. Chr., Index Fil. 178 (1905).
Syns. *Polypodium pteridioides* Reichard in L., Syst. Pl. Nov., ed. 4, 4: 424 (1780)
nom. nov. pro *Polypodium fragrans* L. (1771) non L. (1753).
Cheilanthes fragrans (L.) Sw., Syn. Fil. 127, 325 (1806).
Cheilanthes suaveolens Sw., Syn. Fil. 127 (1806).

Rhizome erect, with brownish scales; stipes 2-8 cm, reddish-brown, lustrous; lamina 2-3-pinnate, bright-green, glabrous or with a few glandular-hairs; pinnules with undulate margins; false indusia whitish, with marginal hairs.

S; sheltered rock crevices. Macaronesia, Mediterranean region, Southwest Asia.

2. ***Cheilanthes coriacea*** Decne., Arch. Mus. Hist. Nat. 2: 190 (1841).

Rhizome creeping, rhizome-scales brownish with a black midrib; fronds leathery; stipe 5-15 cm, reddish-brown, covered with pale-brown scales; lamina dark-green and glabrous on the upper surface, brown and hairy on the lower; lowermost pinnae with a pinnatifid basal segment; false indusia continuous along the margin.

GE; sheltered rock crevices. Tropical Northeast Africa, Arabia, Southwest Iran.

3. ***Cheilanthes vellea*** (Aiton) F. Muell., Fragm. 5: 123 (1866).
Syns. *Acrostichum velleum* Aiton, Hort. Kew., ed. 1, 3: 457 (1789).
Notholaena vellea (Aiton) R. Br., Prodr. 146 (1810).
Cosentinia vellea (Aiton) Tod., Syn. Pl. Acot. Vasc. 15 (1866); Giorn. Sci.
Nat. Econ. Palermo 1: 220 (1866).
Cheilanthes catanensis (Cosent.) H. P. Fuchs, Brit. Fern Gaz. 9: 45 (1961).

Rhizome erect, covered with brownish scales; stipe 1-3 cm, densely hairy; lamina dark-green, slightly hairy; on the upper surface, lanate with white or brown hairs on the lower; pinnules with rudimentary false indusia.

GE, S; shaded rock crevices. Macaronesia, Mediterranean region, North and East Africa, southwards to Ethiopia, Southwest Asia eastwards to Afghanistan.

7. *Onychium* Kaulfuss

Rhizomes creeping, densely covered with scales; fronds parsley-like, irregularly 3-4-pinnate; sori marginal, covered by reflexed leaf margins. 8 species, tropical and warm temperate Old World.

1. *Onychium divaricatum* (Poir.) Alston, Bol. Soc. Brot., ser. 2, 30: 21 (1956).

Syns. *Trichomanes divaricatum* Poir., Encycl. 8: 78 (1808).

Allosorus melanolepis Decne., Arch. Mus. Hist. Nat. 2: 189 (1841).

Onychium melanolepis (Decne.) Kunze, Farnkräuter 2: 9, t. 104, f. 2 (1848).

Rhizome-scales linear, black; stipe 5-15 cm; fronds tufted, dimorphic; lamina 8-18 x 4-12 cm, glabrous; segments of sterile fronds ovate, 3.5-6 x 2.5-4.5 mm; segments of fertile fronds narrowly-oblong, 1.5-12 x 1-1.25 mm, acute; sori linear.

GE; sheltered rock crevices. North and Northeast Africa, Arabia to Iran and India.

ACTINIOPTERIDACEAE

Description as for *Actiniopteris*, the only genus in the family.

8. *Actiniopteris* Link

Rhizomes short, creeping, densely covered with linear scales; stipe furrowed; lamina shorter than the stipe, wedge- or fan-shaped, dichotomously branched; segments linear; sori submarginal, covered by the reflexed margin of the frond. 5 species, Old World tropics.

1. *Actiniopteris semiflabellata* Pic. Serm., Webbia 17: 24 (1962).

Syns. *Acrostichum dichotomum* Forssk., Fl. Aegypt.-Arab. 184 (1775).

Actiniopteris australis (L. f.) Link var. *radiata* (Sw.) C. Chr., Dansk Bot. Ark. 7: 125 (1932).

Densely tufted perennial; fronds 5-25 cm; stipe 1.5-2.5 times as long as the lamina; lamina 1-7 cm, wedge-shaped, slightly declinate when desiccated, dichotomously divided into 4-18 segments; segments laterally toothed at the apex.

GE; sheltered rocky crevices. Northeast and tropical East Africa, southern Arabia, Socotra, Madagascar, Mascarenes.

ASPLENIACEAE

Rhizome with clathrate scales; fronds simple or multipinnate; stipe with 2 vascular strands, often fusing to form a single x-shaped strand; sori superficial, borne along one or both sides of the fertile veins; spores bilateral. 1 genus, about 720 species, cosmopolitan.

9. *Asplenium* L.

Rhizomes short-creeping, covered with scales; fronds coriaceous, 1-3-pinnatifid; sori elongate, placed along the veins; indusia narrow, membranous, rudimentary or absent. About 720 species, cosmopolitan.

1. Pinnæ 1-5.5 x 0.5-2.5 cm, pinnules dentate
+ Pinnæ 0.5-1.2 x 0.3-0.6 cm, not divided into pinnules
1. *A. adiantum-nigrum*
2. *A. ceterach*

1. *Asplenium adiantum-nigrum* L., Sp. Pl., ed. 1, 1081 (1753).

Rhizome short-creeping; rhizome scales filiform blackish-brown; fronds 10-22 cm, tufted, green, lustrous, coriaceous; stipe equalling the lamina, reddish-brown or black, basal part swollen and hairy; lamina 2-3-pinnate; pinnæ 1-5.5 x 0.5-2.5 cm; pinnules dentate; sori 1-2 mm, linear, extending at maturity to cover the entire surface of the pinnule.

S; sheltered rock crevices. Europe, North Africa, Southwest Asia, Taiwan, North America, Australia, locally in Polynesia.

2. *Asplenium ceterach* L., Sp. Pl., ed. 1, 1080 (1753).

Syn. *Ceterach officinarum* Willd., Anleit. Selbststud. Bot. 578 (1804).

Rhizome short-creeping; rhizome-scales blackish-brown, narrowly lanceolate; fronds tufted, coriaceous; stipe 1-3 cm, densely covered with scales; lamina 3-12 x 1-2 cm, pinnatifid, the lower surface densely covered by brownish or silvery scales, upper almost glabrous; pinnæ 0.5-1.2 x 0.3-0.6 cm, alternate, apex rounded; sori linear, masked by the scales.

S; sheltered rock crevices. Europe, North Africa, Southwest and Central Asia.

MARSILEACEAE

Description mainly as for *Marsilea* (65 species); also *Pilularia*, frond filiform (6 species); *Regnellidium*, frond 2 lobes (1 species), neither occurring in Egypt.

10. *Marsilea* L.

Amphibious or aquatic ferns; rhizomes creeping, rooting at the nodes; fronds with 4 pinnæ on long stipes; pinnæ sessile, fan-shaped with cuneate base; sporocarps hard, on short pedicels. About 65 species, tropics and temperate regions.

1. Sporocarps sessile; pedicels 1-2 mm, shorter than sporocarps
+ Sporocarps pedicelled; pedicels 3-8 mm, twice as long as the sporocarps
1. *M. strigosa*
2

2. Sporocarps with 2 conspicuous teeth at the base
+ Sporocarps with 1 tooth or 2 minute, of which 1 is obscure
2. *M. minuta*
3

3. Mature sporocarps 2.5-3 mm, quadrangular with vertical depressions on both sides and 1 conical to acute tooth
3. *M. aegyptiaca*

+ Mature sporocarps 3-3.5 x 2.8-3 mm, broadly elliptic, with 2 minute marginal teeth, the upper distinct and the lower obscure
4. *M. capensis*

1. *Marsilea strigosa* Willd., Sp. Pl., ed. 4, 5(1): 539 (1810).

Syn. *Marsilea pubescens* Ten., Cat. Pl. Hort. Neapol. App. 1: 76 (1815).

Fronds glabrous or sparsely hairy, stipes 2.5-25 cm; pinnae 0.5-1.5 cm, cuneate; apex rounded, crenulate; sporocarps 3-5 mm, subsessile, obovoid, with a conspicuous raphe and obscure basal teeth.

N; moist habitats. North Africa, southern Europe.

2. *Marsilea minuta* L., Mant. Alt. 308 (1771).

Adult plants almost glabrous; fronds with long stipes, to 12 cm; pinnae 1-2.5 cm; sporocarps in groups of 2-4, each on a pedicel at least twice as long as the sporocarp; sporocarp ellipsoid; apex rounded to truncate, with 2 teeth at the base.

O (Bahariya); swamps and moist ground. Tropical Africa, Asia.

NOTE: This species is rather similar to the European species *Marsilea quadrifolia* L.

3. *Marsilea aegyptiaca* Willd., Sp. Pl., ed. 4, 5(1): 540 (1810).

Fronds sparingly hairy or glabrous, dimorphic; small fronds with stipes 1-4 cm, pinnae 2.5-5 mm, cuneate with deeply crenate to lobed apex; large fronds with stipes 4-10 cm, pinnae 0.8-1.2 cm, with crenate to entire rounded apex; sporocarps 2.5-3 mm, quadrangular, with vertical depressions on both sides and 1 conical to acute tooth; pedicel 4.5-6 mm, erect.

N, O, M, De; in moist ground. North and tropical Africa, Madagascar, Southwest Asia, extending to Russia.

4. *Marsilea capensis* A. Braun, Monatsber. Königl. Preuss. Acad. Wiss. Berlin 1863: 428 (1864).

Fronds glabrous or sparingly appressed hairy; stipes to 15 cm; pinnae fan-shaped, base cuneate, margins entire, apex rounded and crenate, sporocarps 3-3.5 x 2.8-3 mm, blackish-brown, broadly elliptic, with 2 minute marginal teeth, the upper distinct and the lower obscure; pedicel 3-5 mm.

N (eastern edge of the delta); in moist ground. Egypt, Iraq, South Africa.

Division II. **Spermatophyta**

Plants reproducing by seeds, woody or herbaceous.

Subdivision 1. **Gymnospermae**

Ovules not enclosed in an ovary, perianth absent, trees or shrubs.

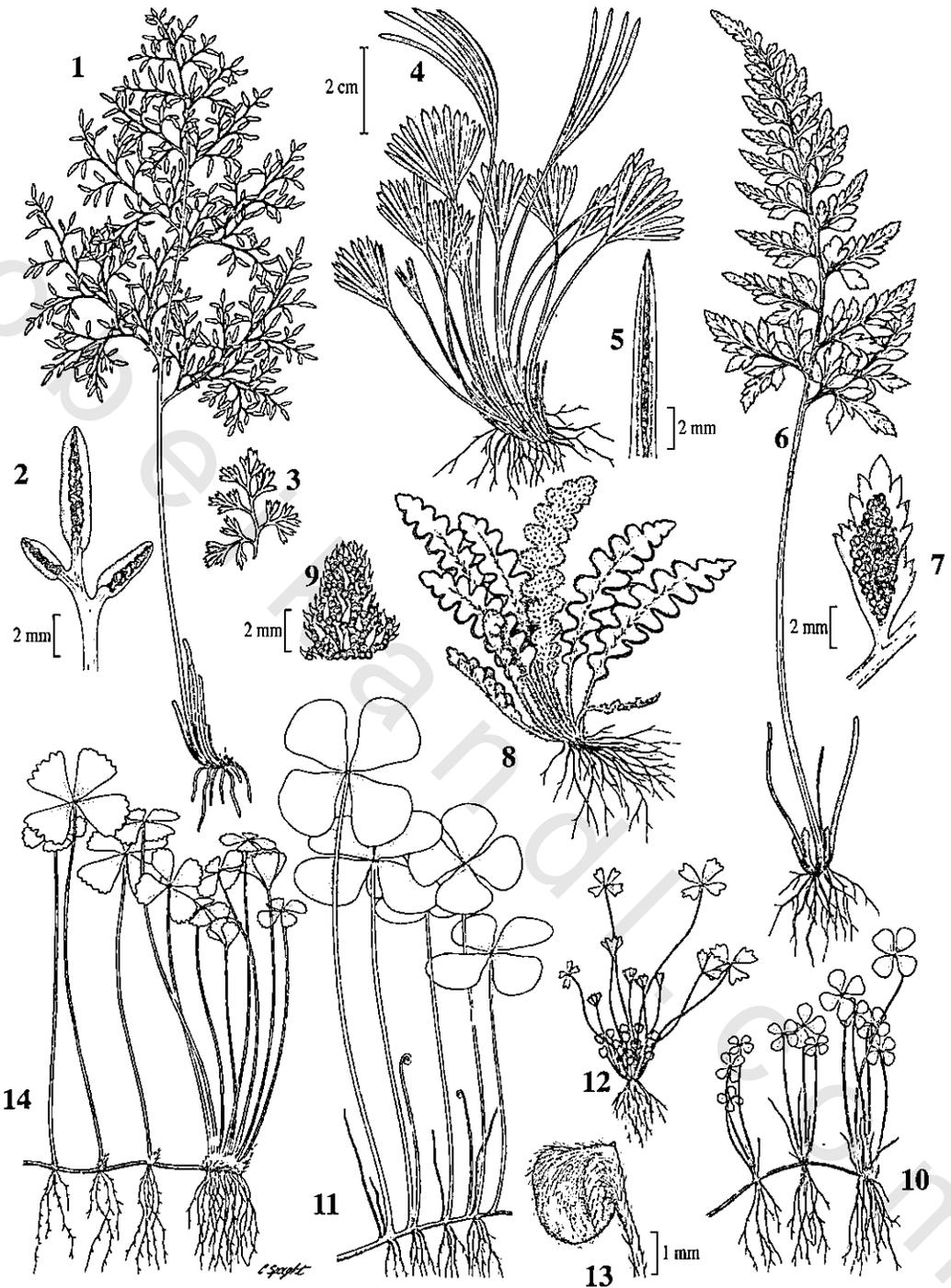


Plate 2. ADIANTACEAE: *Onychium divaricatum* 1, habit, fertile frond; 2, segments of a fertile frond; 3, segments of a sterile frond. ACTINIOPTERIDACEAE: *Actiniopteris semiflabellata* 4, habit (the fertile fronds longer); 5 a segment of a fertile frond. ASPLENIACEAE: *Asplenium adiantum-nigrum* 6, habit; 7 fertile pinnule. *Asplenium ceterach* 8, habit; 9 fertile lobes. MARSILEACEAE: *Marsilea strigosa* 10, habit. *Marsilea aegyptiaca* 11, habit (large fronds); 12, habit (small fronds, with sporocarps); 13, sporocarp. *Marsilea capensis* 14, habit. All drawings to the same scale except enlarged parts (scale given).

CUPRESSACEAE

Monoecious or dioecious trees, resiniferous; leaves opposite or whorled, usually scale-like; scales of male strobili (cones) with 3-5 pollen-sacs on the lower surface; scales of female cones with 2-many erect ovules on the upper surface; fruit a woody cone, or the scales fleshy and the fruit berry-like, indehiscent; seeds winged or not. 20 genera, 125 species, subcosmopolitan.

1. *Juniperus* L.

Trees or shrubs, monoecious (our species) or dioecious; leaves opposite or in whorls of 3, acicular in juvenile growth; male strobili terminal; female cones subtended by scale-like bracts; seed scales 3-8, united into a berry-like fruit; seeds 1-12 in each cone, wingless. 50 species, northern hemisphere.

1. *Juniperus phoenicea* L., Sp. Pl., ed. 1, 1040 (1753).

Monoecious shrub or tree to 6 m; juvenile leaves acicular; mature leaves 0.8-1.2 mm, ovate-rhomboid, densely imbricate; male strobili 3-4 x 2.5-3 mm; female cones 2.5-3.5 mm diam., globose, deep violet; seed scales 6-8; mature cones 8-10 mm diam., reddish, 3-9-seeded.

S (Yelleg., Halal, Maghara mountains); rocky ridges. Mediterranean region, Sinai, extending to Central Arabia.

EPHEDRACEAE

Description as for *Ephedra*, the only genus in the family.

1. *Ephedra* L.

Xeromorphic shrubs, usually dioecious; leaves opposite or in whorls of 3-4, scale-like, fused at the base; flowers in small cones; male flowers subtended by a bract, perianth 2-lipped, staminal column with 2-9 anthers; female flowers solitary or in groups of 2-3, subtended by 2-4 pairs of bracts; ovules with scarious or fleshy bracts. 40 species, Mediterranean region to China, South America.

- | | |
|--|-------------------------|
| 1. Margins of bracts and leaf sheaths glabrous | 2 |
| + Margins of bracts and leaf sheaths ciliate | 3 |
| 2. Stems erect, male flowers with 6-8 anthers | 5. <i>E. pachyclada</i> |
| + Stems climbing or hanging, male flowers with 4-6 anthers | 4. <i>E. foemina</i> |
| 3. Leaves 1-1.5(-3.5) cm | 3. <i>E. ciliata</i> |
| + Leaves to 3(-6) mm | 4 |
| 4. Male flowers with 3-4 sessile anthers; ripe cones fleshy, red | 2. <i>E. aphylla</i> |
| + Male flowers with 4-6 distinctly stipitate anthers; ripe cones with broad scarious margins, not fleshy | 1. <i>E. alata</i> |

1. **Ephedra alata** Decne., Ann. Sci. Nat. Bot., sér. 2, 2: 239 (1834).

Shrub to 1 m; stems richly branching, erect, not climbing; leaves to 3 (-6) mm; margins of leaf sheaths and bracts ciliate; male cones in dense axillary clusters; flowers with 4-6 anthers, distinctly stipitate; female cones 2-seeded, bracts with broad scarious margins at maturity.

O, M, D, S; desert sandy plains. North Africa, Palestine, Sinai, Arabia, Iraq.

2. **Ephedra aphylla** Forssk., Fl. Aegypt.-Arab. 170 (1775).

Syn. *Ephedra alte* C. A. Mey., Monogr. Ephedra, Mém. Acad. Sci. Pétersb. 5: 75 (1846).

Erect or hanging shrub to 1.5 m, leaves to 3 mm, margins of sheaths and bracts ciliate; male cones in dense axillary clusters, male flowers with 3-4 sessile anthers; female cones 1(-2)-seeded; ripe cones fleshy, red.

M, D, S; calcareous slopes and wadi beds. Northeast Africa, Syria to northern Arabia.

3. **Ephedra ciliata** Fischer & C. A. Mey., Monogr. Ephedra, Mém. Acad. Sci. Pétersb. 4: 100 (Mar. 1846).

Syns. *Ephedra foliata* Boiss., Diagn. Pl. Orient. 7: 101 (Jul.-Oct. 1846).

Ephedra peduncularis Boiss. & Hausskn., Fl. Orient. 5: 716 (1884).

Shrub to 3 m, climbing or prostrate; leaves 1-1.5 (-3.5) cm; margins of leaf sheaths and bracts ciliate; male cones at the tips of branches; flowers with 3-4 sessile anthers; female cones 1-3-seeded; ripe cones fleshy, white.

De, GE, S; scrambling on shrubs and trees, rocky slopes. North and East Africa, Sinai, Arabia, eastwards to India.

4. **Ephedra foemina** Forssk., Fl. Aegypt.-Arab. 219 (1775).

Syns. *Ephedra campylopoda* C. A. Mey., Monogr. Ephedra, Mém. Acad. Sci. Pétersb. 4: 107 (1846).

Ephedra fragilis Desf. subsp. *campylopoda* (C. A. Mey.) Asch. & Graebn., Syn. Mitteleur. Fl. 1: 258 (1897).

Shrub to 4 m, stems climbing or hanging; leaves 1-2.5 mm; leaf sheaths and bracts with glabrous margins; male flowers with 4-6 sessile anthers; female cones in axillary clusters, usually on curved stalks; 1-2-seeded; ripe cones fleshy, red.

S; rocky cliffs. East Mediterranean region, Sinai, southern Arabia, Ethiopia.

5. **Ephedra pachyclada** Boiss., Fl. Orient. 5: 713 (1884) subsp. **sinaica** (Riedl) Freitag & Maier-Stolte, Edinb. J. Bot. 49: 92 (1992).

Syn. *Ephedra sinaica* Riedl, Notes Roy. Bot. Gard. Edinb. 38: 291 (1980).

Shrub to 1 m; stems richly branching, erect; leaf sheaths and bracts with glabrous margins; male flowers with 6-8 sessile or short-stipitate anthers; female cones on short stalks or in axillary clusters, 1-seeded; ripe cones fleshy, red.



Plate 3. CUPRESSACEAE: *Juniperus phoenicea* 1, branch with mature cones. EPHEDRACEAE: *Ephedra alata* 2, branch with female cones (upper); branch with male flowers (middle); leafy branch (lower). *Ephedra aphylla* 3, female cone (upper), branch with male flowers (middle); branch with female cones (lower). *Ephedra ciliata* 4, branch with female cones (upper); branch with male flowers (lower). *Ephedra foemina* 5, branch with male flowers (left); branch with female cones (right); female cone (upper). *Ephedra pachyclada* 6, branch with male flowers (right); branch with female cones (left). All drawings to the same scale except enlarged parts (scale given).

S; rocky cliffs and slopes. Sinai, Arabia, extending eastwards to Iran and Pakistan.

Subdivision 2. **Angiospermae**

Ovules enclosed in an ovary, perianth usually present, herbs, shrubs or trees.

Class 1. **Dicotyledoneae**

Herbs, shrubs or trees, rarely parasitic; xylem with vessels; flowers bisexual or unisexual; ovules enclosed in an ovary; seeds with 2 cotyledons.

SALICACEAE

Dioecious trees or shrubs; leaves usually alternate; stipules present; flowers subtended by bracts, in catkins; perianth absent; glands present; male flowers with 2-many stamens; filaments filiform, free or united; female flowers with 1 unilocular carpel; ovules numerous, ascending, anatropous; fruit 2-4-valved capsule; seeds numerous, minute, with a tuft of long silky hairs. 2 genera, 435 species, subcosmopolitan, especially northern hemisphere, except Malaysia and Australia.

1. Buds with 1 outer scale; bracts entire; leaves usually narrow

1. **Salix**

+ Buds with several outer scales; bracts dentate or ciliate,
leaves always broad

2. **Populus**

1. **Salix** L.

Dioecious trees or shrubs; leaves alternate, stipules present; flowers subtended by bracts, in catkins, perianth absent; male flowers with 2-many stamens, filaments free or united; female flowers with 1 unilocular carpel, ovules numerous; fruit 2-4-valved capsule; seeds minute, with a tuft of silky hairs. About 400 species, cold and temperate northern hemisphere, few southern except Australia.

1. Female flowers in catkins 1.5-3 cm, leaves to 2 cm diam.

1. **S. mucronata**

+ Female flowers in catkins 8-12 cm, leaves to 6 cm diam.

2. **S. tetrasperma**

1. **Salix mucronata** Thunb., Prodr. Pl. Cap. 6 (1794).

Syns. *Salix subserrata* Willd., Sp. Pl., ed. 4, 4: 671 (1806).

Salix safsaf Trautv., Salic. 6, t. 2 (1836).

Shrub or tree to 8 m, deciduous, bark brownish; leaves to 12 x 2 cm, serrulate; petiole 0.8-1.5 cm; catkins 2-8 x 0.5-1.2 cm; male flowers with 5-10 stamens; female flowers 2-2.5 mm; capsule 5-6 mm, ovoid; male trees in Egypt less common than female trees.

N, O, M, De, S; by canals, also cultivated in the countryside. Northeast to South Africa, Sinai, southern Arabia.

2. **Salix tetrasperma** Roxb., Pl. Coast Corom. 1: 66, t. 97 (1798).

Shrub or tree to 12 m, deciduous, sometimes evergreen; leaves to 18 x 6 cm, alternate, petiolate, broadly ovate-lanceolate, serrulate, apex acuminate; male flowers in catkins to

8 cm; stamens about 6; female flowers in catkins 8-12 cm; ovary sessile, hairy; fruit pyriform; female trees less common in Egypt than male trees.

N, M, De; along canals and pools. Naturalized in Egypt, also cultivated. India, China.

2. *Populus* L.

Diocious deciduous trees; leaves alternate, long-petiolate; flowers appearing before leaves, in stalked pendulous catkins; perianth reduced to a cup-shaped nectariferous disc; stamens 4-numerous; filaments free; ovary 1-celled, many-ovuled; capsule 2-3 (-4)-valved, seeds numerous, minute, with a tuft of long silky hairs. 35 species, north temperate.

1. *Populus euphratica* Oliv., Voy. Emp. Othoman, ed. min., 6: 319, t. 45, 46 (1807).

Tree to 15 m, bark greyish, branches slender; leaves 2-12 x 2-8 cm, broadly ovate or triangular, long-petiolate, leaves on juvenile branches linear-lanceolate; pedicels equalling the flowers; stamens 12-24; ovary sessile; stigmas 3, biforked; capsule 1-1.2 cm, ovoid, 2-3-valved; seeds numerous with a tuft of long silky hairs.

O (Siwa); naturalized on sand dunes. North Africa, Southwest and Central Asia.

MORACEAE

38 genera, 1100 species, especially tropical and warm regions, few temperate. *Ficus* is the only genus in Egypt.

1. *Ficus* L.

Trees or shrubs, monoecious, rarely dioecious; leaves alternate, rarely opposite; inflorescence a syconium (fig), with a hollow fleshy receptacle bearing the flowers; flowers subtended by bracts; perianth 2-6-lobed; male flowers with 1-3 stamens; female flowers with 1-celled ovary; fruit a fig with fleshy receptacle and small 1-seeded drupelets. About 750 species, tropics and warm regions especially Indo-Malaysian region.

1. Leaves lanceolate, to 4 cm wide
+ Leaves 3-5-lobed, to 20 (-30) cm wide

1. *F. cordata* subsp. *salicifolia*
2

2. Leaves to 20(-30) cm wide; fruit 3-5 cm diam.
+ Leaves to 8(-12) cm wide; fruit 1-2 cm diam.

3. *F. carica*
2. *F. palmata*

1. *Ficus cordata* Thunb., Diss. Fic. 8 (1786) subsp. *salicifolia* (Vahl) C. C. Berg, Kew Bull. 43: 82 (1988).

Syns. *Ficus ambiguum* Forssk., Fl. Aegypt.-Arab. 219 (1775).

Ficus salicifolia Vahl, Symb. Bot. 1: 82, t. 23 (1790).

Shrub or tree to 6 m; leaves 2-12(-20) x 1-3(-4) cm, glabrous, entire, acuminate; petiole 1-4 cm; figs 1-3 in the leaf axils, globose, 6-9 mm diam., sessile or with peduncles to 3.5 mm and 3 basal bracts; ostiole circular, with 3 bracts.

O (Uweinat), GE; rocky slopes. Tropical and southern Africa, southern Arabia.

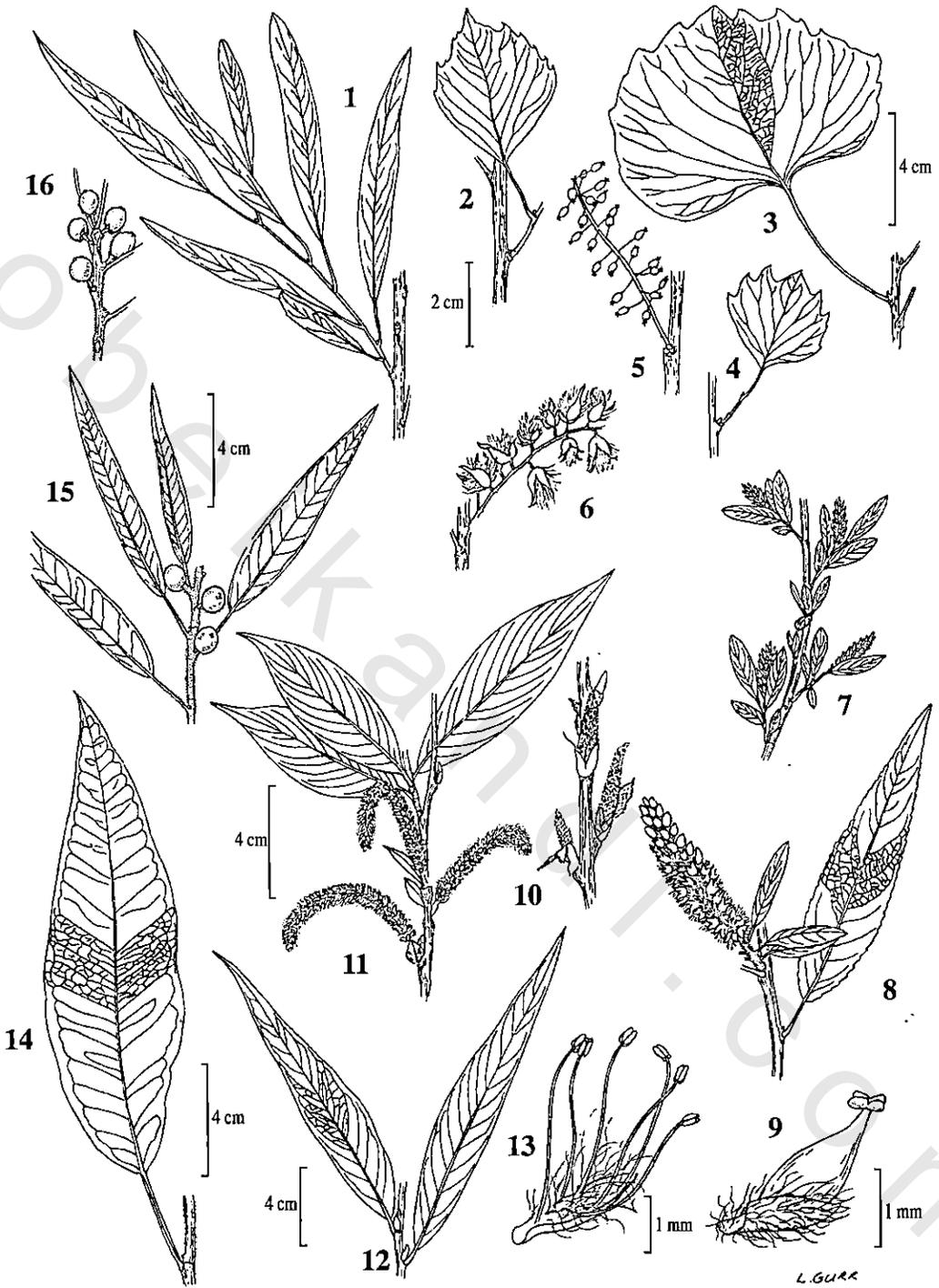


Plate 4. SALICACEAE: *Populus euphratica* 1, branch with juvenile leaves; 2, 3, 4 adult leaves; 5, catkin with female flowers; 6, catkin with open capsules. *Salix mucronata* 7, branch with female flowers; 8, branch with open and closed capsules; 9, female flower. *Salix tetrasperma* 10, leafless branch with young male catkins; 11, leafy branch with male catkins at anthesis; 12, leafy branch. MORACEAE: *Ficus cordata* subsp. *salicifolia* 14, leaf; 15, branch with fruits and leaves; 16, branch with fruits and leaf bases. Drawings 11, 12, 14, 15 (scale 4 cm), the rest (scale 2cm) except enlarged parts (scale 1mm).

2. **Ficus palmata** Forssk., Fl. Aegypt.-Arab. 179 (1775).

Syn. *Ficus pseudo-sycomorus* Decne., Ann. Sci. Nat. Bot., ser. 2, 2: 44 (1834).

Shrub to 4 m; leaves 2-12 x 1.5-8 (-12) cm, broadly ovate, 3-lobed or undivided, serrate, apex acute to rounded, scabrous on the upper surface, pubescent to almost glabrous on the lower; figs 1-2 in the leaf axil, 1-2 cm diam., subglobose, peduncle 0.5-1.5 cm, with 3-4 bracts; ostiole circular, with 4 bracts.

De, GE, S; rocky cliffs and wadi sides. Tropical Northeast Africa, Southeast Mediterranean region, Sinai, Arabia eastwards to Northwest India.

NOTE: Miller in Miller & Cope (1996) recognizes two subspecies in Arabia: subsp. *palmata* and subsp. *virgata* (Roxb.) Browicz in Rech. f., Fl. Iranica 153: 12 (1982), separated as follows:

1. Leaves simple or lobed, ovate in outline, the tip acute or acuminate subsp. **palmata**
+ Leaves simple, rarely shallowly lobed, broadly ovate or suborbicular in outline,
the top rounded or obtuse to shortly acute subsp. **virgata**

The geographical distribution of both subspecies, as given by Miller, *op. cit.*, with the exception of Arabia, does not seem to overlap: subsp. *palmata* in Arabia, Northeast tropical Africa; subsp. *virgata* in Sinai, Palestine, Arabia, Iran, Afghanistan, Pakistan, Northwest India. The morphological variations within the Egyptian populations of *Ficus palmata*, as well as their geographical distribution, suggest that both subspecies occur in Egypt.

3. **Ficus carica** L., Sp. Pl., ed. 1, 1059 (1753).

Shrub or tree to 6 m; leaves 8-15 (-25) x 10-20 (-25) cm, broadly ovate, 3-5-lobed; with acute to rounded apex, scabrous on the upper surface, almost glabrous on the lower; figs 1-2 in the leaf axils, 3-5 cm diam., sessile or with peduncles 1-3 cm, bracts 3-4, ostiole with visible bracts.

N, O, M, D, S; cultivated, and probably naturalized. Mediterranean region, Southwest Asia; cultivated worldwide for its edible fruits.

NOTE: Browicz (1982) recognizes two subspecies from the *Flora Iranica* area: subsp. *carica*, the cultivated fig, and subsp. *rupestris* (Hauskn. ex Boiss.) Browicz in Rech. f., Fl. Iran. 153: 8 (1982). The distribution of the species, including subsp. *carica*, is the Mediterranean region and Southwest Asia, while subsp. *rupestris* is restricted, according to Browicz, *op. cit.*, to North Syria, Southwest Turkey, North Iraq and Southwest Iran. In Egypt the cultivated fig, also probably naturalized, with lobed leaves, large fruits to 5 cm diam. and long peduncles to 3 cm, represents subsp. *carica*, while the Sinai specimens with undivided leaves, and fruits to 2 cm diam. with short peduncles may represent subsp. *rupestris*.

URTICACEAE

Herbs (our species), shrubs or climbers, latex absent; leaves opposite or alternate, simple, usually stipulate; flowers usually unisexual; perianth 4-5-merous; male flowers with

(1-)4-5 stamens, opposite the perianth segments and inflexed in bud, often with rudimentary ovary; female flowers often with small staminodes; ovary superior, 1-loculed; ovule 1; fruit achene. 48 genera, 1050 species, mainly tropical, few temperate.

1. Leaves densely white-pubescent on the lower surface; female flowers without perianth; male flowers with 1 stamen, 3-lobed 3. **Forsskaolea**
 + Leaves green on the lower surface; female flowers with perianth enclosing the achene; male flowers with 4 stamens and deeply-lobed perianth 2
2. Leaves opposite, lobed or toothed, with stinging hairs; stipules free 1. **Urtica**
 + Leaves alternate, entire, without stinging hairs; stipules absent 2. **Parietaria**

1. **Urtica** L.

Annual or perennial herbs, monoecious (our species) or rarely dioecious, with stinging hairs; leaves opposite, lobed or toothed, stipules free; inflorescence axillary, spike-like, with clustered cymes; flowers 4-merous, with free tepals; male flowers with 4 stamens; females with unequal tepals, the larger pair enclosing the achene. 80 species, subcosmopolitan, especially north temperate.

1. Female flowers in spike-like inflorescence mixed with male flowers 1. **U. urens**
 + Female flowers in long-pedunculate heads, male flowers in axillary lax panicles 2. **U. pilulifera**

1. **Urtica urens** L., Sp. Pl., ed. 1, 984 (1753).

Monoecious annual to 60 cm, stems erect; leaves 1.5-6 x 1-3.5 cm, ovate, coarsely dentate; petiole 1-2.5 cm, stipules 4 at each node; panicles clustered in the leaf axils, shorter than the petiole, with numerous female and few male flowers, perianth segments (tepals) of female flowers with ciliate margins; achene 1.5-2 mm.

N, O, M, De; weed of cultivation and waste ground. Temperate regions worldwide.

2. **Urtica pilulifera** L., Sp. Pl., ed. 1, 983 (1753).

Monoecious annual to 80 cm, stems erect; leaves 2-8(-10) x 2-5(-7) cm, coarsely dentate; petiole 2-5.5 cm, stipules 4 at each node; male flowers in panicles 1.5-5 cm; female flowers in globose long-pedunculate heads, 0.5-1.5 cm diam.; achene c. 3 mm.

N, M, S; weed of cultivation and waste ground. Europe, Mediterranean region, tropical Northeast Africa, West Asia.

2. **Parietaria** L.

Monoecious annual or perennial herbs; leaves alternate, simple, entire; stipules absent; flowers unisexual or bisexual, 3- or 4-merous, green, bracteate, in axillary clusters of 1-several flowers; stigma sessile, brush-like; achene ovoid, enclosed in the perianth. About 10 species, subcosmopolitan.

1. Perennial; leaves 3-7 cm; fruit perianth to 4 mm 1. **P. judaica**
 + Annuals; leaves 1-2.5 cm; fruit perianth to 2 mm 2

2. Bracts of female flowers accrescent, 2-3 times as long as the fruit perianth;
perianth of female flowers with clavate hairs **2. P. alsinifolia**
+ Bracts of female flowers not accrescent, equalling or shorter than the fruit perianth;
perianth of female flowers with straight or hooked hairs **3. P. debilis**

1. **Parietaria judaica** L., Diss. Fl. Pal. 32 (1756).

Syns. *Parietaria punctata* Willd., Sp. Pl., ed. 4, 4: 952 (1805).

Parietaria diffusa Mert. & W. D. J. Koch, Deutsch. Fl. 1: 827 (1823).

Perennial herb to 60 cm, stems erect or ascending; leaves 3-7 x 1-4 cm, broadly ovate-elliptic, acute, villous; petiole to 2.5 cm; flowers sessile, in axillary clusters of 1 female and several bisexual flowers; bracts equalling or shorter than the flowers; female flowers 1.5 x 0.5 mm, perianth white-hairy; bisexual flowers 1 x 1.2 mm, accrescent; fruit perianth to 4 mm; achene 1 mm, blackish, ovoid.

N, M; sheltered rocky crevices. Europe, Mediterranean region, Southwest Asia, North India.

2. **Parietaria alsinifolia** Delile, Descr. Egypte, Hist. Nat. 137, t. 50, f. 2 (1814).

Annual herb to 30 cm, pilose-hairy; stems procumbent or ascending; leaves 0.5-1.2 x 0.2-1 cm, ovate; petiole equalling the blade; flowers in axillary clusters of female and bisexual flowers; bracts equalling or longer than the flowers, accrescent in fruit; female flowers covered with clavate hairs, slightly accrescent in fruit; bisexual flowers with fruit perianth 1.5-2 mm; achene 1 mm, reddish-brown, enclosed in the bracts.

De, S; sheltered rocky crevices. North Africa, Southwest and Central Asia.

3. **Parietaria debilis** G. Forster, Fl. Ins. Austr. 73 (1786).

Annual herb to 40 cm; stems weak, prostrate or ascending, pubescent; leaves 0.5-2.0 x 0.2-1.5 cm, broadly ovate to orbicular; petiole 0.5-2.5 cm; flowers in axillary clusters of 1-several, female and bisexual; bracts lanceolate, equalling or shorter than the flowers; female flowers ovoid; bisexual flowers cup-shaped; perianth of bisexual flowers 1 mm, with straight or hooked hairs, slightly accrescent in fruit; fruit perianth 1.5 mm, with erect lobes; achene 1 mm, brownish.

GE; sheltered rock crevices. Tropical Africa, Madagascar, Yemen, Socotra, tropical Asia, Australasia, Central and South America.

3. **Forsskaolea** L.

Monoecious annual or perennial herbs; leaves alternate, dentate; stipules free; flowers axillary, on subsessile receptacles; male flowers 3-lobed, stamen 1; female flowers without perianth; stigma sessile, filiform, ovary woolly; fruit enclosed in an involucre of bracts. 6 species, Canary Islands, southern Spain, North and East Africa, Arabia to India.

1. **Forsskaolea tenacissima** L., Oppobalsam. Decl. 18 (1764).

Syns. *Caidbeja adhaerens* Forssk., Fl. Aegypt.-Arab. 82 (1775).

Forsskaolea cossoniana Webb, Otia Hisp. 49, t. 45 (1839).

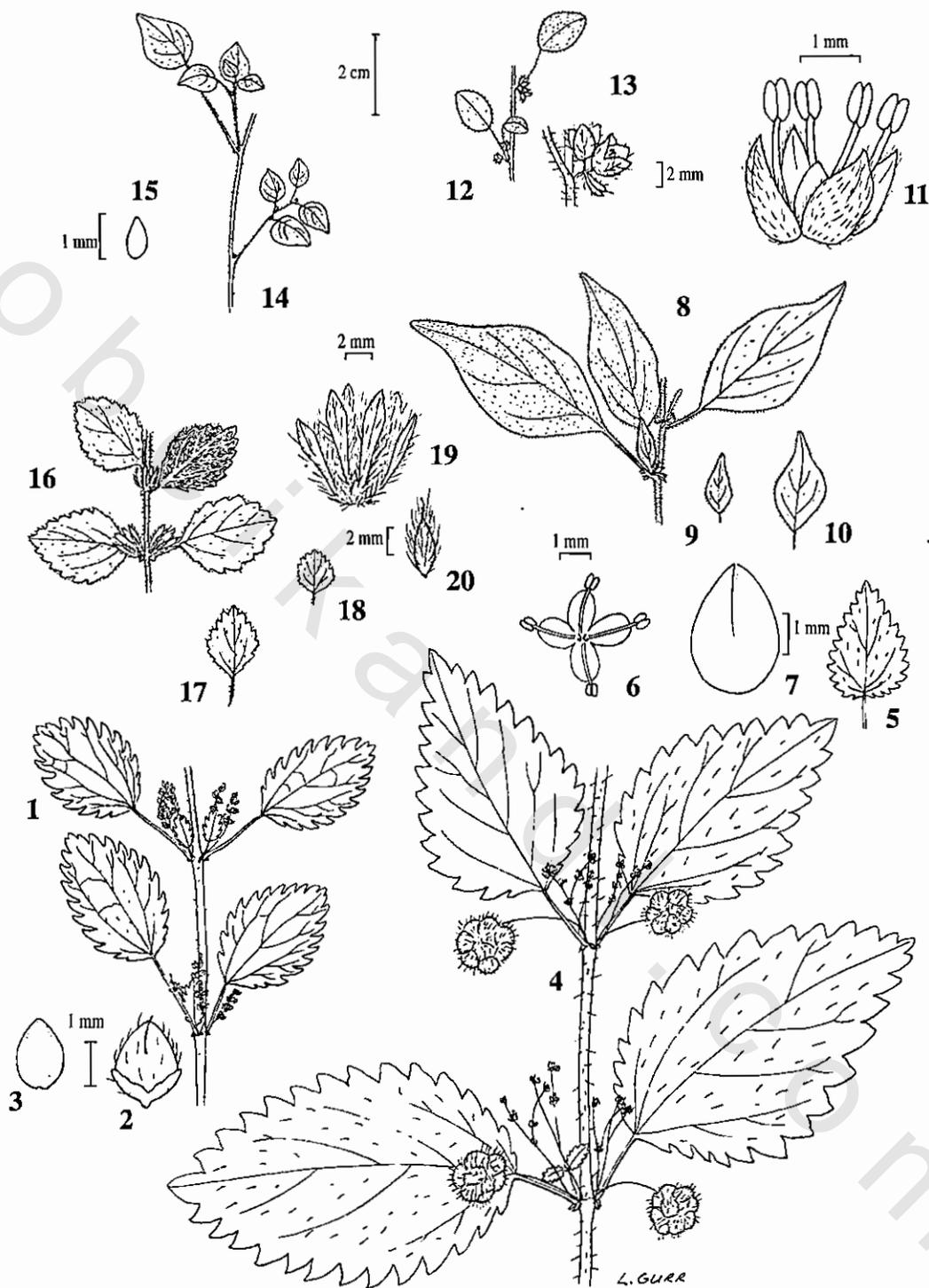


Plate 5. URTICACEAE: *Urtica urens* 1, flowering branch; 2, female flower; 3, achene. *Urtica pilulifera* 4, flowering and fruiting branch; 5, leaf; 6, male flower; 7, achene. *Parietaria judaica* 8, flowering branch; 9, 10, leaves; 11, bisexual flower. *Parietaria alsinifolia* 12, flowering branch; 13, female flower. *Parietaria debilis* 14, leafy branch; 15, achene. *Forsskaolea tenacissima* 16, flowering branch; 17, 18, leaves; 19, cluster of flowers; 20, female flower. All drawings to the same scale except enlarged parts (scale given).

Perennial herb to 80 cm, often woody at the base; stems erect or ascending; leaves 1-4 x 0.5-3 cm, broadly obovate, serrate, green with hooked hairs on the upper surface, densely white-pubescent on the lower; petiole 1-2 cm; stipules scarious, persistent; flowers 1-4 in axillary clusters, on subsessile receptacles, surrounded by 3-6 bracts; bracts 5-8 x 1-2 mm, spatulate, acute, densely white-silky; perianth of male flowers green-hispid; ovary 1-few in each inflorescence.

D, O (Uweinat), GE, S; rocky wadis and slopes. North Africa, extending to Southeast Spain, Sudan, Ethiopia, Palestine, Arabia, Iran eastwards to India.

SANTALACEAE

34 genera, 540 species, subcosmopolitan, especially tropical and warm dry regions; *Thesium* is the only genus in Egypt.

1. *Thesium* L.

Annual or perennial root hemiparasites, herbaceous, green; leaves linear or scale-like; flowers in spikes or racemes, bisexual, with 1 bract and 2 bracteoles; perianth 4-5-lobed; stamens 4-5; ovary inferior, stigma capitate; fruit a nutlet with persistent perianth at its summit; seed 1. About 325 species, Old World.

1. *Thesium humile* Vahl, Symb. Bot. 3: 43 (1794).

Annual herb to 25 cm; stems ascending to erect; leaves 1-4 x 0.1-0.15 cm, narrowly-linear; flowers subsessile, in racemes; bracts 2-3 times as long as the flowers, leaf-like; bracteoles longer than the flowers; perianth 1.5 mm, 5-lobed, campanulate, greenish-white; nutlet 3.5 x 1-2 mm, oblong-elliptic.

Two varieties occur in Egypt:

var. *humile*

Leaves rather fleshy; reticulations between nerves of nut dense and pronounced.

N, O, M, S; weed of cultivation. Mediterranean region, Sinai, Arabia, Iraq.

var. *maritima* (N. D. Simpson) Sa'ad, Fl. Egypt 46, Santalaceae: 25 (1983).

Syns. *Thesium humile* Vahl forma *maritima* N. D. Simpson, Tech. Sci. Serv. Bull. 93: 36 (1930).

Thesium humile var. *maritima* N. D. Simpson, sensu Täckh., Stud. Fl. Egypt, ed. 2, 57 (1974), comb. inval.

Leaves fleshy, thick; reticulations between nerves of nut widely spaced and faint.

M; in coastal sand. Endemic.

LORANTHACEAE

77 genera, 950 species, tropical and temperate regions, especially southern hemisphere. *Plicosepalus* is the only genus in Egypt.

1. *Plicosepalus* Tiegh.

Hemiparasitic shrubs, stems spreading by haustoria-bearing runners; leaves alternate or subopposite, coriaceous, short-petiolate; flowers 5-merous, zygomorphic, short-pedicellate, in pedunculate umbels; calyx cupular; corolla red or yellow, petals free or fused into a tube at the base; stamens 5, subequal, straight or slightly curved; berry elliptic, red or yellow. 12 species, tropical Africa, Southwest Asia.

1. Corolla lobes free, curved, umbels 3-6-flowered; leaves narrowly-oblong, to 0.5 cm diam. **1. *P. curviflorus***
+ Corolla lobes fused at the base, becoming looped; umbels 2-flowered; leaves oblong-ovate, to 2.5 cm diam. **2. *P. acaciae***

1. ***Plicosepalus curviflorus*** (Benth. ex Oliv.) Tiegh., Bull. Soc. Bot. France 41: 504 (1894).

Syns. *Loranthus curviflorus* Benth. ex Oliv., Hooker's Icon. Pl. 14, t. 1304 (1880).

Loranthus faurotii Franch., J. Bot. (Morot) 1: 135 (1887).

Shrub to 80 cm, glabrous; stems spreading; leaves narrowly oblong, coriaceous, 1.5-3.5 x 0.3-0.5 cm; umbels 3-6-flowered; flowers orange-yellow at the base, red above; corolla lobes 3-3.8 cm, curved; berry 1-1.5 x 0.5-0.8 cm.

De (Wadi Allaqi), R, GE; on *Acacia*. Tropical Central and East Africa, Southwest Asia.

2. ***Plicosepalus acaciae*** (Zucc.) Wiens & Polhill, Nord. J. Bot. 5: 221 (1985).

Syns. *Loranthus acaciae* Zucc., Abh. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. 3: 249 (1843).

Loranthus arabicus Defl., Voy. Yémen 197 (1889).

Tapinostemma arabicum (Defl.) Tiegh., Bull. Soc. Bot. France 42: 258 (1895).

Shrub to 80 cm, glabrous, stems woody; leaves 2.5-7 x 0.5-2.5 cm, oblong-ovate, coriaceous; umbels 2-flowered; flowers 3-4.5 cm, corolla lobes fused at the base, tube 4-9 mm; lobes 2.5-3.5 cm, becoming looped; berry 0.6 x 1.2 cm, ovoid, scarlet.

GE, S; on *Acacia*, *Ziziphus*, *Tamarix*. Egypt, Palestine, Arabia, Sudan, Ethiopia.

POLYGONACEAE

Herbs, shrubs or lianes; stems sometimes twining or climbing; leaves simple, alternate, usually entire; stipules united to form a membranous sheath (ocrea); flowers bisexual or unisexual, actinomorphic; perianth with 3-6 segments, often accrescent and enclosing the fruit, sometimes winged, toothed or bearing spines; stamens 6-15; ovary superior, 1-loculed, with 1 basal ovule; styles 2-4; fruit a trigonous or lenticular achene or nut,

sometimes enclosed in the persistent perianth. 46 genera, 1100 species, cosmopolitan, especially north temperate.

- | | |
|---|----------------------|
| 1. Shrubs | 2 |
| + Annual, biennial or perennial herbs | 3 |
| 2. Leaves ovate-rhombic; stamens 6 | 1. Atraphaxis |
| + Leaves subulate, minute, soon deciduous; stamens 10-16 | 2. Calligonum |
| 3. Fruiting perianth with 3 spreading prickles | 4 |
| + Fruiting perianth sometimes toothed but not with rigid prickles | 5 |
| 4. Leaves simple, not lobed | 3. Emex |
| + Leaves lobed | 4. Oxygonum |
| 5. Outer perianth segments keeled or slightly winged in fruit | 7. Fallopia |
| + Outer perianth segments never keeled or winged in fruit | 7 |
| 6. Inner fruiting perianth segments accrescent, winged or toothed | 8. Rumex |
| + Inner fruiting perianth segments never accrescent, winged or toothed | 8 |
| 7. Flowers in spicate racemes, ocreae cylindric, truncate or with a terminal fringe of bristles | 5. Persicaria |
| + Flowers solitary or in axillary clusters, ocreae bilobed or fimbriate | 6. Polygonum |

1. **Atraphaxis** L.

Shrubs, usually spinescent; leaves alternate, simple, entire; ocreae 2-fid; flowers bisexual, in short axillary racemes; perianth 4-5 segments, 2-whorled, inner segments becoming scarious and surrounding the fruit; stamens 6-8; ovary 1-ovuled; fruit a small nut. 25 species, North Africa, Southeast Europe, Arabia to Himalaya and Siberia.

1. **Atraphaxis spinosa** L., Sp. Pl., ed. 1, 333 (1753) var. *sinaica* (Jaub. & Spach) Boiss., Fl. Orient. 4: 1021 (1879).
Syn. *Atraphaxis sinaica* Jaub. & Spach, Ill. Pl. Orient. 2: 12 (1844).

Shrub to 60 cm; stems woody, spinescent, branchlets leafy; leaves 0.3-1.2 x 0.2-1 cm, ovate-rhombic, sessile; ocreae 2-fid; flowers 1-6 in axillary clusters, on short twigs; perianth segments 4, the 2 inner to 1 cm in fruit; stamens 6; styles 2-3; nutlet 3-4 mm, broadly-ovate, brownish, smooth.

De, S; rocky slopes and desert wadis. Egypt, Palestine, Arabia.

2. **Calligonum** L.

Shrubs, stems much branched; main branches woody, rigid; young branches herbaceous, thin, green; leaves minute, soon deciduous; ocreae short; flowers bisexual, small, 1-few in axillary clusters; perianth 5 subequal segments; stamens 10-16, connate at the base; ovary tetragonous, 4-winged, styles 4, stigmas capitate; nut woody, tetragonous, covered with stiff branching bristles. 80 species, Europe, North Africa, West and Central Asia.



Plate 6. SANTALACEAE: *Thesium humile* 1, fruiting branch (left); flowering branch (down right); fruit (up right). **LORANTHACEAE:** *Plicosepalus curviflorus* 2, flowering branch; leafy branch (down right); fruiting branch (up left). *Plicosepalus acaciae* 3, flowering branch. **POLYGONACEAE:** *Atraphaxis spinosa* var. *sinaica* 4, fruiting branch; fruit (left); leafy branch (right). *Calligonum polygonoides* 5, flowering branch; node with leaves (up left); section in fruit (middle right); flowers (up right); fruit (down). *Emex spinosa* 6, flowering and fruiting branch; flower (down left); leaf base and ocrea (middle); fruit (up). *Oxygonum sinuatum* 7, flowering and fruiting branch; leaf base and ocrea (left); flower (up); fruit (right). *Oxygonum atriplicifolium* 8, flowering and fruiting branch; flower (middle); leaf base and ocrea (up right). All drawings to the same scale except enlarged parts (scale 1 mm).

1. **Calligonum polygonoides** L., Sp. Pl., ed. 1, 530 (1753).

Shrub to 1.2 m, glabrous; older stems with whitish bark; leaves 0.2-1 cm, subulate, soon deciduous; ocreae 2-lobed, membranous; perianth 3-5 mm, white; achene to 1.2 x 0.6 cm, ellipsoid to oblong-ovoid, with 4 longitudinal ribs bearing 3-5 mm branching bristles.

Two subspecies occur in Egypt:

subsp. **polygonoides**

Leaves 0.6-1 cm; perianth 3 mm; achene 7-8 x 5-6 mm excluding the bristles, ellipsoid.

S; sandy deserts. Palestine, Syria, Armenia, to Central Iran.

subsp. **comosum** (L' Hér.) Soskov, Nov. Sist. Vyss. Rast. 12: 153 (1975).

Syn. *Calligonum comosum* L' Hér., Trans. Linn. Soc. London 1: 180 (1791).

Leaves 2-4 mm; perianth 3-5 mm; achene 1-1.3 x 0.6 cm excluding the bristles, oblong-ovoid.

O, M, D, R, GE, S; sandy deserts, sand dunes. Northeast Africa, Sinai, Palestine, Arabia to Pakistan.

NOTE: The above two subspecies are often treated as separate species.

3. **Emex** Campd., nom. conserv.

Monoecious annual herbs, glabrous; leaves alternate, simple, ocreae membranous; flowers greenish, in axillary clusters; male flowers with 3-6 segments, fused at the base; stamens 4-6; female flowers with 6 segments, indurate in fruit, the outer 3 becoming spinescent; ovary with 1 ovule, styles 3; nut trigonous, enclosed within the spinescent perianth. 2 species, Old World.

1. **Emex spinosa** (L.) Campd., Monogr. Rumex 58, t. 1 (1819).

Syn. *Rumex spinosus* L., Sp. Pl., ed. 1, 337 (1753).

Annual herb to 40 cm, stems decumbent or erect; leaves 2-10 x 1-6 cm, ovate to deltoid; petiole 2-10 cm, male flowers 1.5 mm, pedicellate; female flowers 5-6 mm, sessile; fruiting perianth 4-5 x 2.5-4 mm including the spines, pitted, with recurved spines.

N, O, M, D, S; weed of cultivation, sandy desert soils. Mediterranean region, Sinai, Arabia to India; naturalized elsewhere.

4. **Oxygonum** Burch.

Annual or perennial herbs, polygamous, heterostylous; leaves alternate, lobed (our species); ocreae with a terminal fringe of setae; flowers in axillary leafless elongated spicate inflorescences; perianth of male flowers with 4-5 petaloid segments fused at the base; bisexual flowers tubular, tepals accrescent around the ovary; stamens 8, outer 5 adnate to the tepals; styles 3, free or united at the base; stigmas capitate; fruiting perianth

fusiform with 3 spreading prickles (our species). 30 species, tropical and South Africa, Madagascar.

1. Leaves deeply lobed, ocreae to 5.5 mm; fruit erect or spreading
+ Leaves slightly lobed, ocreae 1 cm; fruit pendulous
1. **O. sinuatum**
2. **O. atriplicifolium**

1. **Oxygonum sinuatum** (Meisn.) Dammer in Engl. & Prantl., Pflanzenfam. III., I. a: 30 (1892).

Syns. *Ceratogonum sinuatum* Meisn. in DC., Prodr. 14: 40 (1856).

Ceratogonum cordofanum Meisn. in DC., Prodr. 14: 39 (1856).

Oxygonum atriplicifolium var. *sinuatum* (Meisn.) Baker, Fl. Trop. Afr. 6 (1): 101 (1909).

Annual herb to 25 cm, stems decumbent or erect; leaves 4-6 x 1.5-2.5 cm, deeply lobed, ocreae to 5.5 mm, fringed with setae; petiole 1-2 cm; inflorescence to 25 cm; bracts to 6 mm; flowers white or pink; slightly heterostylous; tepals 2.5-3 mm, tube 1-1.5 mm; fruit 5-6.5 mm, fusiform, erect or spreading, the prickles 1.5-2 mm.

GE; rocky slopes and ridges. Tropical East and Central Africa.

2. **Oxygonum atriplicifolium** (Meisn.) Martelli, Florula Bogos. 69 (1886).

Syns. *Ceratogonum atriplicifolium* Meisn. in Wall., Pl. As. Rar. 3: 63 (1832).

Polygonum owenii Bojer, Ann. Sci. Nat., sér. 2, 4: 267 (1835).

Oxygonum somalense Chiov., Miss. Stef.-Paoli Somal. Ital. 1: 152 (1916).

Annual herb to 80 cm; stems slender, trailing; leaves 2-3 x 1.5-2 cm, deltoid or deltoid-ovate, slightly lobed, apex acute, glabrous on the upper surface, pubescent along the margins and veins of the lower surface; petiole 1-1.5 cm, pubescent; ocreae to 1 cm, brownish, pubescent, with a terminal fringe of long setae; inflorescence to 30 cm, bracts 3-4 mm; flowers white or greenish outside, strongly heterostylous; male flowers with 5 tepals, bisexual flowers with 6 tepals; fruit 5-6.5 mm, fusiform, pendulous, the prickles ca. 2 mm.

GE; rocky slopes and ridges. Tropical East Africa, Madagascar.

5. **Persicaria** (L.) Mill.

Annual or perennial herbs, some amphibious; leaves entire, oblong-ovate or lanceolate; ocreae brownish, truncate or with a terminal fringe of bristles; flowers in almost ebracteate, spicate, lax racemes; perianth 4-5 segments; stamens 5-8, with dilated base; styles 2-3, united below; nutlet trigonous or lenticular. About 150 species, subcosmopolitan, mainly in the northern hemisphere.

1. Plant white-woolly
+ Plant glabrous or slightly tomentose
5. **P. lanigera**
2

2. Ocreae with a leafy limb
+ Ocreae without a leafy limb
7. **P. limbatum**
3

3. Leaves oblong with obtuse or rounded apex
+ Leaves lanceolate with acute or acuminate apex
3. **P. obtusifolia**
4

4. Ocreae with a terminal fringe of fine bristles, leaves without gland dots 5
 + Ocreae without a terminal fringe of bristles, sometimes shortly ciliate; leaves minutely gland-dotted 6

5. Annual; leaves often with a large black blotch, leaf margins and veins not setulose 1. **P. maculosa**
 + Perennial; leaves without a black blotch, leaf margins and veins on the lower surface setulose 2. **P. salicifolia**

6. Annual; leaves to 15 x 3 cm, often with a large black blotch; ocreae to 2 cm 6. **P. lapathifolia**
 + Perennial; leaves to 25 x 6 cm, without a black blotch; ocreae to 3.5 cm 4. **P. senegalensis**

1. **Persicaria maculosa** Gray, Nat. Arr. Brit. Pl. 2: 269 (1821).
 Syns. *Polygonum persicaria* L., Sp. Pl., ed. 1, 361 (1753).
Persicaria dolichopoda (Ohki) Sasaki, List Pl. Formos. 168 (1928).

Annual herb 40-80 cm; stems erect or ascending; leaves to 10 x 2.5 cm, elliptic-lanceolate, acuminate, often with a large black blotch; ocreae to 1.6 cm, fringed with fine bristles; racemes 1.5-3.5 cm, dense-flowered, bracts ciliate; perianth 2.5-3 mm, white or pink; nutlet 1.8-2.2 mm, trigonous.

N, M; margins of irrigation canals. Temperate regions of northern hemisphere.

2. **Persicaria salicifolia** (Brouss. ex Willd.) Assenov, Fl. Reipubl. Popul. Bulgar. 3: 243 (1966).

Syns. *Polygonum salicifolium* Brouss. ex Willd., Enum. Pl. Hort. Berol. 428 (1809).

Polygonum decipiens R. Br., Prodr. 420 (1810).

Polygonum serrulatum Lag., Gen. Sp. Pl. 14 (1816), non Webb & Moq.

Persicaria decipiens (R. Br.) K. L. Wilson, Telopea 3: 178 (1988).

Perennial herb 30-80 cm, stems erect or decumbent; leaves 8-15 x 1-2.5 cm, narrowly-lanceolate, acuminate, margins and veins on the lower surface setulose; ocreae 1.6-2 cm; racemes 3-10 cm; bracts ciliate; perianth 2.3-3 mm, white or pink; nutlet 2-3 mm, trigonous.

N, M; irrigation canals and waste moist ground. Old World, mainly tropical.

3. **Persicaria obtusifolia** (Täckh. & Boulos) Greuter & Burdet, Willdenowia 19: 41 (1989).

Syn. *Polygonum obtusifolium* Täckh. & Boulos, Publ. Cairo. Univ. Herb. 5: 91, f. 15 (1974).

Perennial herb 25-40 cm; stems erect or ascending, richly branching, densely leafy; leaves 4-7 x 1-1.5 cm, oblong, with obtuse or rounded apex, often shortly apiculate; ocreae 0.8-1.2 cm; racemes 3-5 cm, with lax flowers; perianth pinkish-green, glandless.

N (Faiyum); along canals. Endemic.

4. **Persicaria senegalensis** (Meisn.) Soják, Preslia 46: 155 (1974).
Syn. *Polygonum senegalense* Meisn., Monogr. Polygon. 54 (1826).

Perennial herb 0.8-2.5 m; stems erect or decumbent, often rooting at the nodes; leaves 10-25 x 2.5-6 cm, lanceolate, acuminate, minutely yellow-glandular, glabrous or slightly white-tomentose; ocreae 2.5-3.5 cm, not fringed; racemes 4-10 cm, densely-flowered, peduncles and racemes yellow-glandular; perianth pink or white; nutlet 2.5-3 mm, flattened, depressed on both faces.

N, M; borders of canals. Tropical Africa, Egypt, Palestine, Yemen.

5. **Persicaria lanigera** (R. Br.) Soják, Preslia 46: 153 (1974).
Syn. *Polygonum lanigerum* R. Br., Prodr. 419 (1810).

White-woolly perennial herb, 0.6-1.5 m; stems erect, often woody at the base, rooting at lower nodes; leaves 10-25 x 2-6 cm, broadly-lanceolate, acuminate, densely-woolly on the lower surface, grey-woolly on the upper; ocreae 2.5-3.5 cm, fringed with short cilia; peduncles without gland dots; inflorescence 2-2.5 cm, densely-flowered; perianth 3-4 mm, pink; nutlet lenticular, blackish.

N, O; along canal banks and around springs. Tropics of the Old World, extending to Crete and Palestine.

6. **Persicaria lapathifolia** (L.) Gray, Nat. Arr. Brit. Pl. 2: 270 (1821).
Syns. *Polygonum lapathifolium* L., Sp. Pl., ed. 1, 360 (1753).
Polygonum tomentosum Schrank, Baier. Fl. 1: 669 (1789).

Annual herb 40-60 cm; stems erect or ascending; leaves 8-15 x 1.5-3 cm, often with a large black blotch, glabrous or slightly pubescent; ocreae 1.5-2 cm, often shortly-fringed; peduncles and racemes yellow-glandular, rough; racemes 4-8 cm, dense-flowered; perianth 2.5 mm, white or pink; nutlet 2 mm, biconvex.

N; canal banks. Europe, Northeast Africa, Asia.

7. **Persicaria limbata** (Meisn.) Hara, Fl. E. Himalaya 71 (1966).
Syn. *Polygonum limbatum* Meisn. in A. DC., Prodr. 14: 123 (1856).

Perennial herb 50-80 cm; stems erect or decumbent, rooting at the nodes; leaves 8-12 x 0.8-2 cm, narrowly-lanceolate, acute, sometimes sparingly hairy on both surfaces, subsessile; ocreae brown, membranous, terminating with a green leafy limb 2-8 mm diam., with a ciliate margin; inflorescence 2-5 cm; perianth 3.5-4.5 mm; nutlet 2.5 mm, lenticular, reddish-brown.

N, M; along canals and borders of ditches. Egypt, tropical Africa and Asia.

6. *Polygonum* L.

Annual or perennial herbs; leaves narrow, entire; ocreae bilobed; flowers in axillary clusters; perianth 4-5-lobed; stamens 4-8, not dilated at the base; styles 2-3; nutlet trigonous. About 200 species, cosmopolitan.

1. Leaves with revolute margins and prominent veins; internodes usually shorter than the leaves and covered by them; ocreae with 8-12 prominent branched veins; plants of maritime sand **6. P. maritimum**
- + Leaves without revolute margins or prominent veins; internodes usually longer than most of the leaves; ocreae with fewer faint veins; plants of cultivation and waste ground 2
2. All leaves of similar size, to 1.2 cm; tepals 4, 1.5-2 mm **3. P. plebeium**
- + Leaves usually unequal, to 5 cm; tepals 5, 2.5-4 mm 3
3. Perennial with a woody base; ocreae to 1.8 mm **5. P. equisetiforme**
- + Annual with herbaceous base; ocreae shorter 4
4. Perianth 3-4 mm; leaves caducous **4. P. bellardii**
- + Perianth 2.5-3 mm; leaves persistent 5
5. Perianth tube very short, about $\frac{1}{4}$ the length of the tepal; nutlet 2.5-3 mm **1. P. aviculare**
- + Perianth tube $\frac{1}{2}$ the length of the tepal; nutlet 1.5-2.5 mm **2. P. arenastrum**

1. **Polygonum aviculare** L., Sp. Pl., ed. 1, 362 (1753).

Annual to 60 cm; stems decumbent or procumbent, much branched; leaves 2-5 x 0.5-1.5 cm, lanceolate to ovate, persistent; inflorescence leafy; flowers 3 mm, solitary or in 2-5-flowered clusters; perianth-tube c. $\frac{1}{4}$ as long as the tepal; achene 2.5-3.5 mm, trigonous, black or dark brown, smooth.

N, M; weed of cultivation and waste ground. Cosmopolitan.

2. **Polygonum arenastrum** Boreau, Fl. Centre France, ed. 3, 2: 559 (1857).

Annual to 50 cm; stems procumbent or prostrate, mat forming; leaves 1-5 x 0.2-1.4 cm, ovate-lanceolate to linear-lanceolate, usually subequal, persistent; ocreae to 1.2 cm; flowers 2-5 in axillary clusters; perianth tube $\frac{1}{2}$ as long as the tepal; nutlet 1.5-2.5 mm, enclosed in the persistent perianth, brown, punctulate-striate.

S; waste and trampled ground. Temperate regions of northern hemisphere.

3. **Polygonum plebeium** R. Br., Prodr. 420 (1810).

Syn. *Polygonum herniarioides* Spreng., Syst. Veg. 2: 256 (1825).

Annual or short-lived perennial to 30 cm; stems prostrate, much branched, reddish-brown; leaves 1.2 x 0.25 cm, all of similar size, linear to obovate-elliptic; ocreae fringed with laciniae; flowers 1-3(-4) in axillary clusters; perianth 2 mm, greenish; tepals 4, 1.5-2 mm; nutlet 1.5-2 mm, trigonous, black.

N, O, M; waste ground. Tropical East Africa, Madagascar, West Asia, Australia.

4. **Polygonum bellardii** All., Fl. Pedem. 2: 207, t. 90, f. 2 (1785).

Syn. *Polygonum patulum* auct., non M. Bieb., Fl. Taur.-Cauc. 1: 304 (1808).



Plate 7. POLYGONACEAE: *Persicaria salicifolia* 1, leafy branch; flowering branch (up right); flowers (down right); nutlet (up left). *Persicaria senegalensis* 2, leafy branch; flowering branches and nutlet (up). *Persicaria lanigera* 3, flowering branch; flowers (left); leafy branch (down right); nutlet (up). *Persicaria lapathifolia* 4, flowering branch; flowers (up right); leaf base and ocrea (down right); nutlet (middle right). *Polygonum aviculare* 5, flowering branch; flower and leaf base (down left); nutlet (up left). *Polygonum bellardii* 6, flowering branches; nutlet (left). *Polygonum equisetiforme* 7, leafy branch; flowering branch (left); leaf base and ocrea (up); flower (right); nutlet (middle left). *Polygonum maritimum* 8, flowering branch; flowers and leaves (up); nutlet (left). *Fallopia convolvulus* 9, flowering branch; nutlet and flowers (right). All drawings to the same scale except enlarged parts (scale 1 mm).

Annual 20-60 cm; stems erect or ascending; leaves 1.2-4.5 x 0.2-1.2 cm, narrowly-elliptic to linear-oblong, caducous; ocreae 1 cm; flowers solitary or 2-3 in axillary clusters; perianth 3-4 mm, green with reddish margins; nutlet 2.5-3.5 mm, blackish-purple, enclosed in the persistent perianth.

N, O, M, S; weed of cultivation and disturbed ground. Europe, North Africa, Southwest Asia.

5. *Polygonum equisetiforme* Sm., Fl. Graec. Prodr. 1: 266 (1809).

Perennial herb 0.6-1.2 m, woody at the base; stems richly branched, decumbent or prostrate; leaves 1.5-5 x 0.5-1.5 cm, deciduous, jointed at the base, oblong-lanceolate to linear-lanceolate; ocreae to 1.8 cm; flowers in loose leafy inflorescences, solitary or 2-3 in axillary clusters; pedicels equalling or longer than the perianth; perianth 3 mm, white to pink; nutlets 2-2.5 mm, trigonous, enclosed in the persistent perianth.

N, O, M, D, S; roadsides and disturbed ground. Mediterranean region, Southwest Asia.

6. *Polygonum maritimum* L., Sp. Pl., ed. 1, 361 (1753).

Perennial herb 10-40 cm, with woody base; stems procumbent, branching, densely leafy, internodes usually shorter than the leaves; leaves 1.5-3.5 x 0.4-0.8 cm, leathery, with revolute margins and prominent veins; ocreae to 1.5 cm, with 8-12 prominent branched veins; inflorescence loose; flowers 1-4 in axillary clusters; perianth 4 mm, pink or white; achene 3-4.5 mm, trigonous, brown, lustrous.

M; maritime sandy shores. Mediterranean region, extending northwards to Britain; North and South America.

7. *Fallopia* Adans.

Annuals or woody perennials; stems twining or procumbent; leaves deltoid or cordate-sagittate; ocreae truncate; flowers in lax spicate or paniculate inflorescences; perianth segments 5(-6), the outer 3 larger, keeled or winged; stamens 8; stigmas capitate, subsessile; nutlet trigonous, enclosed in the perianth. 9 species, north temperate.

1. *Fallopia convolvulus* (L.) Á. Löve, Taxon 19: 300 (1970).

Syns. *Polygonum convolvulus* L., Sp. Pl., ed. 1, 364 (1753).

Bilderdykia convolvulus (L.) Dumort., Fl. Belg. 18 (1827).

Annual to 1.2 m; stems climbing, twining or spreading, angular; leaves 2-5 x 2-4 cm, puberulent or mealy, acuminate, petiolate; flowers in spicate inflorescences; pedicel to 3 mm; perianth 4 mm, of 5 segments, greenish-white, outer segments keeled or slightly winged in fruit; nutlet 4-5 mm, finely granular, black, dull.

N, M; weed of cultivation. North Africa, Europe, Asia; introduced elsewhere.

8. *Rumex* L.

Annual or perennial herbs, rarely shrubs; leaves entire or pinnately lobed; flowers unisexual or bisexual, in racemose or paniculate inflorescences; pedicels jointed; perianth

segments 6, rarely 4, in 2 whorls, the outer remaining small and thin, the inner becoming enlarged and often accrescent in fruit (valves); stamens 6 in 2 whorls, styles 3; anthers basifixed; nutlets trigonous, rarely bigonous. 200 species mainly northern hemisphere.

- | | |
|---|--|
| 1. Lower leaves pinnately-lobed
+ All leaves entire | 5. R. pictus
2 |
| 2. Pedicels club-shaped, reflexed, thickened in fruit
+ Pedicels thin, not as above | 9. R. bucephalophorus
3 |
| 3. Lower leaves oblong-lanceolate, narrow-lanceolate or linear, 3 times or more as long as broad; valves leathery, not suborbicular
+ Lower leaves deltoid, ovate-deltoid to oblong-deltoid, usually as long as broad or slightly longer than broad; valves membranous, suborbicular | 4
7 |
| 4. Valves entire or denticulate, not distinctly toothed
+ Valves distinctly toothed | 4. R. crispus
5 |
| 5. Valves with flexible bristle-like teeth 0.8-1 cm
+ Valves with 1-4 stiff teeth 1-1.5 mm | 1. R. aegyptiacus
6 |
| 6. All 3 valves with a well-developed tubercle
+ One only of the valves with a well-developed tubercle | 2. R. dentatus
3. R. pulcher |
| 7. Largest valve with a prominent red denticulate marginal nerve
+ Largest valve entire, without a prominent red marginal nerve | 6. R. cyprius
8 |
| 8. Pedicel 1-flowered, jointed in the middle; largest valves to 1.5 cm diam.
+ Pedicel 2-3-flowered, jointed below the middle; largest valves to 2.3 cm diam. | 8. R. simpliciflorus
7. R. vesicarius |

1. **Rumex aegyptiacus** L., Sp. Pl., ed. 1, 335 (1753).
Syn. *Rumex comosus* Forssk., Fl. Aegypt.-Arab. 76 (1775).

Annual glabrous herb, 10-30 cm; stems procumbent or ascending, usually branched from the base; leaves 3-10 x 0.2-3 cm; lower leaves oblong-lanceolate, base truncate; the upper narrowly-elliptic to linear, base attenuate, apex acute; petiole 1-5 cm; inflorescence leafy, spicate, interrupted in flower, becoming compact and cylindrical in fruit; flowers 2 mm, in dense axillary clusters; pedicels 0.5-1.5 mm; perianth 4 segments, in 2 whorls, each of 2 segments; nutlet bigonous, valves of the inner fruiting perianth with bristle-like teeth 0.8-1 cm; the compact fruit at maturity with the spreading teeth give a characteristic aspect to the plant.

N; Nile and canal banks. Endemic.

NOTE: The plant has not been collected for over 50 years.

2. **Rumex dentatus** L., Mant. Alt. 226 (1771).

Annual glabrous herb, 0.2-1.2 m; stems erect, branched; basal leaves to 10 x 3 cm,

ovate-oblong to oblong-lanceolate, base truncate, apex obtuse, petiole equalling or shorter than the blade; upper leaves narrowly-lanceolate, acuminate; inflorescence of many-flowered whorls; pedicels reflexed, jointed near the base; fruit valves 3-6 x 2-6 mm including the teeth, each with 1.5-2.5 mm tubercle; nutlet 2 mm, trigonous, brownish.

Two subspecies occur in Egypt:

· subsp. **dentatus**

Teeth 1-2, shorter than the width of the valve; tubercle with smooth margins.

N, M; canals and moist waste ground. Libya, Egypt, Palestine.

subsp. **mesopotamicus** Rech. f., Beih. Bot. Centralbl. 49(2): 16 (1932).

Syn. *Rumex dentatus* L. var. *pleiodon* Boiss., Fl. Orient. 4: 1013 (1879).

Teeth 3-5, longer than the width of the valve; tubercle with wrinkled margins.

N, O, M, S; canals and moist waste ground. Egypt, Palestine, Syria, Arabia, Iraq.

Area of the species: Europe, Mediterranean region, Asia.

3. **Rumex pulcher** L., Sp. Pl., ed. 1, 336 (1753).

Annual (in Egypt) glabrous herb, 20-80 cm; stems erect or ascending, striate; leaves 4-12 x 0.5-3 cm, rather fleshy; lower ovate-oblong, oblong-lanceolate, elliptic-lanceolate, base subcordate, apex acute, long-petiolate; upper linear, sessile or short-petiolate; flowers in racemose or paniced many-flowered whorls, interrupted at the base, compact towards the apex; pedicels jointed below the middle, elongate in fruit; fruit valves 4-6 x 3-5 mm, leathery; tubercles 2.5 mm, rugose, on 1 or all valves; nutlet 2.5 mm, trigonous, ovoid, brown.

O, M; moist ground, borders of canals. Europe, North Africa, Southwest Asia.

4. **Rumex crispus** L., Sp. Pl., ed. 1, 335 (1753).

Annual (in Egypt) glabrous herb, 30-80 cm; stems erect, branched from the base; leaves 3-20 x 2-6 cm; lower oblong-lanceolate, rounded to cuneate at the base, apex acute; upper linear-lanceolate, short-petiolate; flowers in paniculate many-flowered whorls, interrupted at the base, compact towards the apex; pedicels jointed below the middle, elongate in fruit; fruit valves 4-6 x 3-5 mm, leathery; tubercles 2.5 mm on 1 or all valves; nutlet 2.5 mm, trigonous, ovoid, brown.

N; canal edges and moist ground. Cosmopolitan weed.

5. **Rumex pictus** Forssk., Fl. Aegypt.-Arab. 77 (1775).

Syn. *Rumex lacerus* Balb., Mém. Acad. Sci. Turin, Sci. Phys. 1: 335 (1804).

Annual glabrous herb 10-30 cm; stems decumbent, richly branched at the base; leaves 2-5 cm, lower long-petiolate, pinnately-lobed, lobes oblong-triangular; upper lanceolate-



Plate 8. POLYGONACEAE: leaves and fruits of: *Rumex aegyptiacus* 1. *Rumex dentatus* 2. *Rumex pulcher* 3. *Rumex crispus* 4. *Rumex pictus* 5. *Rumex cyprius* 6. *Rumex vesicarius* 7. *Rumex simpliciflorus* 8. *Rumex bucephalophorus* 9. All leaves to the same scale, all fruits (scale 1 mm).

linear; flowers unisexual and bisexual, 1-4(-5), in remote whorls; pedicel longer than the perianth, jointed below the middle; perianth 1.5-2.5 mm; fruit valves 5-8 x 6-8 mm. reniform, purplish-red along the veins; nutlet 2.5 mm, trigonous, yellowish-brown. smooth.

N, S; sandy soils. Egypt, Syria, Arabia.

6. **Rumex cyprius** Murb., Acta Univ. Lund., ser. 2, 2(4): 20 (1907).

Syn. *Rumex roseus* Campd., Monogr. Rumex 62, 128 (1819) non L., Sp. Pl., ed. 1, 337 (1753).

Annual glabrous herb 10-40 cm; stems branched from the base, erect or ascending; leaves 2-7 x 1.5-4.5 cm, fleshy; lower ovate-deltoid, upper lanceolate; flowers 2-3 mm, 1-2 on each pedicel; wings in fruit membranous, distinctly unequal, the largest wing 2 x 2 cm, suborbicular, with red denticulate marginal nerve; nutlet 3 mm, trigonous, lanceolate-ovoid, pale brown, smooth.

M, De, S; Cyprus, North Africa, Sinai, Palestine, Arabia to Iran.

7. **Rumex vesicarius** L., Sp. Pl., ed. 1, 336 (1753).

Annual glabrous herb 10-60 cm; stems branched from the base, ascending; leaves 2-7 x 1.5-5 cm, fleshy; lower ovate-deltoid, petiolate; flowers bisexual and unisexual, in racemose or paniculate inflorescences; pedicels 2-3-flowered, jointed below the middle; wings in fruit membranous, subequal, largest 1.5-2 cm, suborbicular; nutlet 2.5-3 mm, ovoid, brownish.

M, D, R, GE, S; rocky and sandy desert wadis. North Africa, Southwest Asia (extending to South Greece) eastwards to North India and Afghanistan.

8. **Rumex simpliciflorus** Murb., Acta Univ. Lund. 35 (3): 11 (1899).

Annual glabrous herb 10-40 cm; stems erect; leaves 3-7 x 2-4.5 cm, ovate-deltoid, fleshy, petiolate; flowers spicate, bisexual or unisexual; pedicels jointed in the middle; wings in fruit 1-1.5 cm, orbicular, membranous, reticulate-veined, without marginal nerves, often pinkish; nutlets 2-3.5 mm, trigonous, acute, light brown.

De, R, GE; sandy and rocky desert wadis. North Africa, Madeira.

9. **Rumex bucephalophorus** L., Sp. Pl., ed. 1, 336 (1753).

Annual glabrous herb 5-25 cm; stems erect, simple or branched from the base; leaves 1-3.5 x 0.5-2.5 cm; lower ovate-spathulate, long-petiolate; upper lanceolate to linear, short-petiolate; ocreae to 1 cm, membranous; flowers in terminal, simple, spicate or racemose many-whorled inflorescences, whorls 2-4-flowered; pedicels in fruit elongate, dilated and reflexed; flowers 2 mm, bisexual; valves in fruit 2.5-4.5 x 2.5-5.5 mm, deltoid, leathery, with 2-4 spiny teeth on each side and a minute basal wart.

S; desert wadis. Mediterranean region, Sinai.

NYCTAGINACEAE

Annual or perennial herbs (our species), climbing shrubs or trees; leaves opposite, sometimes alternate or whorled, petiolate, simple; stipules absent; inflorescence usually cymose; flowers bisexual, sometimes unisexual, usually subtended by free or united bracts; perianth petaloid, 5-lobed, tubular or funnel-shaped, the lower part persistent in fruit; stamens 1-10; ovary superior, 1-locular, with 1 ovule; style simple; fruit a 1-seeded achene (anthocarp), enclosed by the persistent part of the perianth. 30 genera, 390 species, tropical and warm regions, especially tropical America.

- 1. Anthocarp (fruit) obscurely 10-ribbed, with sessile or stalked wart-like glands
 - + Anthocarp 3- to 5-ribbed, glabrous, puberulous or glandular-pubescent
1. **Commicarpus**
2. **Boerhavia**

1. **Commicarpus** Standl.

Annual or perennial herbs, some shrublets with a woody base; leaves opposite, petiolate, entire or lobed; flowers bisexual, in umbels, heads or whorls; bracts small; perianth petaloid, 5-lobed, funnel-shaped, stamens 2-6, free, exserted; stigma capitate; ovary 1-locular, fruit (anthocarp) obscurely 10-ribbed, with sessile or stalked wart-like glands. 20 species, tropical Africa, Arabia, East Asia, Australia.

- 1. Stem and inflorescence glandular-pilose, sticky
 - + Stem and inflorescence glabrous, puberulent or pilose, not sticky
4. **C. grandiflorus**
2
- 2. Leaves to 4 cm, sinuate or lobed; perianth 6-9 mm, with a long basal tube
 - + Leaves to 8 cm, ovate to ovate-triangular or suborbicular; perianth 2-5 mm, with a short basal tube
2. **C. sinuatus**
3
- 3. Perianth 3-5 mm; pedicel 0.6-1.4 cm; stamens 3(-4)
 - + Perianth 1.5-2.5 mm; pedicel 2-4 mm; stamens 2
1. **C. boissieri**
3. **C. helenae**

1. **Commicarpus boissieri** (Heimerl) Cufod., Bull. Jard. Bot. Bruxelles 23: 79 (1953).
Syn. *Boerhavia boissieri* Heimerl, Akad. Wiss. Math.-Naturwiss. Kl., Denkschr. 71: 346 (1907).

Perennial herb; stems glabrous; leaves 3-8 cm, ovate to suborbicular, entire or slightly sinuate; flowers in whorls, pedicel 0.6-1.4 cm; perianth 3-5 mm, pink or purple, the basal tube short, glabrous; stamens 3(-4); anthocarp clavate, with small glands near the tip and prominent glands towards the base.

S; rocky wadis. Sinai, Oman, Pakistan, India.

2. **Commicarpus sinuatus** Meikle, Kew Bull. 29: 83 (June 1974).
Syns. *Boerhavia plumbaginea* Cav. var. *viscosa* Boiss., Fl. Orient. 4: 1044 (1879).
Commicarpus ehrenbergii Täckh. & Boulos, Publ. Cairo Univ. Herb. 5: 85 (Nov. 1974).
Boerhavia sinuata (Meikle) Greuter & Burdet, Willdenowia 16: 448 (1987).

Perennial herb; stems puberulent; leaves 1-4 cm sinuate or lobed; flowers in umbels; pedicels short; perianth 6-9 mm with a long basal tube; stamens 3-4; anthocarp clavate, puberulent and with sessile glands.

S; rocky and sandy wadis. Sinai, Arabia, Ethiopia, Somalia.

3. **Commicarpus helenae** (Schult.) Meikle, Hooker's Icon. Pl. 37: t. 3694 (1971).

Syns. *Boerhavia helenae* Schult. in Roem. & Schult., Mant. 1: 73 (1822).

Boerhavia stellata Wight, Icon. Pl. Ind. Orient. 3, 2: 6, t. 875 (1843).

Commicarpus stellatus (Wight) Berhaut, Bull. Soc. Bot. France 100: 51 (1953), nom. inval.

Commicarpus verticillatus, sensu auct. mult., non *C. verticillatus* (Poir.) Standl., Contr. U. S. Nat. Herb. 18: 101 (1916).

Perennial herb; stems glabrous or slightly scabrid; leaves 3-6(-8) cm, ovate-triangular; flowers in whorls, the pedicels 0.5-3.5 mm; perianth 1.5-2.5 mm, pink or purple, with a short inconspicuous basal tube; stamens 2; anthocarp clavate, with stalked glands at the tip and small sessile glands below.

De, R, GE, S; stony wadis. Tropical Africa, Egypt, Palestine, Arabia, Iran, India.

4. **Commicarpus grandiflorus** (A. Rich.) Standl., Contr. U. S. Nat. Herb. 18: 101 (1916).

Syn. *Boerhavia grandiflora* A. Rich., Tent. Fl. Abyss. 2: 209 (1850).

Perennial herb; stems glandular-pilose, sticky; leaves 3-6 cm, ovate to ovate-triangular, entire; flowers in umbels, pedicel 3-8 mm; perianth 6-8 mm, pink or purple, narrowly funnel-shaped, the basal tube well-developed; stamens 3; anthocarp clavate, covered with wart-like glands.

S; rocky and sandy wadis. Chad, tropical Northeast Africa, Sinai, Arabia, India.

2. **Boerhavia** L.

Annual or perennial herbs, often with woody base; stems erect, prostrate or sprawling; leaves opposite, petiolate, entire; flowers bisexual, in terminal or axillary umbellate heads or panicles; bracts small; perianth 5-lobed, petaloid, rotate or campanulate; stamens 1-3; ovary 1-celled, 1-ovuled; fruit (anthocarp) 3- to 5-ribbed, enclosing the achene, glabrous, puberulent or glandular pubescent. 20 species, tropics and subtropics, some cosmopolitan weeds.

1. Flowers in axillary unbranched cymes, shorter than or slightly longer than the leaves 1. **B. repens**
- + Flowers in terminal, lax, leafless cymose panicles and occasionally simple axillary cymes 2
2. Flowers 2-7(-10) per cluster, sessile or on pedicels to 1 mm; axillary cymes occasionally present; stems decumbent and ascending; leaves 1-4.5 cm diam., ovate-elliptic or suborbicular 2. **B. diffusa**
- + Flowers solitary, rarely paired, on capillary pedicels to 1.6 cm; axillary cymes absent; leaves 0.2-1.2 cm diam., narrowly lanceolate to oblong-ovate 3. **B. elegans**

1. **Boerhavia repens** L., Sp. Pl., ed. 1, 3 (1753).

Annual or perennial herb, glabrous, puberulent or glandular-hairy; stems to 80 cm, prostrate; leaves 0.5-2.5 x 0.3-1.5 cm, ovate-deltoid or ovate-oblong, often whitish on the lower surface; flowers 2-7, in axillary unbranched cymes, shorter than or slightly longer than the leaves; perianth white or pink; stamens 2-3; anthocarp 2.5-3.5 x 1-1.5 mm, 5-ribbed.

Three subspecies occur in Egypt:

subsp. **repens**

Perennial; stems and leaves almost glabrous, green on both surfaces, eglandular; stamens 2-3; cymes 2- to 7-flowered; anthocarp 3 mm, pilose, glandular.

N; weed of cultivation and waste ground.

subsp. **diandra** (L.) Maire & Weiller in Maire, Fl. Afr. Nord 8: 235 (1962).

Syns. *Boerhavia diandra* L., Sp. Pl., ed. 1, 1194 (1753).

Boerhavia vulvariifolia Poir. in Lam., Encycl. 5: 55 (1804).

Annual or short-lived perennial; stems and leaves glabrous or slightly puberulent, not glandular; stamens 2; cymes 2- to 3-flowered; anthocarp 2.5 mm, papillose.

N, O; weed of cultivation and waste ground.

subsp. **viscosa** (Choisy) Maire, Mém. Soc. Hist. Nat. Afr. Nord 3: 88 (1933).

Syns. *Boerhavia repens* L. var. *viscosa* Choisy in A. DC., Prodr. 13 (2): 453 (1849).

Boerhavia coccinea, sensu Täckh., Stud. Fl. Egypt, ed. 2, 69 (1974).

Boerhavia viscosa, sensu Täckh., Stud. Fl. Egypt, ed. 2, 69 (1974).

Perennial; stems and leaves densely glandular-hairy on both surfaces, with adhering sand particles; stamens 2-3; cymes 2- to 5-flowered; anthocarp 3-3.5 mm.

N, O, D, R, GE, S; sandy desert wadis and waste ground near cultivation.

Area of the species: North and tropical Africa, Sinai, Palestine, tropical Asia; naturalized in Sicily.

2. **Boerhavia diffusa** L., Sp. Pl., ed. 1, 3 (1753).

Syn. *Boerhavia repens* L. var. *diffusa* (L.) Hook. f., Fl. Brit. Ind. 4(2): 709 (1885).

Perennial herb; stems to 80 cm, decumbent or ascending, glabrous or puberulent; leaves 1-5 x 1-4.5 cm, ovate-elliptic or suborbicular; flowers 2-7(-10) per cluster, sessile or on pedicels to 1 mm; axillary cymes occasionally present; perianth 1.5-2.5 mm, glandular-hairy; stamens 1-3, slightly exerted; anthocarp 3-3.5 x 1.5-2 mm, glandular-pubescent.

N; weed of cultivation and waste ground, especially on sandy soils. Tropical regions worldwide.

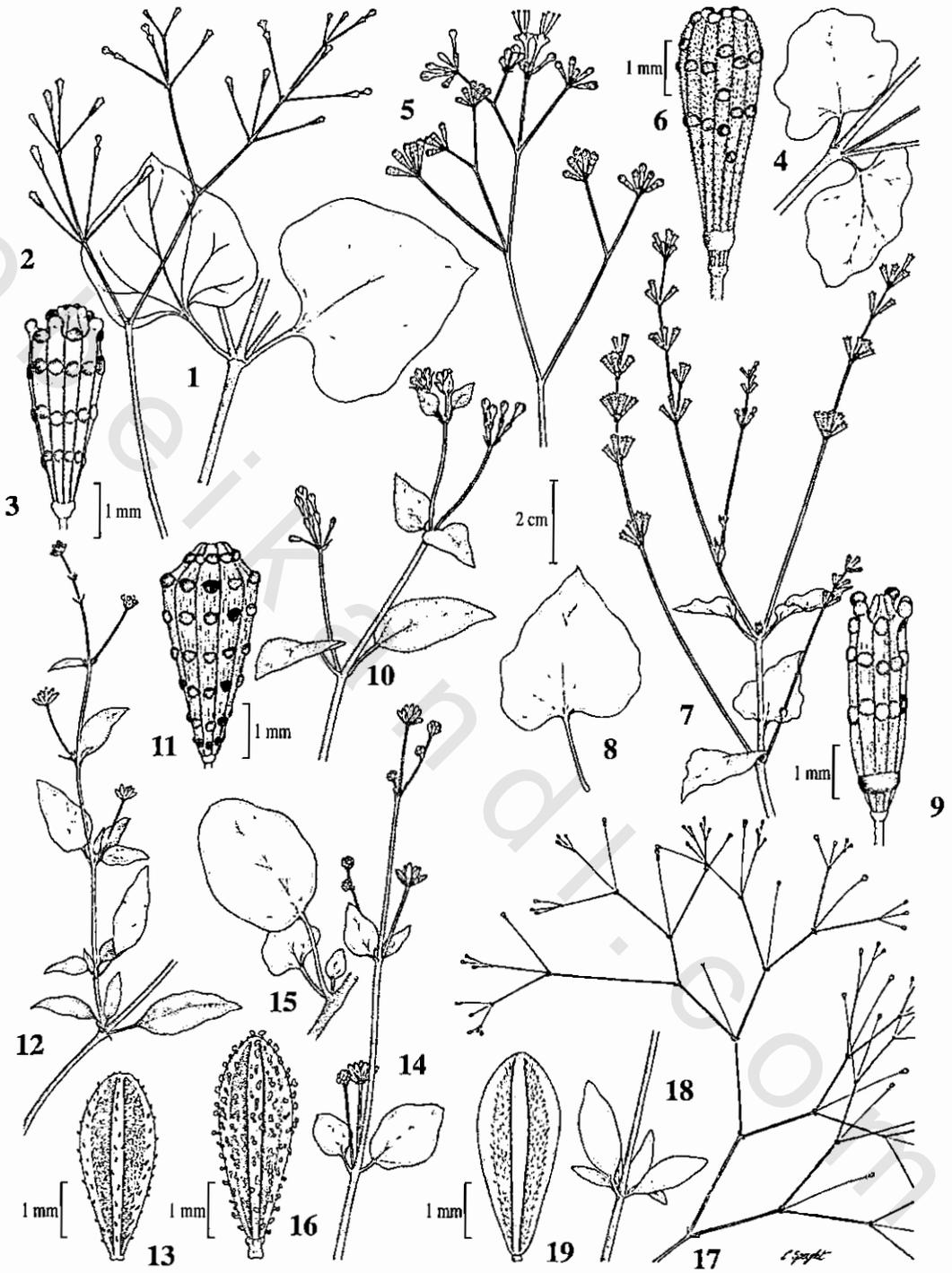


Plate 9. NYCTAGINACEAE: *Commicarpus boissieri* 1, leaves; 2, inflorescence; 3, fruit. *Commicarpus sinuatus* 4, leafy branch; 5, inflorescence; 6, fruit. *Commicarpus helenae* 7, flowering and fruiting branch; 8, leaf; 9, fruit. *Commicarpus grandiflorus* 10, flowering branch; 11, fruit. *Boerhavia repens* 12, flowering and fruiting branch; 13, fruit. *Boerhavia diffusa* 14, flowering and fruiting branch; 15, leafy branch; 16, fruit. *Boerhavia elegans* 17, inflorescence; 18, leafy branch; 19, fruit. All drawings to the same scale except enlarged parts (scale given).

3. **Boerhavia elegans** Choisy in DC., Prodr. 13(2): 453 (1849).

Syn. *Boerhavia rubicunda* Steud., Nomencl. Bot., ed. 2, 1: 213 (1841), nom. nud.

Perennial herb, woody at the base; stems to 50 cm, erect; leaves 2-5 x 0.2-1.2 cm; narrowly lanceolate to oblong-ovate, petiole to 1.2 cm; flowers solitary, rarely paired, on capillary pedicels to 1.6 cm; axillary cymes absent; perianth 2-3 mm, pink or purplish; anthocarp 3-4 x 1 mm, 5-ribbed, puberulent.

GE; rocky slopes and wadi beds. Northeast Africa to Ethiopia, Arabia, Iran, Pakistan, India.

MOLLUGINACEAE

(including Gisekiaceae)

Herbs or shrubs; leaves opposite, alternate or whorled; stipules small, scarious, deciduous, or absent; flowers usually bisexual, regular, solitary or in cymes; sepals 4-5, free or connate at the base; petals small or absent; stamens 5-many, sometimes connate at the base; ovary superior; carpels 2-5, with distinct styles; placentation usually axile; fruit a dehiscent capsule, schizocarp or nutlet. About 13 genera, 130 species, tropical and warm regions, especially Africa.

- 1. Small delicate annual herbs, the stems erect or ascending; cauline leaves linear and whorled, or all leaves in a basal rosette 4. **Mollugo**
- + Prostrate or procumbent annual or perennial herbs; cauline leaves lanceolate, spatulate, linear-oblong, ovate or suborbicular, alternate, opposite, or apparently verticillate, not in a basal rosette 2
- 2. Leaves alternate 3
- + Leaves opposite 4
- 3. Petals and stamens 5; capsule beaked; calyx persistent, surrounding the capsule 6. **Telephium**
- + Petals 0; petaloid staminodes and stamens numerous; capsule not beaked; calyx not persistent 5. **Corbichonia**
- 4. Plant densely stellate-canescens; fruit a many-seeded capsule 3. **Glinus**
- + Plants glabrous or glandular-puberulent; fruit a cluster of achenes or 2 mericarps 5
- 5. Plant glabrous; fruit 5 free achenes in a cluster 1. **Gisekia**
- + Plant glandular-puberulent; fruit 2 indehiscent 1-seeded mericarps 2. **Limeum**

1. **Gisekia** L.

Annual procumbent or prostrate herbs, streaked with numerous, linear, short, whitish raphides; leaves opposite, exstipulate; flowers in axillary clusters, bisexual or unisexual, perianth sepaloïd, of 5 free segments; stamens 5-20, petaloid staminodes absent; ovary 5 free carpels, each 1-locular; fruit 5 free achenes in a cluster. 2 species, tropical Africa and Asia.

1. *Gisekia pharnaceoides* L., Mant. Alt. 562 (1771).

Annual glabrous herb; stems 10-40 cm, prostrate; leaves 0.5-3.5 x 0.1-1.2 cm, lanceolate or linear-oblong, rather fleshy, subsessile, obtuse; flowers greenish-red, in lax or dense 3- to 40-flowered clusters, sessile or pedunculate; peduncles to 5.5 cm, simple or cymose-branched; pedicels 0.2-1.4 cm; perianth segments 2 mm, to 3 mm in fruit, oblong-ovate, with membranous margins, acute; stamens 5; achene 1 mm, ovoid-globose, papillose.

Two varieties occur in Egypt:

var. *pharnaceoides*

Flowers in dense sessile or pedunculate umbels; peduncles stout; pedicels to 1 cm; perianth 1.5-3 mm in fruit.

De, R, GE; sandy desert soils. Tropical East Africa to southern Africa, Mascarenes, Arabia to India and Sri Lanka.

var. *pseudopaniculata* C. Jeffrey, Kew Bull. 14: 235 (1960).

Flowers in pedunculate, few-flowered umbels; peduncles filiform, cymosely branched; pedicels to 1.4 cm; perianth 1-1.8 mm in fruit.

De (Wadi Hodein, north of GE); sandy desert soils. Egypt, Kenya, Ethiopia.

2. *Limeum* L.

Annual or perennial herbs or small shrubs, glabrous or glandular-hairy; leaves opposite or alternate, entire, exstipulate; flowers bisexual, solitary or in axillary cymes; perianth of 5 sepaloid free segments; staminodes 0-5, sometimes petaloid; stamens usually 7, 5 outer and 2 inner; ovary 2 carpels, 2-locular; style 1; stigmas 2; fruit separating into 2 indehiscent, 1-seeded mericarps. 20 species, Tropical and South Africa, Arabia, Pakistan.

1. *Limeum obovatum* Vicary, J. Asiat. Soc. Bengal 16: 1163 (1847).

Syn. *Limeum indicum* T. Anderson, J. Proc. Linn. Soc. Bot. 5, Suppl. 1: 30 (1860).

Annual glandular-puberulent herb; stems prostrate; leaves opposite, 4-6 x 2-4 mm, broadly ovate to suborbicular, mucronate; flowers in subsessile cymes; sepals 3-4.5 mm; mericarps smooth, brown.

O (Uweinat); sandy soil in the wadis. Tropical Africa, Arabia, Pakistan.

3. *Glinus* L.

Annual glabrous or pubescent herbs; stems usually prostrate; leaves opposite or apparently verticillate, exstipulate; flowers in axillary whorls; perianth sepaloid, of 5 free segments; staminodes 0-20, usually 2-fid at the apex, sometimes petaloid; stamens 3-30, free; ovary superior, of 3-5 united carpels, 3- to 5-locular; fruit a 3- to 5-valved, many-seeded capsule; seeds smooth or granulate. 12 species, tropical and subtropical

regions worldwide.

1. Flowers numerous, subsessile in dense whorls; leaves broadly-ovate or suborbicular
+ Flowers few, on long peduncles to 3.5 cm; leaves narrowly spathulate

1. **G. lotoides**

2. **G. runkewitzii**

1. **Glinus lotoides** L., Sp. Pl., ed. 1, 463 (1753).

Syns. *Glinus dictamnoides* Burm. f., Fl. Ind. 113 (1768).

Mollugo hirta Thunb., Prodr. Fl. Cap. 24 (1794).

Mollugo glinus A. Rich., Tent. Fl. Abyss. 1: 48 (1847), nom. illeg.

Annual densely stellate-canescens herb; stems to 80 cm or more, prostrate, often forming thick mats; leaves 0.5-3.5 x 0.5-2.5 cm, broadly-ovate or suborbicular, petiole 0.3-1.2 cm; flowers in dense 2- to 12-flowered whorls; pedicels 2-7 mm; sepals greenish-white; staminodes 12-15, linear, bifid at apex; calyx in fruit 6-8 x 3-4.5 mm; capsule 4-5 x 2.5-3 mm.

N, O, M, De, GE, S; Nile and canal banks, moist ground. Tropical and subtropical regions worldwide.

2. **Glinus runkewitzii** Täckh. & Boulos, Publ. Cairo Univ. Herb. 5: 83, f. 13 (1974).

Annual densely stellate-canescens herb, about 5 cm; stem short, unbranched; leaves 2-4 cm, narrowly-spathulate, long-petiolate; flowers axillary, on long peduncles to 3.5 cm; calyx 5-6 mm; fruit unknown.

N (Luxor, Khizam Island); Nile banks. Endemic.

NOTE: The species is only known from the type.

4. **Mollugo** L.

Annual glabrous herbs, the stems erect or procumbent; leaves verticillate, rarely opposite, linear, lanceolate or suborbicular, entire, often forming a basal rosette, the cauline leaves linear, sometimes absent; flowers bisexual, greenish, in lax dichasial or umbellate cymes; sepals 5, free; stamens 3-5(-10) free; ovary of 3-5 united carpels, 3- to 5-locular; ovules numerous, axile; fruit a subglobose capsule, enclosed in the persistent calyx. 35 species, tropical and subtropical regions worldwide.

1. Leaves cauline and in a basal rosette; the basal leaves to 2 x 0.3 cm, withering

1. **M. cerviana**

- + Leaves in a basal rosette, the stems leafless; basal leaves to 4 x 2.5 cm, persistent

2. **M. nudicaulis**

1. **Mollugo cerviana** (L.) Ser. in DC., Prodr. 1: 392 (1824).

Syns. *Pharnaceum cerviana* L., Sp. Pl., ed. 1, 272 (1753).

Pharnaceum umbellatum Forssk., Fl. Aegypt.-Arab. 58 (1775).

Annual herb 5-15 cm, the stems ascending; basal leaves to 2 x 0.3 cm, forming a rosette, linear or narrowly spathulate, soon withering; cauline leaves to 1.8 x 0.1 cm, linear;

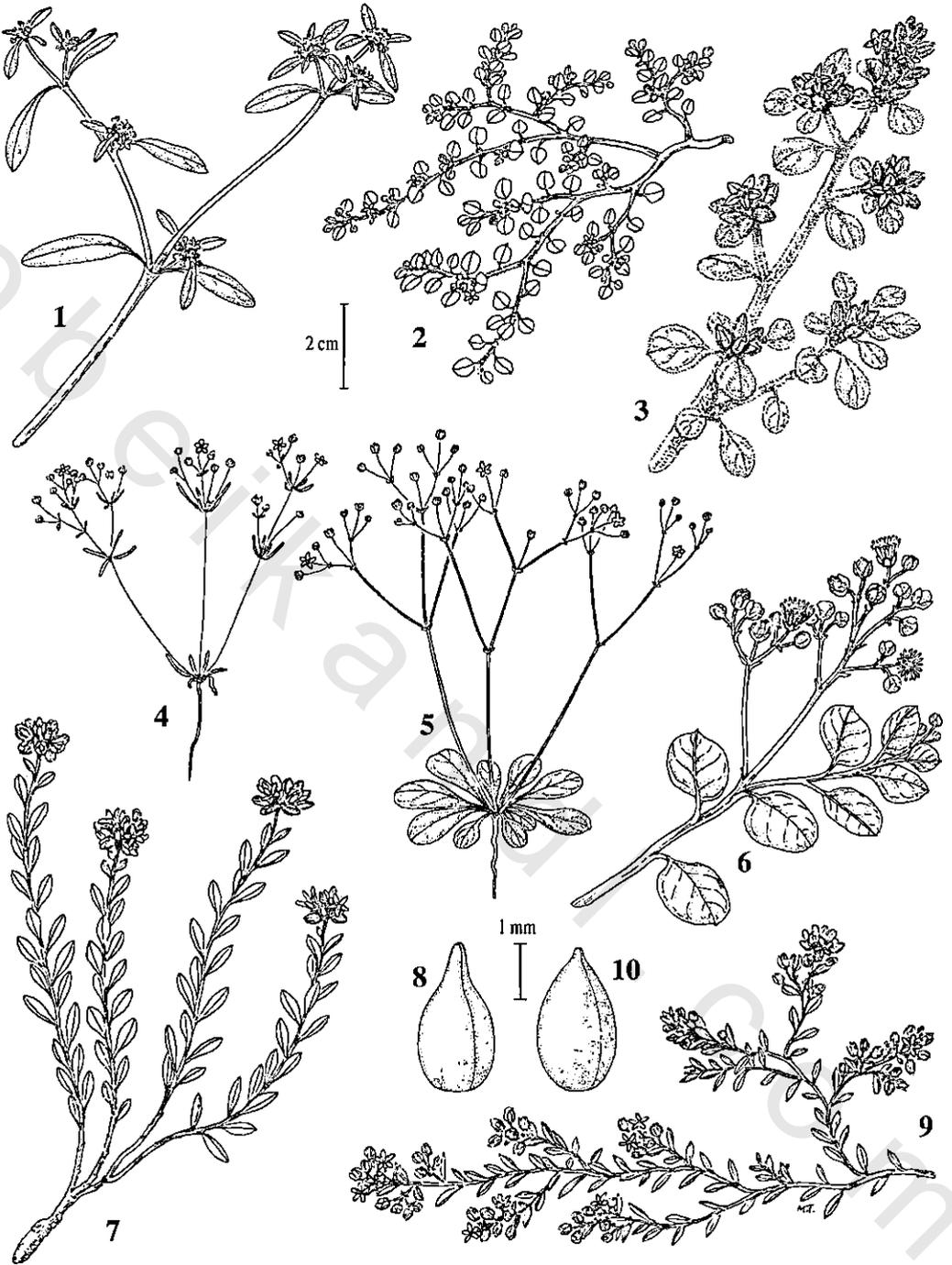


Plate 10. MOLLUGINACEAE: *Gisekia pharnaceoides* 1, flowering and fruiting branch. *Limeum obovatum* 2, flowering and fruiting branch. *Glinus lotoides* 3, flowering and fruiting branch. *Mollugo cerviana* 4, habit. *Mollugo nudicaulis* 5, habit. *Corbichonia decumbens* 6, flowering and fruiting branch. *Telephium imperati* subsp. *orientale* 7, habit; 8, capsule. *Telephium sphaerospermum* 9, flowering and fruiting branch; 10, capsule. All drawings to the same scale except enlarged parts (scale given).

flowers axillary and terminal in sessile or pedunculate 1- to 4-flowered cymes, pedicels to 1.5 cm; sepals 1.5-3 mm, green with white margins; stamens 5; capsule 2 mm.

GE; on silt and sand, rocky places. Tropical and subtropical regions of the Old World.

2. **Mollugo nudicaulis** Lam., Encycl. 4: 234 (1797).

Annual herb 10-25 cm, the stems erect or ascending; all leaves in a basal rosette, 1.5-4 x 0.5-2.5 cm, rounded, attenuate at the base; flowers in a leafless panicle of dichasial cymes; pedicels 0.3-1.5 cm; sepals 2-3 mm, white; stamens 3-5; capsule 3 mm.

S; sandy wadis. Tropical and subtropical regions of the world.

5. **Corbichonia** Scop.

Annual or perennial herbs; leaves alternate, petiolate, exstipulate; staminodes numerous, petaloid, free; stamens numerous, in 2 rows; styles 5, free; ovary 5-locular; fruit a 5-valved capsule; seeds numerous. 2 species, tropical and South Africa, Asia.

1. **Corbichonia decumbens** (Forssk.) Exell, J. Bot. (London) 73: 80 (1935).

Syns. *Orygia decumbens* Forssk., Fl. Aegypt.-Arab. 103 (1775).

Glinus trianthemoides F. Heyne in Roth., Nov. Pl. Sp. 231 (1821).

Glinus mucronatus (Klotzsh) Klotzsh in Peters, Reise Mossamb. Bot. 570, t. 25 (1864).

Perennial herb, glabrous; stems to 25 cm, prostrate or decumbent; leaves 0.5-5 x 0.5-3 cm, obovate or obovate-spathulate, apiculate; petiole 1-8 mm; cymes 4- to 9-flowered; sepals 4 mm, ovate, green, with a white-membranous margin; staminodes many, petaloid, membranous, first short, then becoming longer than the sepals; stamens numerous, in 2 rings; fruit 4-5 mm, globose, yellowish-green; seeds numerous.

GE; sheltered crevices. Tropical Africa, Arabia, Iran, Pakistan, India.

6. **Telephium** L.

Annual or perennial glabrous herbs, sometimes woody at the base; stems procumbent, ascending or prostrate; leaves alternate; stipules membranous; flowers in dense terminal cymes; sepals and petals 5, free, entire, white; stamens 5, opposite the sepals; ovary 1-locular or incompletely 3- to 4-locular below, the ovules numerous; styles 3, free; fruit a beaked, many-seeded capsule, dehiscing with 3(-4) valves, calyx persistent; seeds globular-reniform. 5 species, South Europe, Mediterranean region, Sinai, Arabia to Afghanistan, Madagascar.

1. Capsule conspicuously-beaked, 10- to 18-seeded
+ Capsule short-beaked, 25- to 30-seeded

1. **T. imperati** subsp. **orientale**
2. **T. sphaerospermum**

1. **Telephium imperati** L. subsp. **orientale** (Boiss.) Nyman, Consp. Fl. Europ. 254 (1879).

Syns. *Telephium orientale* Boiss., Diagn. Pl. Orient., ser. 1 (10): 11 (1849).

Telephium imperati L. var. *orientale* (Boiss.) Boiss., Fl. Orient. 1: 754 (1876).

Perennial, glabrous, glaucous, with a woody base, the stems 10-30 cm, procumbent to ascending; leaves 0.5-1.5 x 0.2-0.5 cm, alternate, elliptic-ovate, the upper linear-lanceolate; flowers 5-20 in terminal capitate cymes, short-pedicellate; sepals 3-4.5 mm, oblong-lanceolate, obtuse, green, with white-membranous margins; petals white, equalling the sepals; capsule 5-6 x 3 mm, conspicuously beaked, exceeding the persistent sepals, 10- to 18-seeded.

S; stony wadis. Turkey, Greece, Crete, Cyprus, Sinai, Syria, Northwest Iran, Caucasia, Afghanistan.

2. **Telephium sphaerospermum** Boiss., Diagn. Pl. Orient., ser. 1, 1(10): 12 (1849).

Annual or perennial herb; the stems 5-20 cm, prostrate, much-branched at the base; leaves 0.5-1.5 x 0.1-0.5 cm, rather fleshy, obovate-elliptic; flowers in dense terminal cymes; sepals 3-4 mm, green with a white-membranous margin; petals white, equalling the sepals; capsule 3-4.5 x 2.5-3 mm, ovoid, trigonous, 25- to 30-seeded.

O, D, S; wadi beds and sandy plains. North Africa, Sinai, Arabia.

NOTE: The genus *Telephium* is treated under Caryophyllaceae by some authors.

AIZOACEAE

Succulent herbs (our species), rarely shrubs or subshrubs, unarmed or spiny; leaves opposite to spirally arranged, usually succulent, rarely stipulate; flowers solitary or in small cymes, usually bisexual; sepals (3-)5(-8), mostly succulent; perianth (staminodes) often many, in 1-6 whorls, (the flowers superficially resembling Compositae), rarely absent; stamens 4-5, 8-10 or numerous, free or connate in bundles at the base; nectaries usually in a ring at the inner base of stamens; ovary superior or inferior; carpels 2- to 5 or numerous, many-locular, rarely 1-locular; ovules 1-many in each locule; fruit usually a capsule, often enclosed in the persistent calyx; seeds with large embryo, often arillate. 114 genera, 2400 species, tropical and subtropical, mostly South Africa and Australia.

- | | |
|---|----------------------------|
| 1. Stamines numerous, petaloid, linear;
flowers composite-like | 1. Mesembryanthemum |
| + Stamines absent | 2 |
| 2. Style 1 | 4. Trianthema |
| + Styles 2-5 | 3 |
| 3. Fruit a capsule dehiscing by 5 valves | 2. Aizoon |
| + Fruit a capsule dehiscing by a lid | 4 |
| 4. Flowers in axillary clusters; lid of capsule splitting into 2 valves; styles 2;
seeds not more than 4 | 5. Zaleya |
| + Flowers solitary; lid of capsule 1 piece, not splitting; styles 2-5;
seeds usually more than 5 | 3. Sesuvium |

1. *Mesembryanthemum* L., nom. conserv.

Annual or perennial succulent herbs, covered by glossy papillae; stems dichasially branching; leaves opposite, subopposite or alternate, succulent, stipules absent; flowers solitary, terminal or axillary; calyx of (4-)5 unequal succulent lobes; staminodes numerous, petaloid; stamens numerous, inserted on the calyx; ovary inferior, (4-)5-locular; stigmas 4-5, free or connate at the base; fruit a 5-celled capsule, opening by a stellate-shaped slit; seeds numerous, minute. 70 species, Mediterranean region, Atlantic Islands, Arabia, South Africa, South Australia, California.

1. Leaves flattened, obovate to spatulate, the basal petiolate
+ Leaves thick, terete or linear, all sessile

2. *M. crystallinum*

2

2. Leaves 0.5-2 cm thick; staminodes longer than the calyx
+ Leaves 2-4 mm thick; staminodes shorter than or equalling the calyx

3. *M. forsskaolii*

1. *M. nodiflorum*

1. *Mesembryanthemum nodiflorum* L., Sp. Pl., ed. 1, 481 (1753).

Annual succulent herb, minutely papillose; stems 10-20 cm, branched, ascending or procumbent; leaves 1.2-4 x 0.2-0.4 cm, the lower opposite, the upper alternate, sessile, terete to linear; flowers axillary, subsessile; calyx 1 cm; lobes linear, unequal; staminodes white or cream, shorter than or equalling the calyx; stigmas 5; capsule 0.8-1 cm.

M, N, S; sandy soils. Mediterranean region, Southwest Asia, South Africa.

2. *Mesembryanthemum crystallinum* L., Sp. Pl., ed. 1, 480 (1753).

Annual succulent herb, covered by crystalline vesicles; stems 25-80 cm, procumbent, branched, often making mats; leaves 3-8 x 2-5 cm; radical leaves opposite, spatulate, petiolate; the cauline alternate, obovate, undulate, shortly petiolate or sessile; flowers 1 cm diam., axillary, subsessile; calyx-lobes broadly-ovate; staminodes numerous, longer than the calyx; capsule 1 cm.

M, N, De, S; maritime sand and edges of salt marshes. Macaronesia, Europe, Mediterranean region, Sinai, South Africa.

3. *Mesembryanthemum forsskaolii* Hochst. ex Boiss., Fl. Orient. 2: 765 (1872).

Syn. *Opophytum forsskaolii* (Boiss.) N. E. Br., Gard. Chron., ser. 3, 84: 253 (1928).

Annual succulent papillose herb; stems 10-25 cm, erect or ascending, simple or branched from the base; leaves 2-5 x 1-2 cm, opposite, sessile, terete-conical; flowers axillary; calyx-lobes unequal; staminodes whitish-cream, longer than the calyx; capsule 1.2-1.5 cm.

M, D, O (Wadi Natrun), S; saline sandy soils. Libya, Egypt, Palestine, Arabia.

2. *Aizoon* L.

Annual or perennial herbs or small shrubs; leaves alternate or opposite, succulent, sessile

or petiolate, exstipulate; flowers bisexual, solitary or in clusters, axillary or on stem forks; perianth sepaloid, 4- to 5-lobed; calyx-lobes united at the base into a tube; petals absent; stamens numerous, in 5 bundles, inserted on the calyx-tube; styles (4-)5, free; ovary superior, 4- to 10-locular; ovules 2-numerous per locule; fruit a many-seeded capsule, dehiscing by 5 valves. 11 species, Europe, Mediterranean region, Sinai, South Africa, Australia.

1. Stems procumbent or prostrate; leaves spatulate to suborbicular; perianth 2-5 mm

1. **A. canariense**

+ Stems erect or ascending; leaves narrowly-oblong to oblong-lanceolate; flowers 1.2-1.6 cm

2. **A. hispanicum**

1. **Aizoon canariense** L., Sp. Pl., ed. 1, 488 (1753).

Syn. *Glinus chrystallinus* Forssk., Fl. Aegypt.-Arab. 95 (1775).

Annual herb, papillose-pubescent or villose; stems 5-25 cm, procumbent or prostrate, branched; leaves 1-3.5 x 0.5-1.5 cm, alternate, petiolate, spatulate to suborbicular; flowers 4-6 mm, sessile; perianth 2-5 mm, broadly ovate to triangular, greenish outside, yellowish inside; stamens 15-25; capsule 4-6 mm, flattened; seeds 1 mm, reniform, black.

M, D, GE, S; sandy and stony soils. Macaronesia, tropical and North Africa, Sinai, Palestine, Arabia, Iraq, Iran, Pakistan.

2. **Aizoon hispanicum** L., Sp. Pl., ed. 1, 488 (1753).

Annual papillose herb; stems 5-25 cm, dichotomously branched, erect or ascending; leaves 1-5 x 0.1-1 cm, opposite, basal, sometimes alternate, narrowly oblong to oblong-lanceolate, obtuse; flowers 1.2-1.6 cm, white, sessile, in stem forks; perianth 1.2-1.6 cm, narrowly triangular; stamens numerous; capsule 5-8 mm, 5-angled, flattened at the apex, dehiscing when moistened; seeds 1 mm, reniform, brown.

N, M, D, S; desert wadis, borders of salt marshes. Mediterranean region, Sinai, Arabia, Iraq, Iran.

3. **Sesuvium** L.

Annual or perennial herbs; leaves opposite, exstipulate; flowers axillary, solitary or in clusters; perianth sepaloid, 5-lobed; segments triangular, shortly aristate on the back near the tip; calyx-tube short, obconical; staminodes absent; stamens 5-many, free or fused into a basal ring; ovary 2- to 5-loculed; styles 2-5; fruit a lidded capsule, the lid not splitting; seeds several to many. 12 species, tropical coastal regions.

1. **Sesuvium sesuvioides** (Fenzl) Verdc., Kew Bull. 12: 349 (1957).

Syns. *Diplochonium sesuvioides* Fenzl, Nov. Stirp. Dec. 7: 58 (1839).

Trianthema polysperma Oliv., Fl. Trop. Afr. 2: 588 (1871).

Annual herb; stems 10-25 cm, ascending or prostrate, papillose; leaves succulent, 0.5-3 x 0.1-0.4 cm, narrowly oblong-elliptic, acute or obtuse, short-petiolate; flowers solitary or in clusters of 2-4, sessile, pink or yellow; perianth-lobes equal, narrowly triangular, acute, each with a dorsal arista 1-2 mm below the apex; stamens 5(-7), free; capsule 4-6



Plate 11. AIZOACEAE: *Mesembryanthemum nodiflorum* 1, flowering branch. *Mesembryanthemum crystallinum* 2, flowering and fruiting branch. *Mesembryanthemum forsskaolii* 3, flowering and fruiting branch. *Aizoon canariense* 4, flowering plant; 5, fruiting branch. *Aizoon hispanicum* 6, flowering and fruiting branch. *Sesuvium sesuvioides* 7, flowering and fruiting branch. *Trianthema portulacastrum* 8, flowering branch. *Trianthema triquetra* 9, flowering and fruiting branch. *Zaleya pentandra* 10, flowering and fruiting branch. All drawings to the same scale.

mm; seeds to 10 per locule, black.

GE; sandy saline soils. Tropical Africa, Arabia, Iran, Pakistan, India.

4. *Trianthea* L.

Annual or perennial glabrous or pubescent herbs; leaves opposite, unequal, with membranous margins at the base, often connate in pairs; flowers axillary, solitary or in clusters, sessile or short-pedicellate; perianth sepaloid, 5-lobed, with a dorsal mucro; stamens 5-numerous, staminodes absent; ovary 1 carpel, 1-locular; style 1; ovules 2-numerous, placentation parietal; fruit a capsule. 17 species, tropical and warm regions.

1. Flowers solitary, partly hidden by the membranous base of the petiole;

leaves to 5 cm; perianth 3.5-4.5 mm

1. *T. portulacastrum*

+ Flowers 2-6 in clusters, exposed; leaves to 1.8 cm; perianth 1 mm

2. *T. triquetra*

1. *Trianthea portulacastrum* L., Sp. Pl., ed. 1, 223 (1753).

Syn. *Trianthea monogyna* L., Mant. 69 (1767).

Annual succulent glabrescent herb; stems 15-50 cm, prostrate or ascending; leaves 0.5-5 x 0.5-4 cm, rounded or apiculate; petiole 0.2-2 cm, expanding into a sheathing membrane and connate with that of the opposing leaf; flowers white or pink, sessile, solitary, partly hidden by the leaf-bases; perianth-lobes 3.5-4.5 mm, narrowly obovate, mucronate; stamens 10-20; capsule 3- to 10-seeded, the lid flattened.

GE; sandy soils. Tropical and subtropical regions.

2. *Trianthea triquetra* Willd., Ges. Naturf. Freunde Berlin Neue Schriften 4: 181 (1803).

Syn. *Trianthea salsoloides*, sensu Täckh., Stud. Fl. Egypt, ed. 2, 75 (1974).

Annual or short-lived perennial succulent herb; stems 10-30 cm, prostrate, papillose, often reddish; leaves 0.5-1.8 x 0.1-0.4 cm, linear to narrowly elliptic, terete; petiole 0-5 mm; flowers sessile, 2-6 in axillary clusters; perianth-segments 1 mm, triangular, thickened at the tip by a mucro; capsule depressed in the centre; seeds 2.

De, R, GE; coastal sandy soils, borders of salt marshes. Tropical Africa and Asia, Australia.

5. *Zaleya* Burm. f.

Annual or perennial prostrate herbs; leaves opposite, petiolate, exstipulate, slightly succulent; flowers subsessile, in axillary clusters; perianth sepaloid, 5-lobed, green outside, coloured inside, with a subapical mucro and membranous margins; stamens 5-15, free; staminodes absent; ovary 2-locular, ovules 2 in each locule; stigmas 2, free; fruit a 4-angled capsule, dehiscent with 2-valved lid. 3 species, Old World tropics.

1. Stamens 5

1. *Z. pentandra*

+ Stamens 10-15

2. *Z. decandra*

1. **Zaleya pentandra** (L.) C. Jeffrey, Kew Bull.14: 238 (1960).

Syns. *Trianthema pentandra* L., Mant. 70 (1767).

Rocama prostrata Forssk., Fl. Aegypt.-Arab. CVIII, 71 (1775).

Annual succulent herb, sometimes woody at the base; stems 10-30 cm, prostrate or decumbent; leaves 0.5-2.5 x 0.2-2 cm, oblanceolate, elliptic to broadly ovate-orbicular, the apex obtuse to rounded; petiole 0.2-1.6 cm, membranous-winged and sheathing at the base; flowers in clusters of 5-15, sessile or subsessile; perianth-segments 2 mm, greenish-pink, with white margins; capsule 1.5-3.5 x 1.2-2 mm, rectangular, black; seeds 1.5 mm, ribbed, black.

N, De, R, GE, S; desert sandy and stony soils, edges of cultivation. Tropical Africa, Sinai, Palestine, Arabia, Madagascar.

2. **Zaleya decandra** (L.) Burm. f., Fl. Ind. 110, t. 31, f. 3 (1768).

Syn. *Trianthema decandra* L., Mant. 70 (1767).

Prostrate or decumbent annual herb; leaves 0.5-2 x 0.2-1.2 cm, elliptic-oblong to oblanceolate; flowers in axillary clusters, pinkish; stamens 10; capsule 3-4 mm, truncate at the apex; seeds orbicular or reniform, compressed, rugulose.

GE; sandy soil. Tropical Africa and Asia.

PORTULACACEAE

32 genera, 380 species, cosmopolitan, especially western America; only genus in Egypt *Portulaca*.

1. **Portulaca** L.

Annual or perennial succulent herbs; leaves alternate or opposite, fleshy; stipules a tuft of hairs; flowers sessile, solitary or terminal clusters of 2-10; petals 4-6, free or connate at the base; stamens 7-numerous, inserted at the base of petals; ovary half-inferior to inferior, 1-locular, with central placentation; capsule circumscissile, many-seeded. 40 species, tropical and warm regions.

1. **Portulaca oleracea** L., Sp. Pl., ed. 1, 445 (1753).

Annual, glabrous, succulent herb; stems 10-35 cm, prostrate, much branching; leaves 1-3.5 x 0.2-1.2 cm, alternate, subsessile, obovate to spatulate, the apex rounded; stipular hairs soon deciduous; flowers solitary or 3-5 in clusters; sepals 2, green, 4-5 x 3.5 mm, connate at the base, oblong-ovate; petals 4-6, yellow, 4.5 x 3 mm, almost equalling the sepals; stamens mostly 10, outer 5 opposite the petals, ovary 1-locular; capsule 6 x 5 mm, rhomboid, dehiscing by a beaked lid; seeds pyriform-orbicular, tuberculate, black.

Three subspecies occur in Egypt:

1. Seeds to 0.8 mm, tuberculate-stellate

subsp. **nitida**

+ Seeds 0.9-1.3 mm, tuberculate or flat

2

2. Seeds flat-stellulate, shiny
+ Seeds tuberculate, not shiny

subsp. **stellata**
subsp. **oleracea**

subsp. **oleracea**

Stems ascending; leaves 0.8-1 x 0.25- 0.4 cm, oblong-obovate, sessile or petiole 0.5-1 mm; seeds 1.1-1.3 mm, with regular tubercles, not shiny.

N, GE; weed of cultivation, moist ground.

subsp. **nitida** Danin & H. G. Baker, Israel J. Bot. 27: 194 (1978).

Stems decumbent, much-branched; leaves 1-3 x 0.3-0.9 mm, attenuate at the base to a 2 mm petiole; seeds 0.8 mm, shortly tuberculate-stellulate, shiny.

N, O, M, D, S; weed of cultivation, moist ground.

subsp. **stellata** Danin & H. G. Baker, Israel J. Bot. 27: 198 (1978).

Differs from the type subspecies in the seeds 0.9 mm, and the shiny flat-stellulate testa.

S; weed of cultivation, moist ground.

Area of the species: Tropical and warm regions.

CARYOPHYLLACEAE (incl. Illecebraceae)

Annual or perennial herbs, rarely shrubs; stems often with swollen nodes; leaves opposite, rarely spirally arranged, simple, entire; stipules absent or scarious; flowers usually bisexual and regular, 5-merous, bracteate, in dichasial cymes, sometimes clustered, umbellate or solitary; sepals free or united; petals free, rarely absent, entire or dissected; stamens 5-10; ovary superior, usually 1-locular; fruit a (1-) many-seeded capsule, with as many or twice as many valves or apical teeth; seeds small; testa variously ornamented. 87 genera, 2300 species, especially in temperate and warm northern hemisphere.

- | | |
|--|------------------------|
| 1. Small shrubs, stems woody | 2 |
| + Herbs, rarely woody at the base; stems herbaceous | 4 |
| 2. Flowers with plumose bracts, indurate at maturity and enclosing the fruit | 26. Cometes |
| + Flowers without plumose bracts | 3 |
| 3. Sepals 5.5-6.5 x 1 mm, mucronate | 22. Gymnocarpus |
| + Sepals 2.5-3 x 1-2.5 mm, with recurved awns to 3 mm | 23. Sphaerocoma |
| 4. Flowers with plumose bracts, indurate at maturity and enclosing the fruit | 26. Cometes |
| + Flowers without plumose bracts | 5 |

5. Leaves stipulate, the stipules scarious + Leaves exstipulate	6 15
6. Flowers 4-merous, clustered on flattened peduncles to 5 mm diam. + Flowers 5-merous, peduncles terete	25. Pteranthus 7
7. Bracts silvery, entirely scarious, conspicuous + Bracts green, pink or brown, scarious only along the margins	21. Paronychia 8
8. Flowers in spherical cymes, becoming hard and spinose in fruit + Flowers and fruit not as above	24. Sclerocephalus 9
9. Leaves whorled or appearing whorled + Leaves opposite or alternate	10 11
10. Leaves linear, whorled, more than 4 at one node; pedicels 0.5-1.5 cm + Leaves ovate-elliptic, appearing whorled, never more than 4 at one node; pedicels 2-4 mm	16. Spergula 18. Polycarpon
11. Sepals with stiff lateral awns + Sepals without lateral awns	20. Loeflingia 12
12. Leaves linear or filiform; styles 3, free to the base + Leaves of different shapes, not linear or filiform; style 1 or 2- to 3-lobed at the apex	15. Spergularia 13
13. Sepals keeled and hooded + Sepals not keeled or hooded	18. Polycarpon 14
14. Leaves 2-8 mm; stigma notched or 2-lobed on a very short style; fruit a membranous, 1-seeded utricle + Leaves to 2.5 cm; style 3-lobed at the apex; fruit a 3-valved, many-seeded capsule	19. Herniaria 17. Polycarpaea
15. Calyx subtended by an epicalyx of 1-several pairs of scales + Calyx not as above	1. Dianthus 16
16. Calyx prominently 5-winged, wings more conspicuous in fruit + Calyx not as above	3. Vaccaria 17
17. Sepals free + Sepals connate into a tube at least towards the base	18 24
18. Flowers 4-merous + Flowers 5-merous	19 20
19. Sepals 4 mm; petals present; capsule 2-seeded + Sepals 2 mm; petals absent or minute; capsule many-seeded	8. Bufonia 9. Sagina
20. Capsule opening by 3 valves	11. Minuartia

+ Capsule opening by 4 or more teeth or valves	21
21. Flowers in terminal umbellate cymes	14. Holosteum
+ Flowers not umbellate	22
22. Petals entire or emarginate	10. Arenaria
+ Petals 2-fid	23
23. Styles 3; capsule opening by 8-10 teeth	13. Cerastium
+ Styles 5; capsule opening by 6 valves	12. Stellaria
24. Petals with deeply 3- or 5-incised limb	6. Ankyropetalum
+ Petals with entire or 2-fid limb	25
25. Calyx campanulate	5. Gypsophila
+ Calyx tubular	26
26. Calyx 15-nerved	2. Petrorrhagia
+ Calyx 5-, 10- or 20- to 30-nerved	27
27. Styles 2; capsule opening by 4 teeth	4. Bolanthus
+ Styles 3; capsule opening by 6 teeth, or teeth 2-fid	7. Silene

1. **Dianthus L.**

Perennial herbs, often with woody base, rarely annuals; stems usually thickened at nodes; leaves opposite, linear, exstipulate; flowers conspicuous, bisexual, solitary or in cymose clusters; calyx subtended by an epicalyx of 1-several pairs of scales; calyx-tube cylindrical to conical, teeth 5; petals 5, pink, red, white or cream, the limb entire, dentate or fimbriate; stamens 10; ovary 1-celled, styles 2; capsule many-seeded, dehiscent by 4 teeth; seeds discoid, compressed. About 300 species, Europe, Asia, Africa, America.

1. Annual; epicalyx equalling or exceeding the calyx	1. D. cyri
+ Perennial; epicalyx shorter than the calyx	2
2. Petal-limb dentate or almost entire	3
+ Petal-limb fimbriate	4
3. Petals 2-3 cm; limb dentate, pink, with crimson spots and stripes	3. D. strictus subsp. multipunctatus
+ Petals 4-4.5 cm; limb almost entire, whitish or cream	2. D. judaicus
4. Epicalyx of 4 scales	4. D. guessfeldtianus
+ Epicalyx of 4-14 scales	5
5. Calyx 2.5-3 cm; epicalyx of 10-14 scales	6. D. sinaicus
+ Calyx 4-4.5 cm; epicalyx of 4-6 scales	5. D. libanotis

1. **Dianthus cyri** Fisch. & C.A. Mey., Index Sem. Hort. Petrop. 4: 34 (1837).

Annual glabrous herb 25-60 cm; stems erect, usually branched from the base; leaves 3-10

x 0.2-0.5 cm, linear, scabrous, with narrow scarious margins; flowers in loose, terminal, corymbose inflorescences; epicalyx of 4 scales, equalling or exceeding the calyx, tapering into awns, with white margins; calyx 1.2-1.4 x 0.3-0.5 cm, finely tuberculate, nerveless, teeth shorter than the tube; petals 1.5-1.8 cm, the limb 4-to 6-dentate, pink; capsule 1 cm; seeds tuberculate, black.

N, O; weed of cultivation. East Mediterranean region, Arabia to Afghanistan.

2. **Dianthus judaicus** Boiss., Diagn. Pl. Orient., ser.1, 8: 66 (1849).

Syns. *Dianthus auraniticus* Post., J. Linn. Soc. Bot. 24: 422 (1888).

Dianthus monadelphus Vent. subsp. *judaicus* (Boiss.) Greuter & Burdet,
Willdenowia 12: 186 (1982).

Perennial glaucous herb, 15-30 cm; stems erect, tufted; leaves 2-4 x 0.2-0.3 cm, linear, margins scabrous-ciliate and membranous towards the base; flowers terminal, solitary; pedicels shorter than the calyx; epicalyx of scales with scarious margins and ending with an awn shorter than the scale; calyx 3 cm; petals 4-4.5 cm, white or cream, the limb almost entire; capsule 1.5 mm, ellipsoid; seeds flat, smooth, brown.

S; stony deserts. Sinai, Palestine, Saudi Arabia, Southwest Iraq.

3. **Dianthus strictus** Banks & Sol. subsp. **multipunctatus** (Ser.) Greuter & Burdet,
Willdenowia 12: 187 (1982).

Syns. *Dianthus multipunctatus* Ser. in DC., Prodr. 1: 362 (1824).

Dianthus axilliflorus Fenzl, Pug. Pl. Nov. Syr. 10 (1842).

Perennial herb 15-50 cm, stems erect or ascending; leaves linear, 2-4 mm diam., with scabrous margins; flowers solitary or 2-3 in clusters; epicalyx of 4-6 scales, much shorter than the calyx; calyx 1.5 cm; petals 2-3 cm; limb dentate, pink, marked with crimson spots and stripes; capsule cylindrical; seeds rounded-elliptic, tuberculate, black.

S; stony wadis. East Mediterranean region, Sinai.

4. **Dianthus guessfeldtianus** Muschl., Man. Fl. Egypt 330 (1912).

Perennial glabrous herb 20-50 cm; stems erect, branched from the base; leaves 10-15 x 0.5-1 cm; glaucous, 1-nerved; flowers solitary at the tip of rigid branches, epicalyx of 4 scales, ovate-lanceolate, acute, with narrow scarious margins and an awn shorter than the calyx; calyx teeth linear-lanceolate, striate; petal-limb dentate, pale lilac.

De (Galala); stony ground. Endemic.

5. **Dianthus libanotis** Labill., Icon. Pl. Syr. 1:14 (1791).

Perennial herb 20-40 cm, with a woody base; stems many, angular; leaves 2.5-4 x 0.2-0.6 cm, linear-lanceolate, with a prominent middle nerve and few faint nerves, margin ciliate; flowers solitary or in pairs at the ends of dichotomous branches; epicalyx 2 cm, of 4-6 scales, leathery with a terminal sharp awn; calyx 4 cm, acute; petals fimbriate, pink, with reddish spots at the base.

S; stony wadis. East Mediterranean region, Sinai, Arabia.

6. *Dianthus sinaicus* Boiss., Diagn. Pl. Orient, ser. 1, 1: 23 (1843).

Perennial glabrous herb 20-40 cm, woody at the base; stems many, ascending to erect; leaves linear with scabrous margins, dilated at the base forming a whitish sheath; radical leaves to 3 cm, withering before flowering; cauline leaves 0.5-1.2 cm, acute; flowers terminal, solitary; epicalyx of 10-14 scales, much shorter than the calyx; calyx 2.5-3 cm, teeth acute; petals 3-3.5 cm, glabrous, pink, the limb deeply fimbriate-laciniate; capsule narrowly cylindrical.

S; stony wadis and slopes. Sinai, Palestine, Northwest Saudi Arabia.

2. *Petrorhagia* (Ser.) Link

Annual or perennial herbs; leaves narrow, exstipulate; inflorescence paniculate to capitate; calyx without epicalyx (our species), 5-toothed, 15-nerved (our species), scarious between the nerves; petals 5, stamens 10, styles 2, ovary 4-locular at base, 1-locular at apex; capsule many-seeded, dehiscent with 4 teeth. 28 species, Canary Islands, Mediterranean region, northwards to the Baltic and eastwards to Kashmir.

1. Annual 5-10 cm; petals included or slightly exerted from the calyx 1. *P. arabica*
+ Perennial 20-40 cm; petals much exerted from the calyx 2. *P. illyrica*

1. *Petrorhagia arabica* (Boiss.) P. W. Ball & Heywood, Bull. Brit. Mus. (Nat. Hist.) Bot. 3: 143 (1964).
Syn. *Tunica arabica* Boiss., Diagn. Pl. Orient., ser.1, 8: 62 (1849).

Annual glandular-hairy herb, 5-10 cm; stems dichotomously branched; leaves 0.5-1 x 0.1-0.5 cm, the radical oblong, the cauline linear, scabrous at the margins, 3-nerved; flowers in divaricate paniculate inflorescences; pedicels equalling or longer than the calyx; calyx 6-7 mm, 15-nerved, glandular-hairy along the nerves, the teeth triangular, mucronate; petals 9-12 mm, white, linear, included or slightly exerted from the calyx.

S; stony wadis. Sinai, Palestine.

2. *Petrorhagia illyrica* (Ard.) P. W. Ball & Heywood subsp. *angustifolia* (Poir.) P. W. Ball & Heywood, Bull. Brit. Mus. (Nat. Hist.) Bot. 3: 136 (1964).
Syns. *Silene angustifolia* Poir., Voy. Barb. 2: 164 (1789).
Tunica angustifolia (Poir.) Briq., Prodr. Fl. Cors. 1: 544 (1910).
Tunica compressa (Desf.) Fisch. & C. A. Mey., Index Sem. Hort. Petrop. 4: 50 (1838).

Perennial herb 20-40 cm, woody at the base, glandular-hairy above, glabrous below; stems much branched; leaves 1-3 x 0.1-0.2 cm, linear-subulate to -oblong; flowers solitary or in lax clusters, short-pedicellate; calyx 4-6 mm, 15-nerved, glabrous to glandular-hairy; calyx teeth 1.2-1.5 mm, acute, margins scarious; petals 0.6-1 cm, white or pale yellow, with pink veins towards the base; capsule 5-7 mm, exerted; seeds 1.5-2 x 1 mm, oblong-elliptic, black.

M (Mersa Matruh); stony ground. North Africa, Southeast Europe.

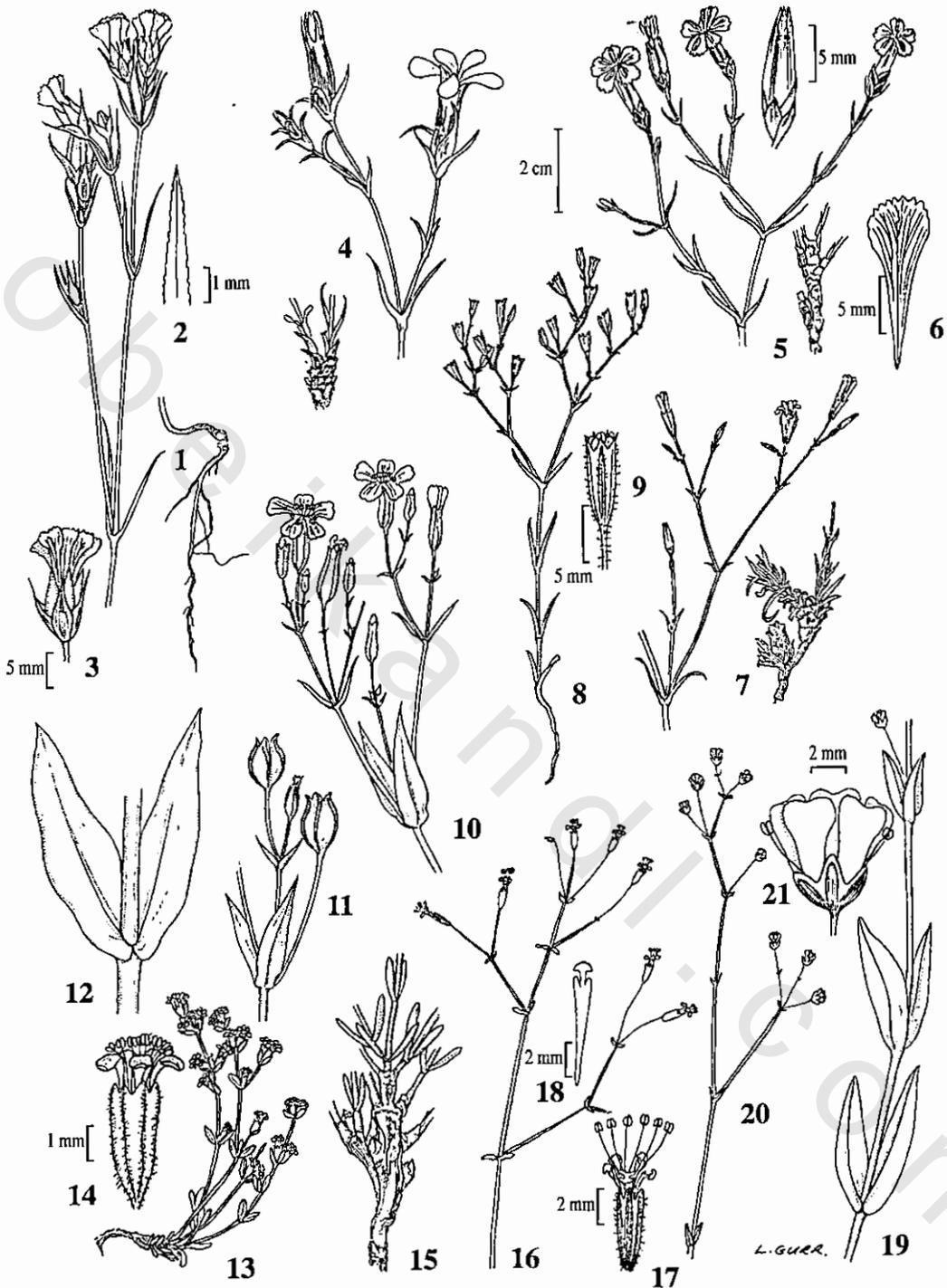


Plate 12. CARYOPHYLLACEAE: *Dianthus cyri* 1, flowering branch and basal part with root; 2, leaf tip; 3, flower. *Dianthus judaicus* 4, flowering and fruiting branch, and basal part. *Dianthus strictus* subsp. *multipunctatus* 5, flowering branch, fruit and basal part; 6, petal. *Petrorrhagia illyrica* 7, flowering branch and basal part with leaves. *Petrorrhagia arabica* 8, habit; 9, flower. *Vaccaria hispanica* 10, flowering branch; 11, fruiting branch; 12, leafy branch. *Bolanthus hirsutus* 13, habit; 14, flower. *Ankyropetalum gypsophiloides* 15, basal part with leaves; 16, flowering branch; 17, flower; 18, petal. *Gypsophila viscosa* 19, leafy branch; 20, flowering branch; 21, flower.

3. *Vaccaria* Wolf

Annual glabrous herbs; leaves opposite, sessile, ovate to lanceolate, exstipulate; flowers in lax paniculate corymbs, bracts absent; calyx prominently 5-winged, inflated, 5-toothed; petals 5; stamens 10; styles 2; capsule dehiscent by 4 teeth; seeds many, subspherical or reniform. 1 species, Europe, Mediterranean region, Asia; naturalized elsewhere.

1. *Vaccaria hispanica* (Mill.) Rauschert., *Wiss. Zeitschr. Martin-Luther Univ. Halle-Wittenberg. Math.-Naturwiss. Reihe* 14: 496 (1965).

Stems 15-80 cm; richly branched above; leaves 5-10 x 0.5-4.5 cm, the lower tapering at the base, the upper connate; calyx 1-1.8 cm; petals 2-2.5 cm, pink; capsule 0.8-1 cm, broadly ovoid.

Two subspecies occur in Egypt:

subsp. *hispanica*

Syns. *Saponaria hispanica* Mill., *Gard. Dict.*, ed. 8, in Eratt. (1768).
Vaccaria pyramidata Medik., *Phil. Bot.* 1: 96 (1789).

Calyx 1.4-1.8 cm, the teeth short triangular, scarious at margins and apex.

N, O, M, S; weed of cultivation.

subsp. *oxyodonta* (Boiss.) Greuter & Burdet, *Willdenowia* 12: 191 (1982).

Syns. *Vaccaria oxyodonta* Boiss., *Diagn. Pl. Orient.*, ser. 2. 1: 68 (1854).
Saponaria oxyodonta (Boiss.) Boiss., *Fl. Orient.* 1: 525 (1867).

Calyx 1-1.4 cm, the teeth longer, lanceolate, not scarious at the apex.

N; weed of cultivation.

Area of the species as for the genus.

4. *Bolanthus* (Ser.) Reichb.

Perennial pubescent herbs; leaves opposite, small, exstipulate; bracts leaf-like; flowers bisexual, pedicellate, small; calyx tubular, 5-ribbed; tube membranous between the ribs, 5-toothed; petals with spreading limb and long-winged claw constricted at the apex; stamens 10; ovary 1-locular, many-ovuled; styles 2; capsule oblong-ovoid to cylindrical, dehiscent by 4 teeth; seeds comma-shaped. 8 species, East Mediterranean region, Sinai.

1. *Bolanthus hirsutus* (Labill.) Barkoudah, *Wentia* 9: 168 (1962).

Syns. *Saponaria hirsuta* Labill., *Icon. Pl. Syr.* 4: 9 (1812).
Gypsophila hirsuta (Labill.) Spreng., *Syst. Veg.* 2: 373 (1825).

Perennial herb 5-20 cm, glandular-pubescent; leaves 1 x 0.2 cm, elliptic, acute, slightly fleshy; inflorescence terminal and axillary; calyx 3-4.5 mm, puberulent; petals 5-6 mm, white; capsule 3 mm; seeds 1 x 0.5 mm, about 20, with acute tubercles.

S; rocky slopes. Sinai, Palestine, Syria, Lebanon.

5. *Gypsophila* L.

Annual and perennial herbs or shrubs; leaves opposite, exstipulate; flowers in dichasial cymose inflorescences, bisexual, rarely unisexual; bracts scarious, rarely herbaceous; calyx campanulate, 5-nerved, membranous between the nerves, 5-toothed; petals 5, white or pink, tapering into a wingless claw; stamens 10, free; ovary 1-locular, styles 2(-3); capsule globose to ovoid, dehiscent to base by 4(-6) valves; seeds reniform. 150 species, Europe, Egypt, Asia; naturalized in other temperate regions.

1. Plant glabrous throughout 1. *G. capillaris*
+ Stems glandular-puberulent or glandular only at the internodes 2

2. Leaves 1-3.5 x 0.1-0.25 cm, linear; stems glandular-puberulent;
seeds 0.5 x 0.5 mm 3. *G. linearifolia*

+ Leaves 1.5-6 x 0.5-1.5 cm, ovate to ovate-oblong; stems with bands of sessile
glands at the internodes; seeds 1.3 x 1.2 mm 2. *G. viscosa*

1. *Gypsophila capillaris* (Forssk.) C. Chr., Dansk Bot. Arkiv. 4(3): 19 (1922).

Annual or short-lived perennial herb with woody base, glabrous, often glaucous; stems 10-80 cm, erect; leaves 1.5-6 x 0.1-0.6 cm; flowers in lax panicles; pedicels 1-3.5 cm, the capillary; calyx 2-3 mm, teeth 1-1.5 mm; petals 1.5-2 cm, white with purple veins; capsule equalling or slightly exceeding the calyx, globose; seeds 1-1.2 x 1 mm, smooth to tuberculate.

Two subspecies occur in Egypt:

subsp. *capillaris*

Syns. *Rokejeka capillaris* Forssk., Fl. Aegypt.-Arab. 90, CXXIV (1775).

Gypsophila rokejeka Delile, Descr. Egypte, Hist. Nat. 87, t. 29, f. 1 (1814).

Gypsophila antari Post & Beauverd ex Dinsm., Pl. Post & Dinsm. Fasc. 1:
4 (1932).

Seeds few per capsule; seed-coat smooth; calyx persistent in fruit.

De; sandy and stony soils.

subsp. *confusa* Zmarzty, Kew Bull. 48: 694 (1994).

Syns. *Gypsophila arabica* Barkoudah, Wentia 9: 139 (1962).

Gypsophila obconica Barkoudah, Wentia 9: 140 (1962).

Seeds 2-3(-8) per capsule; seed coat tuberculate; calyx deciduous.

S; sandy and stony soils.

Area of the species: East Mediterranean region, Sinai, Arabia, Iraq, West Iran.

2. **Gypsophila viscosa** Murray, Commentat. Soc. Reg. Sci. Gott., ser. 2, 6: 9, t. 3 (1783).

Annual herb, glabrous, viscid; stems 10-30 cm, with bands of sessile glands on the internodes; leaves 1-6 x 0.5-1.5 cm, narrowly ovate to ovate-oblong, acuminate; flowers in lax dichasial cymes; pedicel 1-1.5 cm, capillary; calyx 2-2.5 mm, campanulate; teeth 1-1.5 mm, ovate; petals 2-3 times as long as the calyx, white to pale pink; capsule 3 mm, subspherical; seeds 1.2 mm, tuberculate.

S; sandy and rocky wadis. East Mediterranean region, Sinai, Arabia.

3. **Gypsophila linearifolia** (Fisch. & C. A. Mey.) Boiss., Fl. Orient. 1: 550 (1867).

Syn. *Dichoglottis linearifolia* Fisch. & C. A. Mey., Index Sem. Hort. Petrop. 1: 26 (1835).

Annual herb; stems 5-25 cm, richly branched, glandular-puberulent; leaves 1-3.5 x 0.1-0.25 cm, puberulent; flowers in lax dichasial cymes; pedicels 1-2 cm, capillary; bracts leafy, linear; calyx 2 x 1 mm, campanulate, glandular-puberulent, narrowly scarious-margined; petals 3 mm, linear, bilobed to emarginate, white; capsule globose; seeds 0.5 x 0.5 mm, with narrow acute tubercles.

S; sandy wadis and stony slopes. Sinai, Turkey, Iraq, Iran, Russia.

6. **Ankyropetalum** Fenzl

Perennial herbs, with woody base; stems thin; leaves linear, exstipulate; bracts membranous; calyx cylindrical, 5-ribbed with small teeth; petals 5, with long linear claw and deeply 3 or 5 incised limb; stamens 10, long-exserted; ovary ovoid, sessile, with 2 long spreading styles; ovules 8-10; capsule ovoid, dehiscing from the base by longitudinal slits; seeds 1-3, reniform-globose. 4 species, Sinai, Palestine, Syria, Lebanon, Turkey, North Iraq, North Iran.

1. **Ankyropetalum gypsophiloides** Fenzl, Bot. Zeitung (Berlin) 1: 393 (1843)

var. **coelesyriacum** (Boiss.) Barkoudah, Wentia 9: 174 (1962).

Syn. *Ankyropetalum coelesyriacum* Boiss., Diagn. Pl. Orient., ser. 1, 8: 59 (1849).

Perennial herb; stems 30-80 cm, ascending or decumbent, puberulent below, upper densely glandular-hairy above; leaves 1-4 x 0.1-0.2 cm, soon deciduous, linear, glandular-pubescent; pedicels much longer than the calyx, filiform; calyx 3-6 mm, tubular, glandular-puberulent, the teeth small, ovate-rounded, white-margined; petals exceeding the calyx, purplish to pink, the limb with deltoid middle lobe, not 2-toothed below; capsule almost included in the calyx, ellipsoid; seeds 2 x 1 mm, wartless.

S; stony wadis. Sinai, Palestine, Syria, Iraq, Iran.

7. **Silene** L.

Annual, biennial or perennial herbs or dwarf shrubs; leaves opposite, entire, exstipulate; flowers bisexual, rarely unisexual, in monochasial or dichasial cymes; calyx tubular, 5-toothed, 10(-60)-ribbed, sometimes inflated in fruit; petals 5, rarely 0, long-clawed, the limb entire or lobed, coronal scales usually present between limb and claw; stamens 10;

styles 3, free; ovary usually 3(-5)-locular at the base, 1-locular in the upper part; fruit a many-seeded capsule, usually dehiscent by 6 teeth; ovary borne on a stalk (carpophore), usually elongating in fruit; seeds mostly reniform. About 700 species, mainly northern hemisphere, especially Southwest Asia.

- | | |
|--|--|
| 1. Calyx 20- or 30-nerved | 2 |
| + Calyx 10-nerved | 4 |
| 2. Calyx 30-nerved | 1. <i>S. conoidea</i> |
| + Calyx 20-nerved | 3 |
| 3. Perennial; calyx glabrous, strongly inflated in fruit | 3. <i>S. vulgaris</i> |
| + Annual; calyx glandular-hairy, not inflated in fruit | 15. <i>S. confiflora</i> |
| 4. Perennials or biennials | 5 |
| + Annuals | 12 |
| 5. Flowers large, 3-3.5 cm diam.; succulent plant, in maritime sand | 8. <i>S. succulenta</i> |
| + Flowers less than 3 cm diam.; plants not succulent | 6 |
| 6. Flowers sessile in terminal capitate clusters | 2. <i>S. odontopetala</i> var. <i>congesta</i> |
| + Flowers pedicellate, not in capitate clusters | 7 |
| 7. Calyx 2-3 cm | 8 |
| + Calyx 0.8-1.2(-1.5) cm | 9 |
| 8. Calyx glandular-hairy, densely-ciliate on the scarious margins | 6. <i>S. fruticosa</i> |
| + Calyx glabrous, coriaceous | 5. <i>S. schimperiana</i> |
| 9. Capsule 2-2 1/2 times as long as the carpophore | 10 |
| + Capsule equalling or shorter than the carpophore | 11 |
| 10. Pedicel 1.5-2 mm; calyx glandular-hairy, viscid | 7. <i>S. oreosinica</i> |
| + Pedicel 0.8-1.2 cm; calyx glabrous, green nerved | 14. <i>S. longipetala</i> |
| 11. Capsule 6-8 mm | 1. <i>S. linearis</i> |
| + Capsule 1.2-1.4 cm | 4. <i>S. leucophylla</i> |
| 12. Petal-limb with a basal tooth on each side | 12. <i>S. aegyptiaca</i> |
| + Petal-limb not toothed at the base | 13 |
| 13. Calyx 4-6 mm, plant dwarf (4-10 cm) | 10. <i>S. hussonii</i> |
| + Calyx longer, plants larger | 14 |
| 14. Calyx-teeth in fruit 4-5 mm, acuminate-subulate, 1/2 as long as the calyx-tube;
calyx nerves thick; carpophore 1-2 mm; petals almost
included in the calyx | 19. <i>S. tridentata</i> |
| + Plants not as above | 15 |
| 15. Flowers in dichasial corymbose cymes | 16 |

- + Flowers solitary or in monochasial racemose-like cymes 20
16. Carpophore equal to or longer than the capsule 17
 + Carpophore $\frac{1}{3}$ - $\frac{1}{2}$ as long as the capsule 19
17. Leaves linear-subulate; petals white-yellowish, 2-fid into linear lobes; calyx 1 cm 1. **S. linearis**
 + Leaves spatulate, oblong-ovate, ovate-cordate; petals pink, entire or emarginate; calyx 1.2-2.2 cm 18
18. Calyx 1.2-1.5 cm; carpophore glabrous 22. **S. armeria**
 + Calyx 1.8-2.2 cm; carpophore pubescent 13. **S. pseudoatocion**
19. Calyx 0.8-1.2 cm, papery; petals reddish-pink, the limb obovate, retuse 17. **S. rubella** var. **rubella**
 + Calyx 1.4-1.8 cm; petals pink, the limb bipartite 18. **S. behen**
20. Carpophore 0-1.5 mm, $\frac{1}{4}$ as long as the capsule 21
 + Carpophore $\frac{1}{3}$ as long as the capsule or longer 23
21. Petals pink (rarely white), entire; carpophore 0-0.5 mm 20. **S. gallica**
 + Petals white (rarely pink), 2-fid; carpophore 1-1.5 mm 22
22. Capsule 1 cm, oblong-cylindrical; petals 1-1.2 cm, exerted from the calyx 23. **S. nocturna**
 + Capsule 5-6 mm, ovoid-globose; petals absent or 3-3.5 mm, included in the calyx 21. **S. apetala**
23. Petals white 24
 + Petals purple or pink, rarely white 27
24. Leaves linear or narrowly linear, 0.5-2(-3) mm diam. 25
 + Leaves obovate-spatulate, spatulate-oblong to oblong-lanceolate, to 1.5 cm diam. 26
25. Plant glandular-hairy, viscid; calyx 1-1.2 cm; carpophore shorter than the capsule 16. **S. arabica**
 + Plant minutely appressed-pubescent; calyx 1.2-1.8 cm; carpophore longer than or equalling the capsule 25. **S. vivianii**
26. Plant hispid to appressed-hairy, eglandular; flowers 1-1.5 cm; seeds 1-1.2 mm, ear-shaped, deeply grooved on the dorsal side, with 2 undulate margins, almost smooth 27. **S. colorata**
 + Plant hirsute, glandular-viscid; flowers 1.5-2.5 cm; seeds 0.75 mm, rounded-reniform, with minute rows of wrinkles 9. **S. villosa**
27. Plant glandular-villose; seeds 0.5 mm, almost smooth, glossy 26. **S. palaestina**
 + Plant glabrous to villose, eglandular; seeds more than 0.5 mm, not smooth 28
28. Carpophore longer than or equalling the capsule;

petals pink or white 28. *S. biappendiculata*
+ Carpophore $\frac{1}{3}$ - $\frac{1}{2}$ as long as the capsule; petals purple, rarely white 29

29. Calyx 1-1.3 cm; capsule 7-8 mm;

carpophore 2-3 mm

24. *S. burchellii* var. *schweinfurthii*

+ Calyx 1.3-1.8 cm; capsule 0.9-1.2 cm; carpophore 3-6 mm

29. *S. pendula*

1. *Silene conoidea* L., Sp. Pl., ed. 1, 418 (1753).

Annual herb 10-40 cm, pubescent-viscid; stems simple or branched from the base; leaves 1.5-6.5 cm, lanceolate to linear-lanceolate, acute, sessile; pedicels 0.5-1.2 cm, elongating in fruit; flowers 1.5-2.5 cm; calyx 1.5-2 cm, 30-nerved, inflated in fruit; petals pink or reddish, 2-fid; capsule equalling the calyx, sessile, carpophore 0; seeds tuberculate-wrinkled.

N, S; weed of cultivation. Mediterranean region, West Asia to Himalayas.

2. *Silene odontopetala* Fenzl, Pug. Pl. Nov. Syr. 9 (1842) var. *congesta* Boiss., Fl.

Orient. 1: 626 (1867).

Syn. *Silene sinaica* Boiss., Diagn. Pl. Orient., ser. 1, 1: 25 (1843).

Perennial glandular-villose herb, with few stems; leaves in a basal rosette, lanceolate, acute; flowers sessile in congested globose cymes; calyx 1.2 cm, 10-nerved, campanulate, viscid; teeth broadly triangular, acuminate; petals white, capsule 1 cm, ovate, included in the calyx; carpophore 3-4 mm; seeds tuberculate.

S; in the mountains, St. Catherine. Endemic.

3. *Silene vulgaris* (Moench) Gärcke, Fl. N. Mitt.-Deutschland, ed. 9, 64 (1869).

Syn. *Behen vulgaris* Moench, Meth. 709 (1794).

Cucubalus behen L., Sp. Pl., ed. 1, 414 (1753).

Perennial, glabrous, glaucescent herb, 20-60 cm; stems branched from the base; leaves 4-10 x 0.5-3 cm; lower broadly ovate to narrowly-lanceolate, sessile; upper linear-lanceolate, acuminate; flowers in dichasial cymes, bracts scarious; pedicel 1-2.5 cm; calyx 1-1.5 cm, 20-nerved, inflated in fruit and enclosing the capsule; calyx-teeth 3-4 mm, triangular; corolla 2 cm, white; limb 8-9 mm, deeply 2-lobed; capsule 0.8-1 cm, ovoid-globular; carpophore 2-4 mm; seeds reniform, tuberculate.

M; weed of cultivation and roadsides. North Africa, Europe, West Asia.

4. *Silene leucophylla* Boiss., Diagn. Pl. Orient., ser. 1, 1: 29 (1843).

Perennial tomentose-canescens herb, woody at the base; stems to 40 cm, simple, slender, viscid, almost leafless; leaves 1.5-4 x 0.3-0.7 cm, densely rosetted, ovate-oblong to narrowly spatulate; flowers 3-5 in terminal cymes; pedicel to 7 mm; calyx 1.2 cm, 10-nerved, glandular-hairy; calyx-teeth 1.5 mm, ovate-deltoid, obtuse, with scarious margins; capsule longer than the calyx; carpophore equalling the capsule.

S; stony ground, St. Catherine. Endemic.

5. *Silene schimperiana* Boiss., Diagn. Pl. Orient., ser. 1, 1: 31 (1843).

Perennial glaucous herb, woody at the base; stems 50-80 cm, erect, rigid, branching, thicker at the nodes; lower leaves 4-10 x 0.3-0.5 cm, narrowly linear-spathulate, acute, with a prominent midrib on the lower surface; upper leaves shorter, narrowly linear; flowers in lax paniculate cymes, solitary or rarely 2 together, subtended by 2 minute bracteoles; pedicel 1.5-2 cm; calyx 2.2-2.7 cm, to 3 cm in fruit, 10-nerved, cylindrical, glabrous, coriaceous; calyx-teeth 2-2.5 mm, dimorphic, triangular, acute (2.5 mm), and broadly triangular, obtuse (2 mm); petals 2-fid; capsule 1.3-1.5 cm, oblong, glabrous; carpophore equalling the capsule; seeds 1 x 1.5 mm, deeply grooved.

S; stony ground. Endemic.

6. *Silene fruticosa* L., Sp. Pl., ed. 1, 417 (1753).

Small shrub 30-60 cm, glabrescent below, sometimes viscid above; basal leaves obovate or spatulate, the upper lanceolate, with a ciliate-setose margin; flowers in racemose inflorescences, sometimes dichasially branched above; calyx 2.2-2.4 cm, 10-nerved, glandular-pubescent; petals 2.8-3.2 cm, pink or reddish, greenish below, deeply 2-fid; carpophore 7-9 mm; capsule 1.2-1.5 cm, ovoid, exserting from the calyx; seeds 1.5-2 mm.

M; stony ground. East Mediterranean region.

7. *Silene oreosinaica* Chowdhuri, Notes Roy. Bot. Gard. Edinb. 22: 269 (1957).

Perennial, caespitose, 20-35 cm, woody at the base; stems simple or branched, erect or ascending, densely leafy; basal leaves 3-6 x 0.5-0.8 cm, glandular-tomentose, oblong-lanceolate to oblanceolate; upper leaves 1.5-4 x 0.3-0.6 cm, lanceolate to linear-lanceolate, acute; pedicel 1.5-2 mm; calyx 1-1.3 cm, 10-nerved, glandular-viscid; petals 1.2-1.3 cm; capsule 6-8.3 x 4-4.5 mm, ovoid-cylindrical; carpophore 2.5-3 mm; seeds 0.9-1.3 mm, brown, papillose.

S; stony ground, St. Catherine. Endemic.

8. *Silene succulenta* Forssk., Fl. Aegypt.-Arab. LXVI, 89 (1775) subsp. *succulenta*

Perennial herb, viscid, papillose-pubescent; stems 10-50 cm, ascending, much branched; leaves 1-3 x 0.8-1.5 cm, sessile, oblong-spathulate to lanceolate, obtuse, ciliate, pubescent, fleshy; flowers 3-3.5 cm diam., solitary or in short dichasial racemes; calyx 1.8-2.2 cm, 10-nerved; teeth 5 mm, acuminate; petals 2.4-2.6 cm, white; limb 1.3-1.5 cm, bifid; capsule 0.9-1.2 cm, oblong, equalling or slightly longer than the hairy carpophore; seeds 1.5 mm, flat on the dorsal side, almost smooth.

M; coastal sand. East Mediterranean region, Corsica, Sardinia.

9. *Silene villosa* Forssk., Fl. Aegypt.-Arab. 88, non 210 (1775).

Annual herb 10-25 cm, hirsute, viscid; stems procumbent to ascending, usually branched from the base; leaves 1-4.5 x 0.15-0.6(-0.8), narrowly-elliptic to linear, glandular-hairy, sessile or short-petiolate; flowers solitary or 2- to 5-flowered in dichasial cymes; bracts

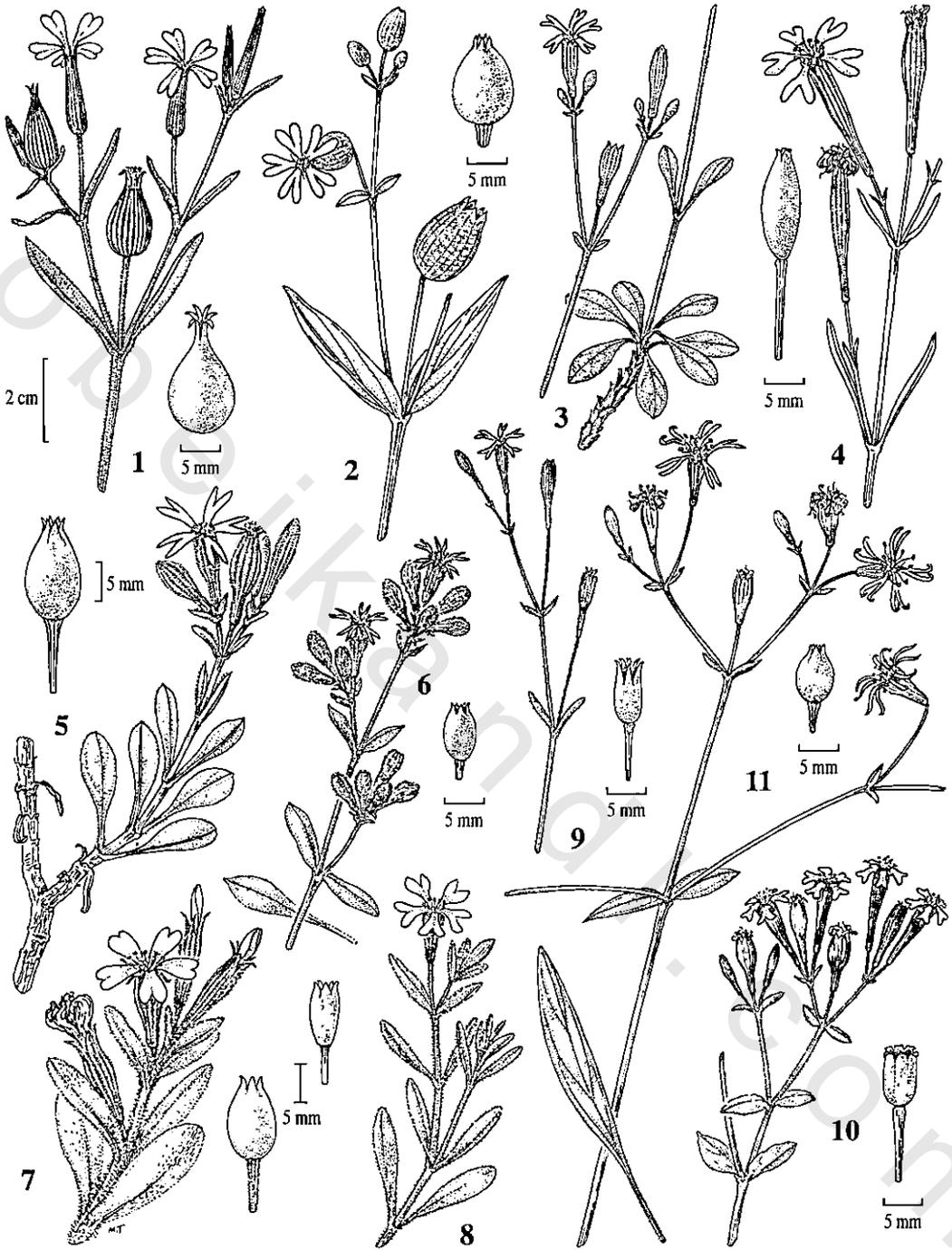


Plate 13. CARYOPHYLLACEAE: *Silene conoidea* 1, flowering and fruiting branch and capsule. *Silene vulgaris* 2, flowering and fruiting branch and capsule. *Silene leucophylla* 3, flowering and fruiting branch and basal part. *Silene schimperiana* 4, flowering branch and capsule. *Silene fruticosa* 5, habit and capsule. *Silene oreosinaica* 6, flowering and fruiting branch and capsule. *Silene succulenta* 7, flowering branch and capsule. *Silene villosa* 8, flowering branch and capsule. *Silene linearis* 9, flowering branch and capsule. *Silene aegyptiaca* 10, flowering branch and capsule. *Silene longipetala* 11, flowering branch, basal leaf and capsule. All drawings to the same scale except enlarged parts (scale given).

leafy; pedicels 0.5-2.2 cm, glandular-hairy; calyx 1.2-2.5 cm, 10-nerved, cylindrical, the upper part slightly inflated in fruit, glandular-villous, the teeth 2.5-3.5 mm; petals 1.5-2.5 cm, white or pinkish; the limb 0.5-1 cm, 2-fid; capsule 1.1-1.2 cm; carpophore 0.5-1 cm, glabrous.

Four varieties occur in Egypt:

var. **villosa**

Calyx 1.5-2.5 cm; petals pinkish; carpophore equalling the capsule.

N, M, S; sandy deserts, edges of cultivation.

var. **ismailitica** Schweinf., Mém. Inst. Egypt. 2, Suppl. 748 (1889).

Syn. *Silene ismailitica* (Schweinf.) Botsch., Nov. Sist. Vyss. Rast. 1: 376 (1964).

Calyx 1.2-1.5 cm; petals pinkish; carpophore slightly shorter than the capsule.

M, D, R, GE, S; sandy deserts.

var. **erecta** Täckh. & Boulos, Publ. Cairo Univ. Herb. 5: 17, f. 3 (1974).

Stems erect, simple or with few branches; flowers few on long erect peduncles.

De, GE; sandy soil.

var. **graveolens** Sickenb., Mém. Inst. Egypt. 4(2): 184 (1901).

Plant viscid, with a characteristic strong smell resembling that of *Cleome amblyocarpa*.

O (Kharga); sandy soil.

Area of the species: Egypt, Palestine, Arabia, West Iran.

10. **Silene hussonii** Boiss., Diagn. Pl. Orient., ser. 1, 8: 76 (1849).

Annual herb 4-10 cm, puberulent-viscid; stems erect, simple or branched from the base; leaves 1-2 x 0.2-0.4 cm, the lower oblong-spathulate or oblanceolate, the upper oblong-lanceolate to linear; flowers few, in dichasial cymes; pedicel longer than the calyx; calyx 0.6-1.1 cm, 10-nerved, the teeth 1.5-2 mm, scarious-margined, ciliate; petals 0.6-1.2 cm, white to pale pink; the limb 2-fid; capsule 5-6 mm, ovoid; carpophore 4-6 mm; seeds tuberculate wrinkled.

S; desert wadis. Sinai, South Palestine, Northwest Saudi Arabia.

11. **Silene linearis** Decne., Ann. Sci. Nat. Bot., ser. 2, 3: 276 (1835).

Annual or short-lived perennial, 20-50 cm, puberulent below, glabrescent-viscid above; stems erect, branched; leaves 1.5-3.5 x 0.15-0.3 cm, the basal linear to linear-elliptic, sessile; the upper smaller, narrowly linear; flowers 1.3-1.6 cm, in lax dichasial corymbose cymes; pedicel 0.5-1.5 cm; calyx 1.2-1.5 cm, longer in fruit, 10-nerved,

cylindrical; calyx-teeth very short, acute, ciliate; petals 1-1.2(-1.5) cm, the limb 2-fid, white or pinkish; capsule 6-8 mm, ovoid-cylindrical, equalling or shorter than the carpophore; seeds 1 mm, reniform-globose, wrinkled, brown.

De, R, S; sandy and stony deserts. Egypt, Palestine, Arabia.

12. **Silene aegyptiaca** (L.) L. f., Suppl. Pl. 241 (1781).

Syns. *Cucubalus aegyptiacus* L., Sp. Pl., ed. 1, 415 (1753).

Silene atocioides Bioss., Diagn. Pl. Orient. 5: 83 (1844).

Silene atocion Jacq., Hort. Bot. Vindob. 3: 19, t. 32 (1776).

Annual herb 10-35 cm; stems erect or ascending, glandular-hairy, viscid; leaves glabrous or minutely scabrid, the basal 1.5-5 x 1-2 cm, spatulate, narrowing to a petiole; cauline leaves oblong-obovate, sessile; flowers in short dichasial cymes; pedicels 2-7 mm; calyx 1.4-1.8 cm, 10-nerved, densely glandular-hairy, purplish, the teeth short; petals 1.4-1.6 cm, pink-violet, 2-fid, the limb with a basal tooth on each side; capsule 6-8 mm, oblong, shorter than the carpophore; seeds 1 mm, reniform-globose, wrinkled-tuberculate, brown.

M, S; moist ground. East Mediterranean region, Sinai.

13. **Silene pseudoatocion** Desf., Fl. Atlant. 1: 353 (1798).

Annual herb 10-30 cm, glandular-hairy; stems erect or ascending, branched; basal leaves 3-4.5 x 0.5-1.5 cm, obovate to spatulate, the upper smaller, ovate to oblong; flowers 2-2.5 cm, in lax terminal dichasial cymes; calyx 1.8-2.2 cm, 10-nerved, glandular-hairy, greenish; petals pink, the limb 1 cm, entire; capsule 0.8-1.1 cm; carpophore 1-1.4 cm; pubescent; seeds 1.5-1.75 mm, reniform, deeply concave on both sides, with 4 rows of tubercles.

N (Cairo); weed of cultivation. North Africa, Spain, Balearic Islands.

14. **Silene longipetala** Vent., Descr. Pl. Jard. Cels., t. 83 (1802).

Perennial herb 30-60 cm, woody at the base; stems solitary or few, erect, branched, pubescent below, viscid above; leaves 2.5-7 x 0.5-1.5 cm, the lower elliptic-oblong, the upper linear-lanceolate; flowers 1.2-1.6 cm, in lax paniculate cymes, ending with 2- to 6-flowered dichasia; pedicel 0.8-1.2 cm; calyx 0.8-1 cm, glabrous, 10-nerved; the teeth short, ciliate at the margins; petals 1.2-1.4 cm, white, the limb 2-partite into 2 linear lobes; capsule 6-8 mm, ovoid-globose, twice as long as the carpophore; seeds 2-2.5 mm, reniform, the dorsal surface flat, brown, with rows of ridges.

M; stony ground. East Mediterranean region, Iraq.

15. **Silene coniflora** Nees ex Oth in DC., Prodr. 1: 371 (1824).

Annual herb 5-25 cm, viscid-hairy; stems simple or branched from the base; leaves 1.5-4 x 0.2-0.4 cm, narrowly linear-lanceolate, acuminate; flowers 1-1.5 cm, in terminal dichasial cymes; calyx 0.8-1.2 cm, 20-nerved, glandular-hairy, obconical to cylindrical, not inflated in fruit; the teeth 2 mm, acute; petals white or purple, entire; capsule 0.9-1.1 cm, almost equalling the calyx; carpophore 0.5-1.5 mm; seeds tuberculate-wrinkled.

M, (Ras El-Hekma); cultivated plots and waste ground. Portugal, Spain, Italy, Turkey, Syria, Palestine, Egypt, Iraq, Afghanistan.

16. **Silene arabica** Boiss., Fl. Orient. 1: 593 (1867).

Syn. *Silene affinis* Boiss., Diagn. Pl. Orient., ser. 2, 1: 72 (1854), non Gordon, Mém. Sect. Méd. Acad. Sci. Montpellier 1: 417 (1853).

Annual erect herb, 10-25 cm, glandular-hairy, viscid; leaves 1.5-4 x 0.1-0.3 cm, linear to linear-lanceolate, sessile; flowers 1.2-1.5 cm, in monochasial cymes; pedicels 0.5-1.2 cm; calyx 1-1.2 cm, 10-nerved, cylindrical in flower, becoming obovoid in fruit, teeth 2-2.5 mm, scarious-margined and long-ciliate; corolla 1.2-1.5 cm, white, limb 8-10 mm; 2-fid into 2 strap-shaped lobes, each lobe emarginate; capsule 6.5-9 mm, ovoid-cylindrical; carpophore 3-6 mm; seeds 0.6 mm, smooth or finely striate on both faces.

R, S; desert wadis, sandy soil. Egypt, Arabia, Iraq, Iran, Pakistan, Afghanistan.

17. **Silene rubella** L., Sp. Pl., ed. 1, 419 (1753) var. **rubella**

Annual herb 20-80 cm, glabrous or slightly puberulent; stems simple or branched from the base; lower leaves 3-6 x 0.5-1.5 cm, spatulate to obovate-oblong, obtuse narrowed into the petiole; upper smaller, lanceolate-linear, sessile; obtuse; flowers in dichasial cymes; calyx 0.8-1.2 mm, 10-nerved, papery, white or purplish; calyx-teeth short, obtuse, recurved in fruit; petals reddish-pink, the limb obovate, retuse; capsule 7-9 mm, ovoid-cylindrical; carpophore $\frac{1}{3}$ - $\frac{1}{2}$ as long as the capsule; seeds 1 mm, reniform, with fine sharp regular ridges, dark brown.

N, M, S; weed of cultivation. Mediterranean region, Sinai.

18. **Silene behen** L., Sp. Pl., ed. 1, 418 (1753).

Annual glabrous herb 20-50 cm; stems erect, simple or branched; lower leaves 2-6.5 x 1-1.5 cm, spatulate to oblanceolate, the upper oblong; flowers in lax dichasial cymes; bracts 0.5-1 cm, narrowly lanceolate; pedicel 1-1.5 cm, much thickened in fruit; calyx 1.4-1.8 cm, 10-nerved, ovoid-cylindrical, inflated in fruit, glabrous; petals 1.5-2 cm, pink, the limb 2-fid; capsule 0.8-1 cm, ovoid; carpophore $\frac{1}{3}$ to $\frac{1}{2}$ as long as the capsule; seeds 1.2-1.4 mm, tuberculate, with 4-5 furrows on the dorsal side.

N, M, S; weed of cultivation. Canary Islands, South Europe, East Mediterranean region, Sinai.

19. **Silene tridentata** Desf., Fl. Atlant. 1: 349 (1798).

Syn. *Silene calycina* Salzm. ex Rohrb., Monogr. Sil. 99 (1868).

Annual herb 10-25 cm, appressed-pubescent; stems simple or branched; leaves 1-3.5 x 0.1-0.4 cm, linear-lanceolate; flowers 1.1-1.4 cm, in monochasial cymes, subsessile; calyx 1.1-1.4 cm, oblong-cylindrical, ovoid-globose in fruit, hispid; teeth 4-5 mm in fruit, acuminate, subulate, $\frac{1}{2}$ as long as the calyx-tube, calyx nerves thick; petals pink, almost included in the calyx, the limb 2-fid; capsule 8-9 mm, ovoid-globose; carpophore 1-2 mm; seeds 0.8-0.9 mm, reniform-orbicular, grooved.

M; waste ground. Canary Islands, Mediterranean region.

20. **Silene gallica** L., Sp. Pl., ed. 1, 417 (1753).

Annual herb 20-50 cm, hirsute, the upper branches glandular; stems erect or ascending, branched from the base; basal leaves 1.5-4 x 0.2-0.8 mm, spatulate; the upper smaller, narrowly lanceolate, sessile; flowers 1-1.2 cm, in monochasial racemose-like cymes, subsessile or with a pedicel to 8 mm; calyx 7-9 mm, 10-nerved, ovoid-cylindrical, glandular-hispid, sometimes with spreading hairs; calyx teeth short, slightly recurved; petals pink, rarely white, the limb entire; capsule 7-9 mm, ovoid; carpophore 0-0.5 mm; seeds 1 mm, reniform, tuberculate, black.

O, M; cultivated plots. Atlantic Islands, Europe, North Africa, West Asia; introduced into other temperate regions.

21. **Silene apetala** Willd., Sp. Pl., ed. 4, 2(1): 703 (1799).

Annual herb 10-25 cm, appressed-pubescent; stems simple or branched; leaves 2-5 x 0.2-0.5 cm, the lower narrowly spatulate, the upper lanceolate-linear; flowers 7-9 mm, in terminal and lateral monochasial or irregular congested cymes; pedicels 0.3-3 cm; calyx 7-9 mm, 10-nerved, ovoid-cylindrical, campanulate in fruit, green- or purple-nerved; teeth short, acute; petals absent or 3-3.5 mm, white or pink, 2-fid; capsule 5-6 mm, ovoid-globose; carpophore 1-1.5 mm; seeds 0.8-1 mm, flat, grooved on the dorsal side, margins undulate, blackish-brown.

Two varieties occur in Egypt:

var. **apetala**

Calyx appressed-puberulent.

O, M, S; cultivated ground.

var. **alexandrina** Asch. in Asch. & Schweinf., Mém. Inst. Egypt. 2: 46 (1887).
Syn. *Silene alexandrina* (Asch.) Danin, Israel J. Bot. 36: 65 (1987).

Calyx white-hispid along the nerves.

Area of the species: Mediterranean region, West Asia; introduced into tropical Africa.

22. **Silene armeria** L., Sp. Pl., ed. 1, 420 (1753).

Annual herb 15-40 cm, glabrous, often viscid above; stems erect, usually unbranched; basal leaves spatulate, withering before anthesis; upper ovate-cordate to lanceolate, smaller; flowers in congested corymbose cymes; calyx 1.2-1.5 cm, 10-nerved, teeth obtuse; petals pink, obovate, emarginate; capsule 0.7-1 cm, oblong, equalling or slightly longer than the glabrous carpophore.

N (Cairo), M; cultivated plots. South, East and Central Europe, Egypt, Northwest Asia; naturalized in other temperate regions.

23. *Silene nocturna* L., Sp. Pl., ed. 1, 416 (1753).

Annual herb 15-40 cm, appressed-pubescent, viscid above; stems erect or ascending, branched; lower leaves 2-5 x 0.5-1.5 cm, spatulate to oblong-linear, the apex rounded or blunt, apiculate; upper smaller, linear-lanceolate; flowers in monochasial racemose-like cymes; pedicel 0.2-1.2 cm, thicker in fruit; calyx 0.8-1 cm, cylindrical, teeth short; petals 1-1.2 cm, white, exceeding the calyx, the limb 2-fid; capsule 1 cm, cylindrical; carpophore 1-1.5 mm; seeds 0.8 mm, reniform, tuberculate-wrinkled.

N, O, M, D, S; weed of cultivated ground. Mediterranean region, Sinai.

24. *Silene burchellii* Otth ex DC. Prodr. 1: 374 (1824) var. *schweinfurthii* (Rohrb.)

Täckh. & Boulos, Publ. Cairo Univ. Herb 5: 16 (1974).

Syn. *Silene schweinfurthii* Rohrb., Bot. Zeit. 25: 82 (1867).

Annual (in Egypt) herb 10-40 cm, appressed-hairy; stems erect, branched from the base; lower leaves 4-10 x 2-5 cm, linear-lanceolate to lanceolate-spathulate; flowers 2-6 in monochasial cymes; pedicel 0.3-2 cm, pubescent; calyx 1-1.3 cm, longer in fruit, 10-nerved, the teeth 1.5-4 mm; corolla 0.9-1.3 cm, purple; capsule 7-8 mm, ovoid; carpophore 3-4 mm.

R, GE; sandy and rocky soils. Egypt, Sudan, Ethiopia, Arabia.

25. *Silene vivianii* Steud., Nomencl. Bot., ed. 2, 2: 588 (1841).

Annual herb 10-30 cm, minutely appressed-pubescent or papillose-scabrid, viscid; stems erect or ascending, branched from the base; leaves 1-3.5 x 0.05-0.2 cm, narrowly linear, pubescent; flowers in monochasial racemose-like cymes; pedicel 0.1-1.2 cm; calyx 1.2-1.8 cm, the teeth 3 mm, acute or obtuse, scarious-margined, ciliate; petals white, the limb deeply 2-fid into linear lobes; capsule 6-8 mm, ovoid; carpophore 6-7 mm, pubescent; seeds 0.5-1 mm, reniform, rugulose.

Two subspecies occur in Egypt:

subsp. *vivianii*

Syns. *Silene setacea* Viv., Fl. Libyc. Spec. 23, t. 12, f. 2 (1824), non Otth in DC., Prodr. 1: 372 (1824).

Silene ligulata, sensu Täckh., Stud. Fl. Egypt, ed. 2, 89 (1974).

Plant minutely appressed-pubescent, not viscid; calyx-teeth acute.

N, M, D, S; sandy soils. North Africa, Sinai, Palestine, Arabia, Iraq.

subsp. *viscida* (Boiss.) Boulos, Fl. Egypt Checklist 14 (1995).

Syn. *Silene setacea* Viv. var. *viscida* Boiss., Fl. Orient. 1: 594 (1867).

Plant papillose-scabrid, viscid; calyx-teeth obtuse.

S; stony wadis. Sinai, Iraq, Iran.



Plate 14. CARYOPHYLLACEAE: *Silene coniflora* 1, flowering and fruiting branch and capsule. *Silene arabica* 2, flowering and fruiting branch. *Silene rubella* 3, flowering and fruiting branch, basal leaves and capsule. *Silene behen* 4, flowering and fruiting branch, basal leaf and capsule. *Silene tridentata* 5, flowering and fruiting branch and capsule. *Silene gallica* 6, flowering and fruiting branch and capsule. *Silene apetala* 7, flowering and fruiting branch and capsule. *Silene nocturna* 8, flowering and fruiting branch and basal leaf. *Silene burchellii* 9, flowering and fruiting branch. *Silene palaestina* 10, flowering and fruiting branch and capsule. *Silene biappendiculata* 11, flowering and fruiting branch and capsule. All drawings to the same scale except enlarged parts (scale given).

26. **Silene palaestina** Boiss., Diagn. Pl. Orient., ser. 1, 8: 80 (1849).

Annual herb 20-50 cm, glandular-villose, viscid; stems erect, simple or branched; lower leaves 1.5-4.5 x 0.3-0.8 cm, oblong, oblanceolate or lanceolate, sessile, the upper smaller; flowers 1.2-2 cm, in monochasial cymes, rarely branched; pedicels 2-5 mm, elongating in fruit to 1.4 cm; calyx 1-1.5 cm, 10-nerved, glandular-hairy; petals red or purple, the limb 2-fid with a basal tooth on each side; capsule 0.7-1 cm; carpophore 2.5-3.5 mm; seeds 0.5 mm, almost smooth.

S; coastal sands. Sinai, Palestine, Lebanon.

27. **Silene colorata** Poir., Voy. Barb. 2: 163 (1789).

Syns. *Silene bipartita* Desf. var. *stenophylla* Boiss., Fl. Orient. 1: 597 (1867).

Silene colorata Poir. var. *stenophylla* (Boiss.) Dinsm. in Post, Fl. Syr. Pal. Sinai, ed. 2, 1: 178 (1932).

Annual herb 10-30 cm, hispid to appressed-hairy, not glandular; stems erect or decumbent, simple or branched from the base; leaves 2-8 x 0.2-1.2 cm; lower obovate, oblong-lanceolate to oblong-linear; upper narrowly-linear, smaller; flowers 1-1.5 cm, in small monochasial cymes; pedicel 1-8 mm; calyx 1-2 cm, cylindrical, ovoid in fruit, pubescent; teeth 1.5-4.5 mm, ciliate; petals pink to white, 2-partite into oblong-linear lobes; capsule 1-2 times as long as the carpophore, ovoid; seeds 1-1.2 mm, ear-shaped, deeply grooved on the dorsal side, with 2 undulate margins, almost smooth.

Two varieties occur in Egypt:

var. **colorata**

Lower leaves obovate, obtuse, the upper oblong-linear; calyx-teeth 2-4.5 mm, obtuse; petal limb pink; capsule 1-2 times as long as the carpophore.

N, M, D, S; sandy soils and wadi beds. Mediterranean region, Sinai.

var. **oliveriana** (Otth) Muschl., Man. Fl. Egypt 1: 338 (1912).

Syns. *Silene oliveriana* Otth in DC., Prodr. 1: 373 (1824).

Silene colorata Poir. subsp. *oliveriana* (Otth) Rohrb., Mon. Sil. 116 (1868).

Lower leaves oblong-linear, the upper narrow-linear, acute; calyx-teeth 1.5-2 mm, acute; petal limb whitish; capsule equalling or shorter than the carpophore.

M, De, S; sandy soils and desert wadis. Mediterranean region, Sinai, Arabia.

28. **Silene biappendiculata** Rohrb., Bot. Zeitung (Berlin) 25: 82 (1867).

Syn. *Silene canopica* Boiss., Fl. Orient. 1: 596 (1867), non Spreng., Syst. Veg. 2: 406 (1825).

Annual herb 10-25 cm; stems ascending, branched; leaves 1-2.5 x 0.1-0.3 cm, oblong, oblong-lanceolate to linear; pedicel 1-5 mm; flowers in terminal monochasial cymes; calyx 8-9 mm, 10-nerved, whitish appressed-hairy, the teeth obtuse; petals pink or white, limb 2-fid into 2 obtuse lobes; capsule ovoid; carpophore longer than or equalling the capsule, hairy; seeds reniform, acutely grooved on the dorsal side.

M, S; stony ground. Egypt, Libya.

29. *Silene pendula* L., Sp. Pl., ed. 1, 418 (1753).

Annual pilose herb, 15-40 cm; stems ascending to erect; leaves 2-5 x 0.5-1.5 cm, ovate-lanceolate, appressed-pilose; flowers in lax terminal monochasial cymes, often branched below; pedicel erect in flower, pendent in fruit; calyx 1.3-1.8 cm, inflated in fruit; petals pink, 2-fid; capsule 1-1.6 cm, ovoid-conical; carpophore 3-6 mm; seeds 1.2 mm, reniform-subglobose, dorsal side flattened, black.

M, S; cultivated ground. North Africa, Sinai, Italy; occasionally naturalized elsewhere in Europe.

8. *Bufonia* L.

Annual or perennial herbs, or shrubs; leaves opposite, subulate, exstipulate; flowers small, in cymose spikes or panicles; sepals 4, scarious-margined; petals 4, entire or 2-dentate to 2-fid; stamens (2-)4-8; filaments inserted on a perigynous disc; ovary 1-locular, 2- to 10-ovuled; styles 2; capsule 2-valved, 2-seeded; seeds horseshoe-shaped. 20 species, Atlantic Islands, Mediterranean region, Sinai.

1. *Bufonia multiceps* Decne., Ann. Sci. Nat. Bot., ser. 2, 3: 278 (1835).

Perennial with woody base; stems 15-25 cm, herbaceous, wiry, erect or ascending, appressed-pubescent; leaves 0.4-1.5 cm, narrowly linear-lanceolate, connate at the base and appressed to the stem; base scarious-margined, ciliate; flowers 4-5 mm, in terminal spicate monopodial inflorescences; peduncle 3-4 mm; calyx 4 mm, linear-lanceolate, 6- to 7-nerved, glabrous; petals 4-5 mm, lanceolate, entire; stamens 8; ovary ellipsoid, 2-ovuled; capsule ellipsoid; seeds 1.5 mm, obovate, muricate-tuberculate.

S; stony ground. Endemic.

9. *Sagina* L.

Dwarf annuals or perennials; stems slender, prostrate or ascending; leaves opposite, subulate, connate at the base, exstipulate; flowers small, in dichasial cymes or solitary and terminal, usually on long pedicels; sepals 4-5, free; petals 4-5 or 0; stamens 4-10; ovary 1-celled, many-ovuled; styles 4-5, alternating with the sepals; capsule dehiscent to the base into 4-5 valves; seeds minute, reniform. 20 species, mainly north temperate regions and tropical mountains.

1. *Sagina apelata* Ard., Animadv. Bot. Spec. Alt. 22 (1764).

Syns. *Sagina ciliata* Fries in Liljebld, Utkast Sv. Fl., ed. 3, 713 (1816).

Sagina reuteri Boiss., Diagn. Pl. Orient., ser. 2, 3 (1): 82 (1854).

Annual herb 5-15 cm; stems decumbent or ascending, branched from the base; leaves 4-8 mm, narrowly linear-subulate, aristate, connate at the base into a ciliate cup; pedicels longer than the flowers, filiform, elongate in fruit, flowers terminal and axillary; sepals 4, c. 2 mm, ovate-oblong, white-margined, spreading in fruit; petals absent or minute; stamens 4, shorter than the sepals; capsule exceeding the sepals, ovoid to subglobose; seeds 0.3-0.4 mm, reniform, brown, rugose.

S; sandy and rocky ground. Europe, Mediterranean region, Southwest Asia; introduced into North America.

10. *Arenaria* L.

Annual or perennial herbs; leaves opposite, exstipulate; flowers in lax dichasial cymes; sepals 5, free; petals 5, rarely 0, entire or emarginate, white or pink; stamens 10; styles 2-5, free; fruit a many-seeded capsule, dehiscent by 6 teeth; seeds reniform. About 150 species, north temperate regions.

- 1. Perennial, petals 5 mm
- + Annual, petals 2.5-3 mm

- 1. *A. deflexa*
- 2. *A. serpyllifolia*

1. *Arenaria deflexa* Decne., Ann. Sci. Nat. Bot., ser. 2, 3: 277 (1835) subsp. *deflexa*

Perennial herb 5-25 cm, glandular-pubescent; stems tufted, slender, ascending or decumbent, often forming mats; leaves 0.3-1.2 x 0.2-0.5 cm, ovate-elliptic or oblong, apiculate, glandular-hairy, sessile or with a petiole to 3 mm; flowers in lax irregular dichotomously branched cymes; pedicel 2-8 mm; sepals 2.5-4.5 mm; the outer 4-4.5 mm, narrowly lanceolate, more than 3½ times longer than broad, 3-nerved, scarious-margined; petals 5 mm, white, oblong-linear; capsule 4 mm, narrowly ovoid; seeds 0.5-0.7 mm, tuberculate.

S; stony ground. East Mediterranean region, Sinai.

2. *Arenaria serpyllifolia* L., Sp. Pl., ed. 1, 423 (1753).

Annual herb 5-25 cm, glandular-pubescent; basal leaves spatulate, withering before flowering time; cauline leaves 2-6 mm, ovate-triangular, acute, sessile, 5-nerved; flowers in monochasial cymes; pedicel 2-8 mm; sepals 3-4 mm, ovate-lanceolate; petals 2.5-3 mm, ovate; capsule subglobose; seeds 0.5-0.7 mm, tuberculate-papillose.

N, M, GE; cultivated ground and mountain slopes. Temperate Europe and Asia, North Africa, Ethiopia; introduced into America and Australia.

11. *Minuartia* L.

Annual or perennial herbs, rarely small shrubs; leaves exstipulate; flowers in terminal cymes or clusters; sepals 5, free, 3- to 9-veined; petals 5, rarely 0, white or pink; stamens (3-)10, the outer whorl with basal glands; styles 3; capsule opening by 3 valves; seeds dark brown. About 100 species, arctic and temperate northern hemisphere.

- 1. Perennial, with a tough woody base; petals white
- + Annuals, herbaceous; petals white, occasionally flushed reddish beneath, or pink

1. *M. geniculata*

2

- 2. Sepals 6-8 mm
- + Sepals 1.5-4 mm

3. *M. meyeri*

3

- 3. Sepals 1.5-1.75 mm, with rounded apex; leaves crowded below
- + Sepals 2-4 mm, with acute apex; leaves not crowded below

2. *M. picta*

4

4. Flowers in lax, dichasial cymes; all pedicels much longer than the calyx 4. *M. hybrida*
 + Flowers in congested fasciculate cymes; pedicels of upper flowers shorter than the calyx 5. *M. mediterranea*

1. ***Minuartia geniculata*** (Poir.) Thell., Mém. Soc. Nat. Cherbourg 4, 38: 231 (1912).
 Syns. *Arenaria geniculata* Poir., Voy. Barb. 2: 166 (1789).
Arenaria procumbens Vahl, Symb. Bot. 2: 50, t. 33 (1791).
Alsine procumbens (Vahl) Fenzl, Geogr. Verbreit. Alsin., 87 (1833).
Rhodalsine geniculata (Poir) F. N. Williams, Bull. Herb. Boiss. 6: 3 (1898).
Minuartia procumbens (Vahl) Graebn. in Asch. & Graebn., Syn. Mitteleur. Fl. 5(1): 775 (1918).

Perennial with tough woody base; stems 15-40 cm, prostrate or decumbent; leaves 0.5-2 x 0.1-0.6 cm, linear, oblanceolate or suborbicular, 1-nerved, glabrescent or glandular-pubescent, sessile or short-petiolate; flowers in lax, irregularly branched cymes; bracts leafy; pedicel 0.5-2 mm; sepals 3 mm, ovate; petals 2.5 mm, white; capsule 3.5 mm, oblong, splitting into 3 boat-like valves; seeds 0.75 mm, reniform, dark brown.

N, (Faiyum), M, S; coastal sands, rocky coastal areas. Mediterranean region, Sinai.

2. ***Minuartia picta*** (Sibth. & Sm.) Bornm., Beih. Bot. Centralbl. 28(2): 148 (1911).
 Syns. *Arenaria picta* Sibth. & Sm., Fl. Graec. Prodr. 1: 304 (1809).
Arenaria filiformis Labill., Icon. Plant. Syr. Rar. 4: 8, t. 3, f. 2 (1812).
Alsine picta (Sibth. & Sm.) Fenzl, Geogr. Verbreit. Alsin. 57 (1833).

Annual erect herb 5-12 cm, viscid-glandular; stems short, 1-3 cm, densely leafy; leaves 0.5-2 x 0.05 cm, setaceous, the apex sharp-cuspidate; flowers in lax, leafless, dichotomous cymes; bracts minute, 0.5-mm; pedicels 0.5-2 cm; sepals 1.5-1.75 mm, with a rounded apex, the margins scarious; petals 2.5-3 mm, pink; capsule 3 mm, ovoid; seeds 0.8 mm, suborbicular, finely tuberculate or smooth, dark brown.

Two varieties occur in Egypt:

var. ***picta***

Seeds tuberculate.

De, S; stony ground. East Mediterranean region, Sinai, Arabia, Iraq, Iran, Afghanistan.

- var. ***sinaica*** (Boiss.) Bornm., Beih. Bot. Centralbl. 28(2): 148 (1911).
 Syns. *Alsine sinaica* Boiss., Diagn. Pl. Orient., ser. 1, 8: 100 (1849).
Minuartia sinaica (Boiss.) Danin, Isreal J. Bot. 36: 63 (1987).

Seeds smooth, not tuberculate.

S; stony ground. Sinai, Palestine (Negev).

3. ***Minuartia meyeri*** (Boiss.) Bornm., Beih. Bot. Centralbl. 27 (2) 318 (1910).
 Syns. *Alsine meyeri* Boiss., Diagn. Pl. Orient., ser. 1, 8: 96 (1849).

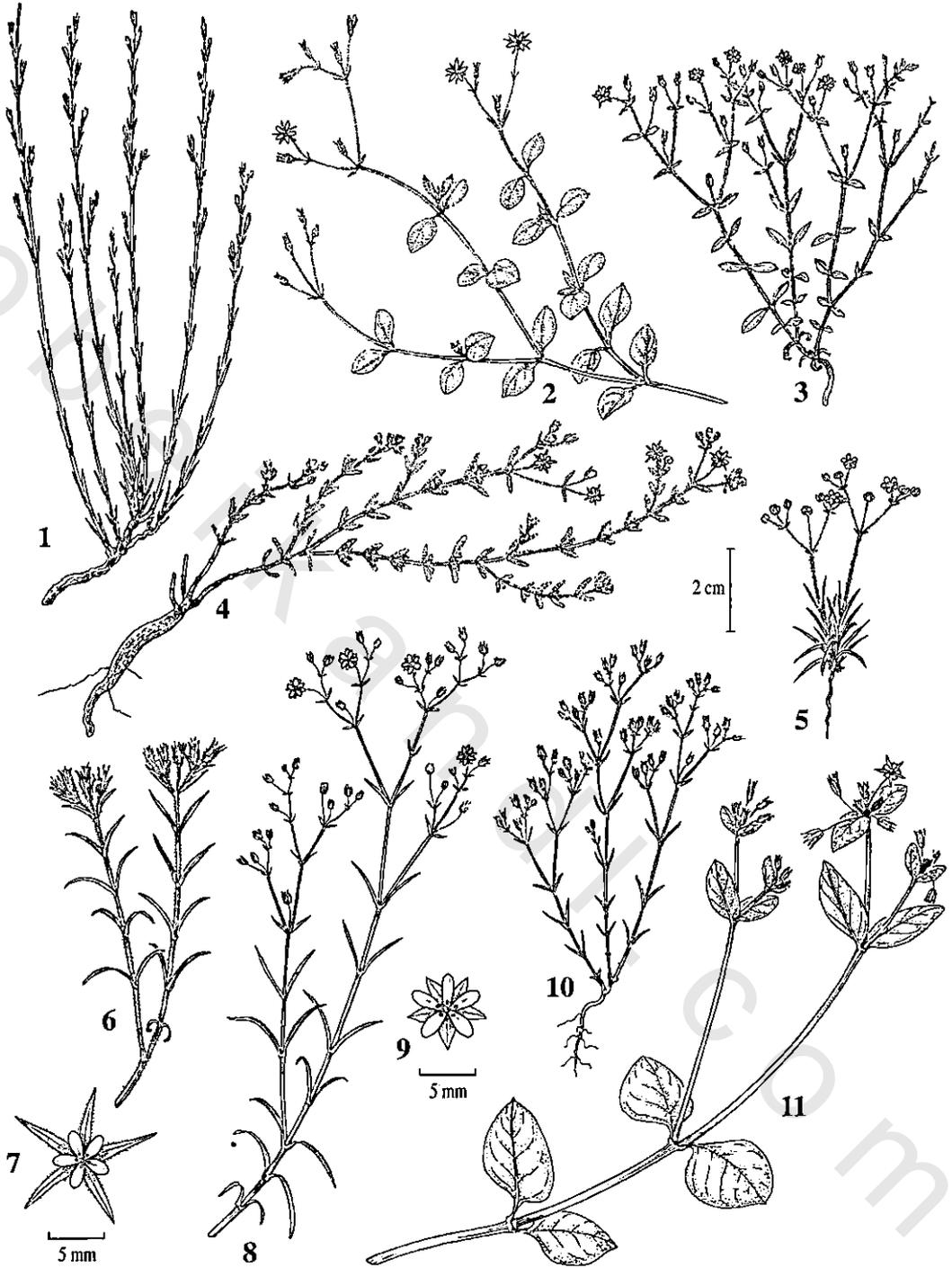


Plate 15. CARYOPHYLLACEAE: *Bufonia multiceps* 1, habit. *Arenaria deflexa* 2, flowering and fruiting branch. *Arenaria serpyllifolia* 3, habit. *Minuartia geniculata* 4, habit. *Minuartia picta* 5, habit. *Minuartia meyeri* 6, flowering and fruiting branch; 7, flower. *Minuartia hybrida* 8, flowering and fruiting branch; 9, flower. *Minuartia mediterranea* 10, habit. *Stellaria pallida* 11, flowering branch. All drawings to the same scale except enlarged parts (scale given).

Alsine brevis Boiss., Diagn. Pl. Orient., ser. 1, 8: 96 (1849).

Annual herb 2-10 cm, glandular hairy; stems branched from the base; leaves 0.5-1.8 x 0.05-0.15 cm, linear, acute, often recurved, 5- to 7-nerved; flowers in congested dichasial cymes; pedicel shorter than the calyx; calyx 6-8 mm, sepals unequal, 3- to 5-nerved, lanceolate, acuminate; petals 2-3 mm, white; capsule 4 mm, oblong; seeds 0.6 mm, finely tuberculate, brown.

S; stony ground. Southwest Asia.

4. **Minuartia hybrida** (Vill.) Schischk. in Kom., Fl. SSSR 6: 488 (1936) subsp. **hybrida**

Syns. *Arenaria hybrida* Vill., Prosp. Hist. Pl. Dauphiné 48 (1779).

Minuartia tenuifolia (L.) Hiern, J. Bot. (London) 37: 321 (1899), non Martius. Pl. Hort. Erlang. 44 (1814).

Minuartia tenuifolia subsp. *hybrida* (Vill.) Mattf., Bot. Jahrb. Syst. 57, Beibl. 126: 29 (1921).

Annual herb 5-20 cm, glabrous to slightly glandular-puberulent; leaves 0.5-2 x 0.05-0.15 cm, linear-subulate, acuminate; flowers in lax dichasial cymes, pedicels much longer than the calyx; sepals 2.5-3.75 mm, lanceolate, acuminate, 3-nerved, pilose-glandular; petals 2.5-3 mm, white, ovate-lanceolate; capsule 3.5-4 mm, ovoid-cylindrical; seeds 0.5 mm, reniform-orbicular, tuberculate, brownish.

M; stony ridges. West Europe, Mediterranean region, Southwest Asia.

5. **Minuartia mediterranea** (Ledeb.) K. Maly, Glasn. Zamaljsk. Muz. Bosni

Hercegovini 20: 363 (1809).

Syns. *Arenaria mediterranea* Ledeb. in Link, Enum. Hort. Berol. Alt. 1: 431 (1821).

Alsine tenuifolia (L.) Crantz var. *mucronata* (Sibth. & Sm.) Boiss., Fl. Orient. 1: 686 (1867).

Annual erect herb, 5-15 cm, hairy-viscid; stems simple or branching from the base; leaves 0.5-2 x 0.1-0.15, linear-filiform; flowers in dichasial, congested, usually glandular-pubescent cymes; pedicels 0.5-8 mm, the upper shorter than the calyx; calyx 3-4 mm, glandular-pubescent; sepals ovate-lanceolate, mucronate; petals much shorter than the sepals or 0; capsule 3-4 mm, conical-cylindric; seeds 0.4 mm, blackish.

M; sandy soils. Mediterranean region.

12. **Stellaria** L.

Annual or perennial herbs; leaves opposite, entire, exstipulate; flowers in dichasial cymes; sepals (4-)5, free, persistent; petals (4-)5, usually 2-fid, sometimes 0; stamens 3-10, rarely 0, inserted on an annular disc; ovary 1-locular, few to many-ovuled; styles mostly 3; capsule dehiscing by 6 valves; seeds numerous, rounded-reniform, compressed, papillose. About 170 species, cosmopolitan.

1. Calyx 3.5-5 mm; petals usually present; stamens 5-7; seeds 0.8-1.25 mm, reddish-brown; plants bright green

+ Calyx 2.5-3 mm; petals usually absent or very small; stamens 3-5;

1. **S. media**

seeds 0.6-0.8 mm, pale brown; plants pale green

2. *S. pallida*

1. ***Stellaria media*** (L.) Vill., Hist. Pl. Dauphiné 3: 615 (1789).
Syn. *Alsine media* L., Sp. Pl., ed. 1, 272 (1753).

Annual delicate, bright green herb, 15-40 cm; stems weak, decumbent or ascending, with 2 lines of long hairs or glabrous; leaves 1-2.5 x 1-2 cm, ovate-lanceolate, the apex acute; petiole 0-1 cm; flowers in lax axillary or terminal dichasial cymes; pedicels 1-2 cm; sepals 3.5-5 mm, ovate, obtuse; petals 2-3 mm, white, 2-fid, sometimes 0; stamens 5-7; capsule 6-8 mm; seeds 0.8-1.25 mm, reddish-brown.

M; moist cultivated land. Cosmopolitan.

2. ***Stellaria pallida*** (Dumort.) Murb., Beitr. Fl. Südbosnien 158 (1891).
Syns. *Alsine pallida* Dumort., Fl. Belg. 109 (1827).
Stellaria pallida (Dumort.) Piré, Bull. Soc. Roy. Bot. Belg. 2: 49 (1863),
comb. inval.
Stellaria media (L.) Vill. subsp. *pallida* (Dumort.) Asch. & Graebn., Fl.
Nordostdeutsch. Flachl. 310 (1898).

Similar to *Stellaria media*, but differs by its pale green colour, calyx 2.5-3 mm, petals usually 0 or very small, stamens 3-5 and seeds 0.6-0.8 mm, pale brown.

N, O, M, S; moist cultivated land. Europe, Mediterranean region, West Asia.

NOTE: The above two *Stellaria* species are sometimes treated as subspecies of *Stellaria media*.

13. *Cerastium* L.

Annual or perennial herbs, exstipulate; sepals 5, free; petals (4-)5, white, 2-fid; stamens 5 or 10; styles usually 5; capsule opening by 8-10 teeth, exerted, many-seeded. About 100 species, subcosmopolitan.

1. Capsule 0.8-1 cm; seeds 0.5-0.6 mm
+ Capsule 1.5-2 cm; seeds 1-1.4 mm

1. ***C. glomeratum***
2. ***C. dichotomum***

1. ***Cerastium glomeratum*** Thuill., Fl. Paris, ed. 2, 226 (1799).
Syn. *Cerastium viscosum* L., Sp. Pl., ed. 1, 437 (1753), p. p., nom. ambig.

Annual herb 10-25 cm, densely pilose-glandular; stems erect or ascending; leaves 0.5-3 x 0.4-1.2 cm, the lower obovate-spathulate, petiolate, the upper oblong-elliptic, sessile; flowers in compact dichasial cymes; pedicels shorter than the calyx; calyx 4-5mm; petals 4-5 mm, 2-fid, sometimes 0; stamens 10; capsule 0.8-1 cm, cylindrical, curved at its tip; seeds 0.5-0.6 mm, finely tuberculate.

S; stony ridges. Subcosmopolitan.

2. **Cerastium dichotomum** L., Sp. Pl., ed. 1, 438 (1753).

Annual herb 10-25 cm, densely villous, some hairs glandular; stems branched; leaves 1.5-3 x 0.4-0.8 cm, lanceolate; flowers in terminal dichotomous cymes, lax in flower, dense in fruit; pedicels 5-8 mm; calyx 0.8-1 cm, glandular-hairy; petals 5-7 mm, 2-fid; stamens 10, the filaments ciliate at the base; capsule 1.5-2 cm, straight; seeds 1-1.4 mm, brown, tuberculate.

Two subspecies in occur Egypt (sometimes treated as separate species).

1. Calyx inflated in fruit

subsp. **inflatum**

+ Calyx not inflated in fruit

subsp. **dichotomum**

subsp. **dichotomum**

S; stony slopes.

subsp. **inflatum** (Link) Cullen, Notes Roy. Bot. Gard. Edinb. 27: 211 (1967).

Syn. *Cerastium inflatum* Link in Desf., Tabl. Ecol. Bot., ed. 3 (Cat. Hort. Paris) add., 462 (1832).

S; stony slopes.

Area of the species: Mediterranean region, Southwest and Central Asia.

14. **Holosteum** L.

Annual herbs; leaves opposite, exstipulate; flowers in terminal umbellate cymes; sepals 5, free; petals 5, white; stamens 3-5 or 10; styles 3, free; fruit a many-seeded capsule, opening by revolute teeth; seeds tuberculate. 4 species, temperate Europe and Asia.

1. **Holosteum umbellatum** L. subsp. **glutinosa** (M. Bieb.) Nyman, Consp. Fl. Europ. 112 (1878).

Syns. *Arenaria glutinosa* M. Bieb., Fl. Taur.-Caucas. 1: 344 (1808).

Holosteum glutinosum (M. Bieb.) Fisch. & C. A. Mey., Index Sem. Hort. Petrop. 6: 52 (1839).

Annual erect herb 10-15 cm, glandular-pubescent; stems branched from the base; leaves 1-2.5 x 0.2-0.5 cm, linear-lanceolate to oblong; flowers in lax umbellate cymes, pedicels 1-3 cm; sepals 3.5-4 mm, scarious-margined; petals 7-8 mm, white, oblong-elliptic, entire; stamens 10; capsule 7-9 mm; seeds finely tuberculate.

S; sheltered slopes and crevices. Southeast Europe, Southwest Asia.

15. **Spergularia** (Pers.) J. Presl & C. Presl, nom. conserv.

Annual or perennial herbs, sometimes with a woody base; stems erect, decumbent or prostrate; leaves opposite, linear or filiform, stipulate; flowers in cymose inflorescences; sepals 5, free, with scarious margins; petals 5, white or pink, entire; stamens 2-10, styles 3, free to the base; capsule 3(-5)-valved, seeds winged or wingless. 25 species, especially halophytes, cosmopolitan.

- | | |
|--|-----------------------|
| 1. Capsule 7-9 mm, all seeds winged | 1. S. media |
| + Capsule 2-6 mm, all seeds wingless, or winged and wingless mixed in the same capsule | 2 |
| 2. Seeds winged and wingless in the same capsule | 2. S. marina |
| + Seeds wingless | 3 |
| 3. Capsule 4-5 mm | 3. S. rubra |
| + Capsule 2-3.5 mm | 4 |
| 4. Stamens 2-3; stipules dull-coloured | 5. S. diandra |
| + Stamens 5-8; stipules white | 4. S. bocconii |

1. **Spergularia media** (L.) C. Presl, Fl. Sic. 161 (1826).

Syns. *Arenaria media* L., Sp. Pl., ed. 2, 606 (1762).

Arenaria maritima All., Auct. Syn. Stirp. Taurin 35 (1773).

Spergularia marginata (DC.) Kittel, Taschenb., ed. 2, 1003 (1844).

Spergularia maritima (All.) Chiov., Ann. Bot. (Roma) 10: 22 (1912).

Perennial herb 10-50 cm, woody at the base; stems branched, prostrate or ascending, glabrous or glandular-hairy in the inflorescence; leaves 0.5-3.5 x 0.1-0.2 cm, linear, fleshy; stipules 2-3 mm, white, triangular, connate at the base, mucronate; pedicels to 1.5 cm; sepals 4-6 mm, scarious-margined, glandular-hairy; petals 4-5 mm, pale pink; stamens 10; capsule 7-9 mm, exceeding the calyx, ovoid; seeds 0.8-1 mm, excluding the wing, smooth, brownish; wings entire.

N, O, M, S; saline soils, edges of salt marshes. Europe, Mediterranean region, Southwest Asia.

2. **Spergularia marina** (L.) Bessler, Enum. Pl. 97 (1822).

Syns. *Arenaria rubra* L. var. *marina* L., Sp. Pl., ed. 1, 423 (1753).

Arenaria marina (L.) Roth., Tent. Fl. Germ. 2(1): 482 (1789).

Spergularia salina J. & C. Presl, Fl. Cech. 95 (1819).

Spergularia marina (L.) Griseb., Spic. Fl. Rumel. 1: 213 (1843).

Annual or short-lived perennial herb, 10-40 cm; stems prostrate or procumbent; leaves 0.5-3 x 0.05-0.15 cm, fleshy; stipules 2-2.5 mm, triangular, connate at the base to form a sheath; sepals 3.5-4.5 mm; petals shorter than the sepals, pink; capsule 4-6 mm; seeds 0.6-0.8 mm, pyriform, papillose-tuberculate, blackish-brown, wingless and winged in the same capsule, wings erose to lacinate.

N, M, S; saline soils. Northern hemisphere, introduced into southern hemisphere.

3. **Spergularia rubra** (L.) J. & C. Presl, Fl. Cech. 94 (1819).

Syns. *Arenaria rubra* L., Sp. Pl., ed. 1, 423 (1753).

Spergularia radicans C. Presl in J. & C. Presl, Delic. Prag. 64 (1822).

Spergularia campestris (L.) Asch., Bot. Zeit. 17: 292 (1859).

Annual or short-lived perennial, 5-20 cm; stems erect or procumbent, branched; leaves 1-4 x 0.1-0.2 cm, narrowly-linear, glabrous or glandular-hairy; stipules 2-2.5 mm, white-silvery, scarious; flowers in terminal, richly-branched, dichasial cymes; pedicels

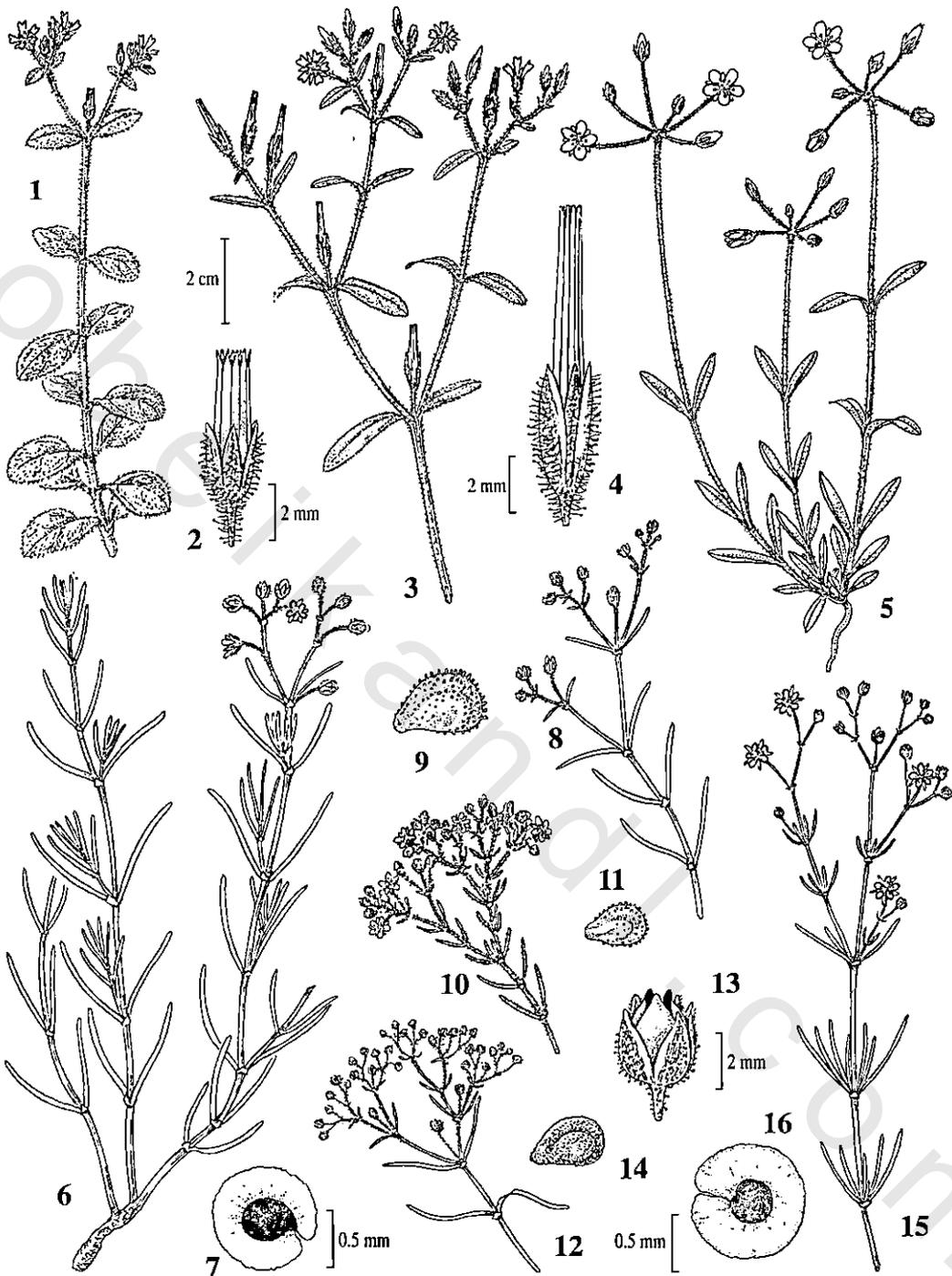


Plate 16. CARYOPHYLLACEAE: *Cerastium glomeratum* 1, flowering and fruiting branch; 2, capsule. *Cerastium dichotomum* 3, flowering and fruiting branch; 4, capsule. *Holosteum umbellatum* 5, habit. *Spergularia media* 6, habit; 7, seed. *Spergularia marina* 8, flowering and fruiting branch; 9, seed. *Spergularia bocconii* 10, flowering and fruiting branch; 11, seed. *Spergularia diandra* 12, flowering and fruiting branch; 13, capsule; 14, seed. *Spergularia fallax* 15, flowering and fruiting branch; 16, seed. All drawings to the same scale except enlarged parts, flowers (scale 2 mm), seeds (scale 0.5 mm).

longer than the calyx; sepals 3-5 mm, broadly scarious-margined, glandular-pubescent; petals 3-5 mm, pinkish-red; stamens 5-10; capsule 4-5 mm; seeds 0.5 mm, wingless, brown.

N, M, S; saline soils. Macaronesia, Europe, North Africa, Sinai, Ethiopia, North America, Australia.

4. **Spergularia bocconii** (Scheele) Graebn. in Asch. & Graebn., Syn. Mitteleur. Fl. 5(1): 849 (1919).

Syns. *Alsine bocconii* Scheele, Flora 26: 431 (1843).

Spergularia atheniensis Asch. in Schweinf., Beitr. Fl. Aethiop. 267, 305 (1867).

Spergula jallui Maire, Bull. Soc. Hist. Nat. Afr. Nord 27: 214 (1936).

Annual or short-lived perennial herb, 5-25 cm; stems glandular-hairy in the inflorescence; leaves 1-3 x 0.1 cm, narrowly linear, mucronate; stipules triangular, white; flowers in terminal dichasial cymes; pedicels 2-4 mm; sepals 2-3.5 mm, glandular-hairy; petals shorter than the sepals, pinkish; stamens 5-8; capsule 3-3.5 mm; seeds 0.5 mm, wingless, brown, tuberculate.

N, O, M, De; waste ground. Mediterranean region, extending along the Atlantic coast to Southwest England.

5. **Spergularia diandra** (Guss.) Boiss., Fl. Orient. 1: 733 (1867).

Syns. *Arenaria diandra* Guss., Fl. Sicul. Prodr. 1: 515 (1827).

Spergula diandra (Guss.) Murb., Acta Univ. Lund 33(12): 44 (1897).

Annual herb 5-20 cm; stems slender, ascending, glandular-hairy in the inflorescence, glabrous below; leaves 1-4 x 0.05-0.1 cm, filiform-linear, mucronate; stipules triangular, dull-coloured; flowers in dichasial, richly-branched cymes; pedicels longer than flowers; sepals 2-3 mm, obtuse, scarious-margined, glandular-pubescent; petals equalling or longer than the sepals, pink; stamens 2-3; capsule 2-3 mm, equalling the calyx; seeds 0.6 mm, wingless, dark brown, rugulose.

N, O, M, D, R, GE, S; alluvial and sandy soils. Mediterranean region, Southwest and Central Asia.

16. **Spergula** L.

Annual, rarely perennial, herbs; stems many, arising from the base; leaves whorled, linear; stipules small, scarious; flowers in dichasial terminal, lax cymes; sepals 5, free, herbaceous, with scarious margins; petals 5, entire, white; stamens (5-)10, on a perigynous ring; ovary 1-locular; styles (3-)5; capsule (3-)5-valved or toothed; seeds numerous, lenticular, keeled or winged. 6 species, north temperate regions.

1. **Spergula fallax** (Lowe) E. H. L. Krause in Sturm, Fl. Deutschland, ed. 2, 5: 19 (1901).

Syns. *Spergularia fallax* Lowe, Hooker's J. Bot. Kew Gard. Misc. 8: 289 (1856).

Spergularia flaccida Asch., Verh. Bot. Vereins Prov. Brandenb. 30: XLIII (1889), nom. illeg.

Glabrous annual herb, 5-30 cm; stems many from the base, erect or ascending; leaves 0.5-3.5 x 0.05-0.15 cm, linear, sessile; stipules 2 mm, ovate-deltoid, scarious; flowers in lax dichotomous cymes; pedicels 0.5-1.5 cm, filiform; sepals 3-4 mm, oblong-lanceolate, with white margins; petals shorter than the sepals, white; stamens 10, rarely less; styles 3; capsule 4-5 mm, subglobose, 3-valved; seeds black, with a broad hyaline wing, almost smooth.

N, M, D, GE, S; desert wadis, sandy and alluvial soils. Canary Islands, North Africa, Southwest Asia, India.

17. *Polycarpaea* Lam., nom. conserv.

Annual or perennial herbs, or low shrubs; stems prostrate or erect; leaves opposite, appearing whorled, linear, spatulate or suborbicular; stipules scarious; flowers in paniculate or corymbose, terminal or axillary cymes; sepals 5, free, unequal, scarious-margined; petals 5, free, unequal, shorter than the sepals; stamens 5; style 1, 3-lobed at the apex; capsule 3-valved, many-seeded; seeds pyriform or reniform. 50 species, tropical and warm regions of the Old World.

1. Plant glabrous 2
+ Plant pubescent 3

2. Erect annual; flowers in dense spicate heads 1. *P. spicata*
+ Prostrate perennial; flowers in lax cymes 4. *P. robbairea*

3. Annual, stems erect; sepals entirely scarious, glabrous 2. *P. corymbosa*
+ Perennial, stems prostrate; sepals with green midribs, pubescent 3. *P. repens*

1. *Polycarpaea spicata* Wight ex Arn., Ann. Nat. Hist., sér. 1(3): 91 (1839).

Annual erect glabrous herb, 3-15 cm; stems branched; basal leaves in a rosette; cauline leaves 0.5-2.5 x 0.3-0.5 cm, appearing whorled, spatulate; stipules 1-2 mm; flowers in dense spicate heads; sepals 3 mm; petals 1.5 mm, 2-fid; capsule ovoid; seeds subtrigonus, glossy.

De, GE; sandy soil. East Africa, Arabia, Iran, Pakistan, India, North Australia.

2. *Polycarpaea corymbosa* (L.) Lam., Tabl. Encycl. 2: 129 (1797).
Syn. *Achyranthes corymbosa* L., Sp. Pl., ed. 1, 205 (1753).

Annual erect herb, 5-15 cm, glabrous or sparsely hairy; leaves 1-2.5 x 0.05-0.15 cm; stipules 2-5 mm; flowers in dense corymbose heads; sepals 2-3 mm, acuminate, entirely scarious, glabrous, white or pink; petals much shorter than the sepals; capsule elliptic; seeds subtrigonus, smooth.

GE; sandy and stony ground. Tropical and subtropical regions.

3. *Polycarpaea repens* (Forssk.) Asch. & Schweinf., Oesterr. Bot. Z. 39: 126 (1889).
Syns. *Corrigiola repens* Forssk., Fl. Aegypt.-Arab. 207 (1775).
Polycarpaea fragilis Delile, Descr. Egypte, Hist. Nat. 209 (1814), nom. illeg.

Perennial herb 5-30 cm, woody at the base, appressed-tomentose; stems prostrate to ascending, branched; leaves 0.5-1.5 x 0.1-0.25 cm, linear, mucronate; stipules 4-5 mm, acuminate; flowers in dense terminal and axillary cymes; sepals 2 mm, with green pubescent midribs; petals 1 mm, acute; capsule ovoid.

D, GE, S; sandy and stony soils. North and East Africa, Sinai, Arabia, Iran, Pakistan.

4. **Polycarpaea robbairea** (Kuntze) Greuter & Burdet, Willdenowia 12: 189 (1982).

Syns. *Polycarpon robbairea* Kuntze, Revis. Gen. Pl. 1: 51 (1891).

Polycarpaea confusa Maire, Bull. Soc. Sci. Nat. Afr. Nord 39: 129 (1948),
nom. illeg.

Robbairea delileana Milne-Redh., Kew Bull. 3: 452 (1949).

Robbairea confusa Maire, Mém. Inst. Fr. Afr. Noire 8: 34 (1950).

Robbairea major (Asch. & Schweinf.) Botsch., Nov. Sist. Vyss. Rast. 1:
370 (1964).

Perennial herb, sometimes flowering in first year, 5-30 cm, glabrous; stems prostrate to ascending, branched; leaves 0.5-1.5 x 0.05-0.3 cm, linear to narrowly oblanceolate; stipules 0.2-1.5 mm; flowers in lax cymes; pedicels 2-4 mm; calyx 2-3 mm, midrib green; petals white or pinkish, equalling the calyx; capsule subglobose; seeds smooth, glossy.

M, D, GE, S; sandy and stony soils. North Africa, Sinai, Palestine, Arabia, Sudan.

18. **Polycarpon** L.

Annual or perennial herbs; leaves opposite or apparently in whorls of 4; stipules scarious; flowers in dichasial cymes; bracts scarious; sepals 5, free, keeled and hooded; petals 5; stamens 3-5, on a perigynous disc; ovary 1-locular; style 3-lobed at the apex; capsule many-seeded, dehiscent by 3 valves. 16 species, cosmopolitan.

1. Plant pubescent; sepals 3-3.5 mm

+ Plant glabrous, sepals 2 mm

3. **P. prostratum**

2

2. Sepals ovate, acute, mucronate, twice as long as the petals; leaves ovate to elliptic,
to 6 mm broad

1. **P. tetraphyllum**

+ Sepals oblong-ovate, obtuse; equalling the petals; leaves narrowly spatulate to
oblong-linear, to 1.5 mm broad

2. **P. succulentum**

1. **Polycarpon tetraphyllum** (L.) L., Syst. Nat., ed. 10, 881 (1759).

Syn. *Mollugo tetraphylla* L., Sp. Pl., ed. 1, 89 (1753).

Annual herb 3-15 cm, glabrous; stems prostrate to ascending, branched at the base; leaves 0.5-1.5 x 0.2-0.6 cm, in opposite pairs, appearing in whorls of 4, ovate-elliptic, tapering into a short petiole; stipules and bracts scarious; flowers in dichotomous leafy cymes; pedicels equalling or longer than the calyx; sepals 2 mm, ovate, acute- mucronate, white-margined; petals 1 mm, white, slightly emarginate; stamens 3 or 5; capsule included in the calyx, shorter than the sepals, ovoid; seeds minute, triangular- reniform, tuberculate.

Two varieties occur in Egypt:

var. **tetraphyllum**

Syns. *Polycarpon tetraphyllum* (L.) L. var. *verticillatum* Fenzl in Ledeb., Fl. Ross. 2: 165 (1843).

Polycarpon floribundum Willk., Bot. Zeitung (Berlin) 5: 430 (1847).

Leaves oblong-spathulate to elliptic; cymes slightly loose; stamens mostly 3.

N, O, M; sandy and alluvial soils.

var. **alsinifolium** (Biv.) Ball, J. Linn. Soc. Bot. 16: 370 (1877).

Syns. *Hagea alsinifolia* Biv., Stirp. Rar. Sicilia 3: 7 (1815).

Polycarpon alsinifolium (Biv.) DC., Prodr. 3: 376 (1828).

Leaves obovate to oblong; cymes somewhat dense; stamens 5.

N, M, D, S; sandy and alluvial soils, gravelly wadis.

Area of the species: Western Europe, Mediterranean region, Sinai, Arabia, Iran.

2. **Polycarpon succulentum** (Delile) J. Gay, Rev. Bot. Recueil Mens. 2: 372 (1847).

Syns. *Alsine succulenta* Delile, Descr. Egypte, Hist. Nat. 211 (1814).

Polycarpon arabicum Boiss., Diagn. Pl. Orient., ser. 1, 10: 13 (1849).

Similar to *P. tetraphyllum* but leaves narrowly spathulate to oblong-linear, to 1.5 mm broad; succulent; sepals oblong-ovate, obtuse.

N, M, D, S; sandy soils. Egypt, Palestine, Lebanon, Arabia, Iraq.

3. **Polycarpon prostratum** (Forssk.) Asch. & Schweinf., Oesterr. Bot. Z. 39: 128 (1889).

Syns. *Alsine prostrata* Forssk., Fl. Aegypt.-Arab. 207 (1775).

Polycarphaeae memphitica Delile, Descr. Egypte, Hist. Nat. 211 (1814).

Differs from the other two species by its pubescence, larger flowers in axillary and terminal congested cymes; sepals 3-3.5 mm and petals often 2-3 only.

N; canal banks. Tropical and subtropical regions.

19. **Herniaria** L.

Annual or perennial herbs, sometimes woody at the base; stems procumbent or ascending; leaves small, opposite, sometimes alternate when one of a pair is absent; stipules minute; flowers small, leaf-opposed or terminal, bisexual, 4- to 5-merous; bracts inconspicuous; sepals 4-5, equal or unequal; petals 4-5 or 0; stamens 2-5, staminodes 4-5; stigmas 2, notched or 2-fid; fruit a membranous 1-seeded utricle, enclosed in the persistent calyx or projecting; seeds globose or ovoid, compressed. About 48 species, Europe, North Africa, Southwest Asia.

1. Plant almost glabrous

+ Plant hirsute or tomentose

4. **H. glabra**

2

- | | |
|--|-------------------------|
| 2. Sepals 5 | 3 |
| + Sepals 4 | 5 |
| 3. Perennial with woody base | 3. H. cyrenaica |
| + Annual | 4 |
| 4. Sepals distinctly unequal, densely hispidulous, with spreading straight and hooked hairs; stamens 2 | 2. H. cinerea |
| + Sepals subequal, without hooked hairs; stamens 2-5 | 1. H. hirsuta |
| 5. Sepals distinctly unequal; petals absent; stamens 2 | 5. H. hemistemon |
| + Sepals equal or subequal; petals present; stamens 4 | 6. H. fontanesii |

1. **Herniaria hirsuta** L., Sp. Pl., ed. 1, 218 (1753).

Annual pubescent herb 10-15 cm; stems prostrate, branched from the base; leaves 3-7 x 1.5-3 mm, opposite at the base, sometimes alternate above, obovate or oblanceolate, subsessile, thinly pilose especially along the margins, turning reddish with age; flowers in dense lateral and terminal clusters; bracts shorter than the flowers; sepals 0.8-1 x 0.3 mm, green, subequal, narrowly ovate, thinly pilose; stamens 2-5; ovary 0.3 mm, globose; utricle ovoid, enclosed within the persistent calyx; seeds 0.7 mm, blackish-brown, smooth, glossy.

O, M, D, S; stony and sandy soils. Europe, Mediterranean region, Sinai, Arabia, extending to Pakistan, Afghanistan and Ethiopia.

2. **Herniaria cinerea** DC. in Lam. & DC., Fl. Fr., ed. 3, 5: 375 (1815).

Syns. *Herniaria virescens* DC., Prodr. 3: 367 (1828).

Herniaria diandra Bunge, Delect. Sem. Hort. Dorpat 1843: 7 (1843).

Herniaria hirsuta L. subsp. *cinerea* (DC.) Cout., Fl. Portugal, ed. 1, 202 (1913).

Similar to *H. hirsuta*, and considered to be conspecific by some authors, but more densely hispid-pilose, greyish-green, the leaves and stems not turning reddish with age; sepals distinctly unequal, the outer 2 to 1 x 0.5 mm, the inner 3 to 0.7 x 0.3 mm, densely hispidulous, with spreading straight and hooked hairs; stamens 2.

O, M, D, S; sandy and stony soils. Atlantic Islands, Mediterranean region, Arabia, extending to Afghanistan and Pakistan.

3. **Herniaria cyrenaica** F. Herm., Repert. Spec. Nov. Reg. Veg. 42: 210 (1937).

Syn. *Herniaria incana* Lam. subsp. *cyrenaica* (F. Herm.) Maire & Weiller in Maire, Fl. Afr. Nord 9: 48 (1963).

Perennial prostrate herb 10-20 cm, woody at the base, leaves 2-6 x 1-2.5 mm, narrowly elliptic-lanceolate, glabrous with hairy margins, acute; stipules 1.5 mm, membranous-white; flowers 1.5 mm, in lax cymose clusters; sepals 5, equal, 1 mm, lanceolate, obtuse, with long hairs on the outer surface; petals 5; ovary subglobose; utricle 1.5 mm, not exceeding the calyx; seeds 0.5 mm, lenticular, brown, glossy.

M; stony ground. Egypt, Libya.

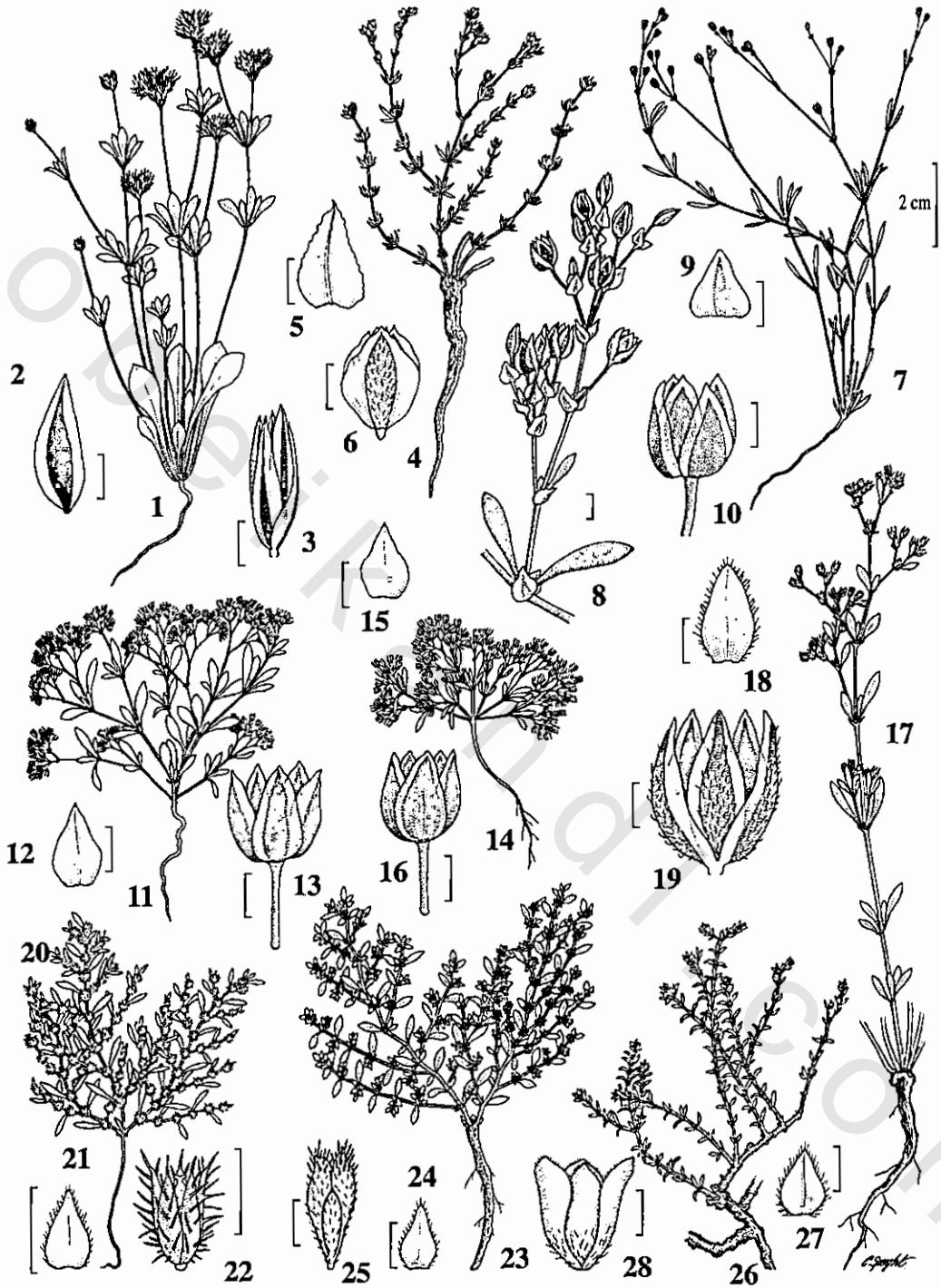


Plate 17. CARYOPHYLLACEAE: *Polycarpaea spicata* 1, habit; 2, bract; 3, calyx. *Polycarpaea repens* 4, habit; 5, bract; 6, calyx. *Polycarpaea robbairea* 7, habit of a young flowering plant; 8, flowering branch of a mature plant; 9, bract; 10, calyx. *Polycarpon tetraphyllum* 11, habit; 12, bract; 13, calyx. *Polycarpon succulentum* 14, habit; 15, bract; 16, calyx. *Polycarpon prostratum* 17, habit; 18, bract; 19, calyx. *Herniaria cinerea* 20, habit; 21, bract; 22, calyx exposing the ovary. *Herniaria hemistemon* 23, habit; 24, bract; 25, calyx. *Herniaria fontanesii* 26, habit; 27, bract; 28, calyx. All drawings to the same scale except enlarged parts (scale 1mm).

4. **Herniaria glabra** L., Sp. Pl., ed. 1, 218 (1753).

Perennial prostrate herb, 10-20 cm, woody at the base; stems spreading, the internodes 1-2 cm, glabrous or minutely hairy; leaves 3-7 x 2-3 mm, opposite at the base, alternate above, subsessile, elliptic-ovate to spatulate, glabrous, sometimes the margins ciliate; stipules scarious; flowers 1.5 mm, subsessile, in axillary and terminal dense cymose clusters; sepals 5, equal, 1 mm, glabrous or with ciliate margins; petals 5, shorter than the sepals; stamens 5; ovary subglobose; utricle 1.5 mm, slightly exceeding the calyx; seeds 0.5 mm, lenticular, smooth, brown, glossy.

S; stony wadis. Europe, North Africa, Sinai, East Mediterranean region.

5. **Herniaria hemistemon** J. Gay, Rev. Bot. Recueil Mens. 2: 371 (1847).

Perennial pubescent prostrate herb, 5-15 cm; stems many, richly branched, brittle; leaves 3-8 x 1-3 mm, short-petiolate, oblong-elliptic; stipules brownish, with ciliate margins; flowers sessile, in axillary clusters; calyx 1.5-2 mm; sepals 4, outer 2 rather fleshy, deltoid-orbicular, larger than the inner membranous, ovate-oblong sepals; petals 0; stamens 2, opposite the inner sepals; utricle 1 mm, included in the calyx; seeds 0.6 mm, suborbicular.

M, De, S; sandy and stony ground. North Africa, Sinai, East Mediterranean region, Arabia, Iraq, Iran.

6. **Herniaria fontanesii** J. Gay, Rev. Bot. Recueil Mens. 2: 371 (1847).

Perennial prostrate herb, 10-20 cm, crispate-hairy to glabrescent; stems branched, spreading, brittle, internodes 1-2 cm; leaves 3-8 x 2-3 mm, linear-lanceolate, the sessile fleshy; stipules 1.5 mm, purplish, the margins ciliate; flowers 2-2.25 mm, subsessile, in dense axillary and terminal cymose clusters; sepals 4, subequal or equal; petals 4, 1/2 as long as the sepals; stamens 4; ovary ovoid; utricle 1 mm, papillose, enclosed in the calyx; seeds 0.75 mm, ovoid, brownish.

M, S; stony ground. Southeast Spain, Sicily, North Africa, Sinai.

20. **Loeflingia** L.

Annual herbs; leaves stipulate, narrow; flowers small, sessile, in compound cymes; sepals 5, free, the outer 3 larger than the inner 2; petals and stamens 3 or 5; style 1, 3-lobed; capsule dehiscent by 3 valves, many-seeded. 7 species, Southwest Europe, Mediterranean region, Sinai, West Asia, North America.

1. **Loeflingia hispanica** L., Sp. Pl., ed. 1, 35 (1753).

Annual herb 5-15 cm, glandular-pubescent; stems branched, procumbent to erect; leaves 0.5-1.8 x 0.05-0.15 cm, linear, mucronate; stipules 2 mm, connate with the leaves to middle; flowers small, clustered in the axils of upper leaves, solitary below; sepals 2-4 mm, unequal, glandular-hairy, with lateral stiff awns, mucronate; petals much shorter than the sepals, white; capsule shorter than the calyx, ovoid; seeds numerous, compressed, yellow.

M, S; sandy soil. Southwest Europe, Sinai, Mediterranean region, Sinai, Arabia, Iran.

21. *Paronychia* Mill.

Annual or perennial herbs; leaves opposite, sessile; stipules scarious, white, conspicuous; flowers in axillary and terminal clusters, hidden by the large silvery scarious bracts; sepals 5, persistent; petals 0; stamens 5, sometimes fewer; staminodes 5, filiform; styles 2, free or fused and 2-lobed at the apex; fruit a membranous 1-seeded utricle, enclosed in the persistent calyx. About 80 species, temperate and subtropical regions.

- 1. Leaves glabrous, mucronate; sepals scarious-margined, aristate at the apex 2
+ Leaves hairy, not mucronate; sepals not scarious-margined, nor aristate at the apex 3
- 2. Flowering clusters 1-1.5 cm diam.; sepals glabrous or with straight hairs 2. *P. argentea*
+ Flowering clusters 5 mm diam.; sepals with hooked hairs at the base 1. *P. arabica*
- 3. Leaves 2-5 x 0.5 mm; bracts broadly ovate to orbicular, short acuminate; calyx 2-3 mm 3. *P. sinaica*
+ Leaves 0.4-1 x 0.15-0.25 cm; bracts ovate-lanceolate, subacute-obtuse; calyx 3.5-5 mm 4. *P. capitata*

1. *Paronychia arabica* (L.) DC. in Lam., Encycl. 5: 24 (1804).

Syns. *Illecebrum arabicum* L., Mant. 51 (1767).

Paronychia desertorum Boiss., Diagn. Pl. Orient., ser. 1, 3: 11 (1843).

Annual or short-lived perennial herb, 5-30 cm; stems prostrate, pilose; leaves 0.5-1.2 x 0.1-0.25 cm, oblong-lanceolate, mucronate, glabrous; stipules and bracts silvery, ovate to oblong-lanceolate, acuminate; flowers in axillary clusters, 5 mm diam.; sepals 1.5 mm; broadly scarious-margined, with hooked hairs at the base and an apical awn equalling or shorter than the sepal; utricle 1.25 mm, ovoid-cylindrical; seeds lenticular or globose, brown, glossy.

Two subspecies occur in Egypt:

subsp. *arabica*

Apical awn of the sepal about 1/2 of its length.

M, D, S; sandy and stony soils.

subsp. *longiseta* Batt., Bull. Soc. Bot. Fr. 46: 267 (1900).

Syn. *Paronychia arabica* subsp. *annua* (Delile) Chaudhri, Meded. Bot. Mus.

Herb. Rijks Univ. Utrecht 285: 203 (1968).

Apical awn of the sepal equalling it in length.

M, D, S; sandy and stony soils.

Area of the species: North Africa, Sinai, Arabia, South Iraq, South Iran.

2. **Paronychia argentea** Lam., Fl. Fr. 3: 230 (1779).

Annual or short-lived perennial herb, 10-50 cm, puberulent-hairy to glabrescent; stems prostrate to ascending; leaves 0.4-2 x 0.1-0.4 cm, elliptic to linear-lanceolate, acute, glabrescent; stipules silvery, lanceolate; flowering clusters 1-1.5 cm diam., lateral and terminal; bracts exceeding the flowers, ovate; sepals 2 mm, scarious-margined, glabrous or with straight hairs, with a short mucro at the apex; seeds 1-1.5 mm, orbicular, tuberculate, brown, glossy.

M, GE, S; sandy and rocky ground. Mediterranean region, Sinai.

3. **Paronychia sinaica** Fresen., Mus. Senckenb. 1: 180 (1834).

Syn. *Paronychia flavescens* Boiss., Diagn. Pl. Orient., ser. 1, 10: 4 (1849).

Perennial herb 5-20 cm, with a woody base, pubescent; stems decumbent to ascending, branched at the base; leaves 2-5 x 0.5 mm, lanceolate to linear-oblong, acute; stipules lanceolate; flowering clusters 0.5-1 cm; bracts 3.5-7 mm, broadly ovate to orbicular, shortly acuminate; calyx 2-3 mm, sepals unequal, oblong-linear, pubescent; seeds 1.5-2 mm, punctate, brownish.

De, S; stony deserts. Egypt, Palestine, Northwest Arabia.

4. **Paronychia capitata** (L.) Lam., Fl. Fr. 3: 229 (1779).

Syns. *Illecebrum capitatum* L., Sp. Pl., ed. 1, 207 (1753).

Paronychia nivea DC. in Lam., Encycl. 5: 25 (1804).

Perennial herb 10-25 cm, woody at the base; stems prostrate, branched, mat-forming; leaves 0.4-1 x 0.15-0.25 cm, oblong-lanceolate, sessile, acute, pubescent to glabrous; stipules lanceolate; flowers in apical or subapical clusters; bracts 5-8 x 4-5 mm, ovate-lanceolate, subacute to obtuse, glabrous; sepals 3.5-4.5 x 1-1.5 mm, unequal, awnless, the outer 2 longer, distinctly 3-nerved, margins ciliate; utricle 2 mm, ellipsoid, glabrous; seeds 1.2-1.5 mm, oblong-lenticular.

M; stony ground. South Europe, North Africa, Palestine.

22. **Gymnocarpus** Forssk.

Small shrubs; stems woody, much branched; leaves opposite, sessile or shortly petiolate, terete, fleshy, mucronate; stipules scarious; flowers sessile or short-pedicellate, in axillary or terminal head-like cymes; bracts scarious; sepals 5, scarious-margined, mucronate; petals 0; stamens 5; staminodes 5, filaments filiform with a broad base; ovary 1-celled, with 1 ovule; stigma 3-lobed; fruit a membranous 1-seeded utricle, included in the calyx. 8 species, Macaronesia, North Africa, Palestine, Sinai, Arabia to Baluchistan and Mongolia.

1. **Gymnocarpus decandrus** Forssk., Fl. Aegypt.-Arab. 65 (1775).

Syns. *Trianthea fruticosa* Vahl, Symb. Bot. 1: 32 (1790).

Gymnocarpus fruticosus Pers., Syn. Pl. 1: 262 (1805), nom. Illeg.

Shrub 20-50 cm; stems woody, much branched; leaves 0.5-2 x 0.05-0.15 cm, sessile, linear, terete, mucronate; stipules small, ovate-triangular; flowers in dense axillary and

terminal cymes, sessile; sepals 5.5-6.5 x 1 mm, linear, mucronate, hairy at the base, reddish or green, white-margined; ovary papillose; utricle included in the calyx, rupturing at the base; seeds 2 x 1 mm, ellipsoid, brown.

M, D, S; stony wadis and slopes. Canary Islands, North Africa, Sinai, Palestine, Arabia, Iran, Pakistan.

23. *Sphaerocoma* T. Anderson

Small shrubs, with woody stems; leaves opposite or in fascicles, linear, fleshy; stipules minute; flowers in pedunculate heads; bracts shorter than the flowers, foliaceous; sepals 5, free, unequal, scarious-margined, apex with a deflexed awn; petals shorter than the sepals; stamens 5; style 1, slightly 2-lobed at the apex; fruit 1-seeded, indehiscent. 2 species, Somalia, Northeast Sudan, Southeast Egypt, South Arabia, Iran.

1. *Sphaerocoma hookeri* T. Anderson, J. Proc. Linn. Soc. Bot. 5, Suppl. 1: 16, t. 3 (1860).

Shrub 30-60 cm, glabrous; stems woody, branched, the young growth sometimes sparsely hairy; leaves 0.5-2 x 0.1 cm, linear, opposite, or to 12 in a fascicle; stipules minute, triangular, reddish; flowers in axillary, dense spinescent clusters, 1-1.2 cm diam., on peduncles 1-2.5 cm; sepals 2.5-3 x 1-2.5 mm, ovate to ovate-lanceolate; awns 1-3 mm, recurved, becoming 6 mm in fruit; petals shorter than the sepals, white; fruit subglobose, shorter than the sepals.

Two subspecies occur in Egypt :

subsp. **hookeri**

Plant glabrous; stems not entangled; peduncles thin, to 2.5 cm.

R; sandy soil.

subsp. **intermedia** J. B. Gillett, Kew Bull. 12: 388 (1958).

Plant pubescent, especially young growth; stems entangled; peduncles thick, to 1 cm.

De, R, GE, S; stony and sandy soils.

Area of the species: Egypt, Sudan, Somalia, Yemen, Socotra.

24. *Sclerocephalus* Boiss.

Annual herbs; leaves opposite or in fascicles, succulent; stipules scarious; flowers in compact axillary and terminal clusters; bracts fused with the sepal bases; sepals 5, spine-tipped; petals 0; stamens 5; style 1, 2-3-lobed at the apex; fruit 1-seeded, ovoid, included within the indurate receptacle. 1 species, Macaronesia to Iran.

1. *Sclerocephalus arabicus* Boiss., Diagn. Pl. Orient., ser. 1, 1(3): 12 (1843).

Syn. *Paronychia sclerocephala* Decne., Ann. Sci. Nat. Bot., sér. 2, 3: 262 (1835).

Annual erect or ascending herb to 20 cm, glabrous; stems branched; leaves 1-2.5 cm, linear-terete, sessile, mucronate, succulent; stipules 3-4 mm, triangular-ovate, membranous, acute; flowers in spherical dichasial cymes; bracts 3 mm, acute, membranous; sepals 2.5 mm, linear-lanceolate, membranous-margined, spine-tipped, crispate-hairy at the base; fruit 2.5 mm, hard, spinose, 1-seeded; seeds 2.5 x 1.5 mm, obovoid-reniform, compressed, glabrous.

De, R, GE, S; sandy and stony wadis. Macaronesia to Iran.

25. *Pteranthus* Forssk.

Annual herbs; leaves opposite or in fascicles, fleshy; stipules scarious; flowers clustered on a flattened peduncle, the outer sterile, the inner fertile; some bracts indurate in fruit and becoming broadly spatulate; sepals of fertile flowers with 4 straight, oblong-linear, hooded and spiny-tipped lobes; petals absent; stamens 4; style 1, 2-lobed at the tip; fruit a 1-seeded utricle, indehiscent. 1 species, Cyprus, Sinai, North Africa, Palestine, Arabia to Iran and Pakistan.

1. *Pteranthus dichotomus* Forssk., Fl. Aegypt.-Arab. LXII, 36 (1775).

Syns. *Pteranthus echinatus* Desf., Fl. Atlant. 1: 144 (1798), nom. illeg.

Pteranthus trigynus Caball., Bot. Soc. Esp. Hist, Nat. 13: 88 (1913).

Annual herb 5-25 cm, glabrous at the base, puberulent above, stems dichotomously branched, procumbent to ascending; leaves 0.3-3.5 x 0.1-0.2 cm, linear, fleshy; stipules 2.5 mm, lanceolate; flowers sessile in dichasial corymbose cymes, clustered on a flattened peduncle to 5 mm diam.; bracts minute; calyx 3-4 mm; sepals 4, oblong-linear, scarious-margined, the outer 2 lobes deeply keeled, with wing appendages; utricle and seed 2 mm, oblong-ellipsoid.

M, D, R, S; sandy and stony wadis and plains. North Africa (extending to Southeast Spain), Sinai, Palestine, Arabia, Iraq, Iran, Pakistan.

26. *Cometes* L.

Annual or perennial herbs or small shrubs; leaves opposite; stipules small; flowers in head-like paniculate cymes; each head 3-flowered, the middle bisexual, the 2 lateral rudimentary, accompanied by plumose sterile branchlets (bracts) elongating and indurate at maturity, and enclosing the fruit at dispersal; sepals 5; petals 5; stamens 5, united at the base; ovary 1-locular; style curved, stigmas 3; fruit a 1-seeded utricle, indehiscent. 2 species, Northeast Africa, Palestine, Sinai, Arabia to Northwest India, Sudan, Ethiopia, Somalia.

1. Small shrub; leaves usually 1.5-4 mm diam., linear-lanceolate, rarely ovate; segments of bracts spreading in fruit

1. *C. abyssinica*

+ Annual; leaves more than 5 mm diam., obovate to spatulate; segments of bracts deflexed in fruit

2. *C. surattensis*

1. *Cometes abyssinica* R. Br. in Wall., Pl. Asiat. Rar. 1: 18, t. 18 (1830).

Small hirsute-scabrous shrub, 20-40 cm; stems erect or ascending; leaves 0.5-3 x 1.5-4 (-5) cm, linear-lanceolate, rarely ovate; bracts to 1.5 cm in fruit, the segments needle-

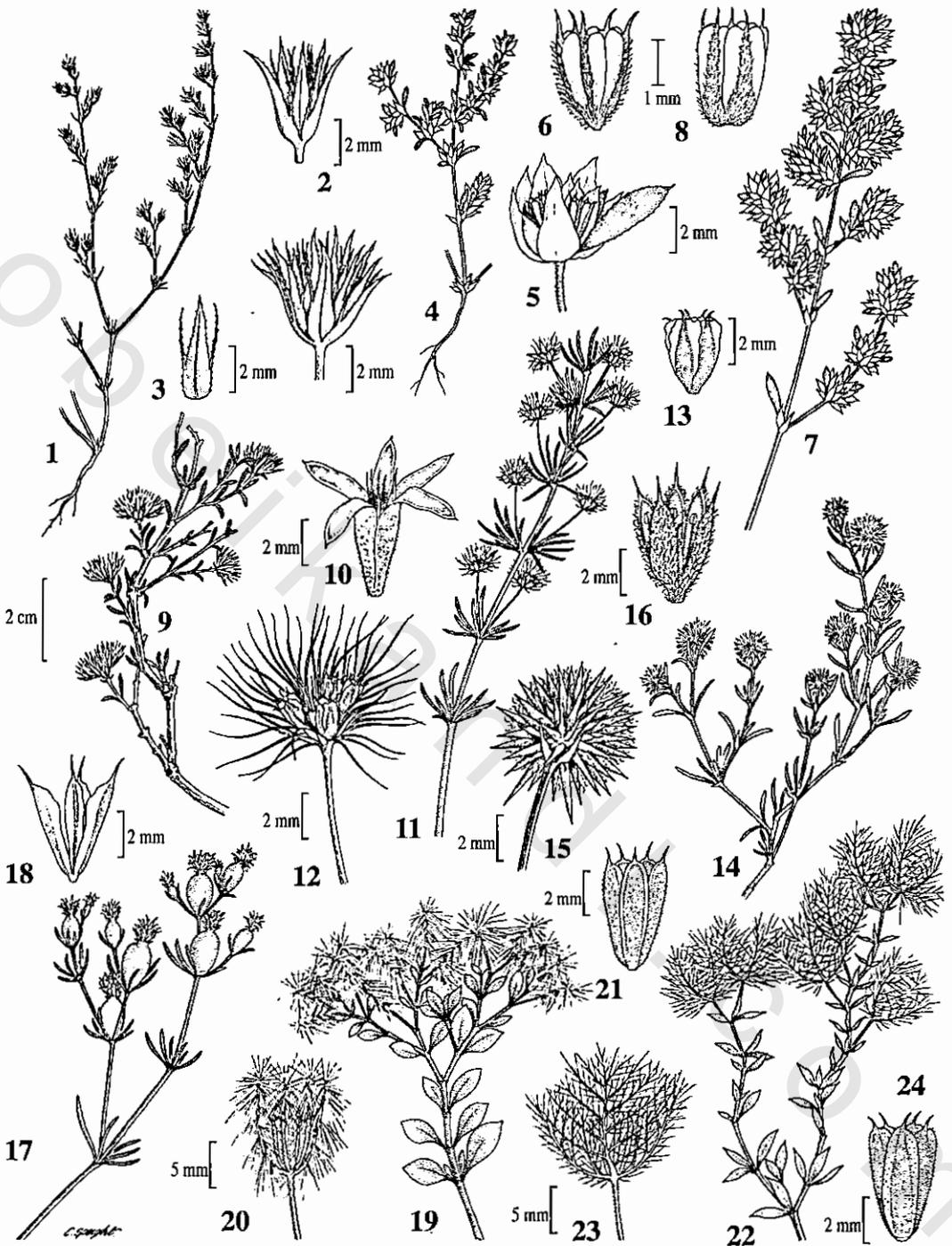


Plate 18. CARYOPHYLLACEAE: *Loeflingia hispanica* 1, habit; 2, clusters of flowers; 3, sepal. *Paronychia arabica* 4, habit; 5, cluster of flowers; 6, flower. *Paronychia argentea* 7, flowering branch; 8, flower. *Gymnocarpus decandrus* 9, flowering branch; 10, flower. *Sphaerocoma hookeri* 11, flowering branch; 12, cluster of flowers; 13, flower. *Sclerocephalus arabicus* 14, flowering branch; 15, cluster of flowers; 16, flower. *Pteranthus dichotomus* 17, flowering and fruiting branch; 18, flower. *Cometes suratensis* 19, flowering branch; 20, flower surrounded by bracts; 21, flower. *Cometes abyssinica* 22, flowering branch; 23, flower surrounded by bracts; 24, flower. All drawings to the same scale except enlarged parts (scale given).

like and spreading; flowers in 3-flowered dichasia; sepals 4-5 mm, oblong, papillose; petals 3 mm, white; fruiting heads 1.2 cm diam. including the bracts.

De, R, GE, S; stony deserts. Egypt, South Palestine, Arabia, Sudan, Ethiopia, Somalia.

2. **Cometes surattensis** L., Mant. 39 (1767).

Annual herb 10-25 cm; stems erect to ascending, much branched, densely pilose above, glabrescent in lower parts; leaves 1-3.5 x 0.5-2 cm, obovate to elliptic or spatulate, sparingly hairy along the midribs and the margins; bracts to 1 cm in fruit, the needle-like segments deflexed; sepals 3-4.5 mm, oblong, papillose; petals 2.5 mm, white; fruit 1-seeded; seeds compressed.

S; stony wadis. Sinai, Arabia, Iraq, Iran, Pakistan.

CHENOPODIACEAE

Herbs or shrubs, rarely small trees (our species) or climbers; stems often jointed and/or succulent; leaves alternate, sometimes opposite, simple, often succulent or reduced and scale-like; stipules absent; flowers small, often green, 1-many, axillary, usually regular, bisexual, sometimes unisexual on dioecious or monoecious plants; floral bracts usually 2; calyx with (1-)5 free segments, sometimes connate at the base or absent; corolla 0; stamens (1-)5, opposite the perianth segments, often inserted on a hypogynous disc which sometimes shows distinct interstaminal lobes (staminodes); ovary superior, of 2-3 (-5) fused carpels, 1-locular, ovule 1, basal; fruit mostly a nutlet, sometimes subtended by the persistent perianth or bracteoles; fruiting perianth often winged; seeds with annular, curved or spiral embryo; perisperm starchy or absent; endosperm usually absent. 103 genera, 1300 species, cosmopolitan, especially arid and saline regions.

- 1. Stems jointed, leafless or with leaves opposite, scale-like and inconspicuous 2
- + Stems not jointed, leafy; leaves usually conspicuous, sometimes scale-like or succulent, usually alternate, rarely opposite 7
- 2. Halophytic succulents; fruiting perianth wingless 3
- + Desert shrubs or small trees, fruiting perianth winged 6
- 3. Flowers in short cone-like spikes; leaves succulent, scale-like, on small bud-like branches 7. **Halocnemum**
- + Flowers in elongated spikes; leaves absent or reduced to short extensions of the joints 4
- 4. Herbaceous annuals 9. **Salicornia**
- + Woody perennials 5
- 5. Flowers immersed; seeds with hard, glabrous testa; endosperm present 8. **Arthrocnemum**
- + Flowers exserted; seeds with membranous, hairy testa; endosperm absent 10. **Sarcocornia**

6. Seeds vertical; perianth with 2 dense fleece-bundles within
+ Seeds horizontal; perianth without fleece-bundles within
7. Branches short, spiny; leaves narrowly linear
+ Branches not spiny, rarely spinescent (*Salsola cyclophylla* & *S. spinescens*); leaves spiny or unarmed
8. Leaves broad, flat
+ Leaves narrow or subglobose, cylindrical or subterete
9. Fruit included in the bracteoles
+ Fruit not included in the bracteoles
10. Plants with mealy crust
+ Plants with grey or reddish-brown stellate hairs
11. Fruits connate at the base in clusters of 2-4; fruiting perianth indurate
+ Fruits separate, 1-seeded utricle with a membranous pericarp; fruiting perianth herbaceous
12. Leaves spine- or bristle-tipped
+ Leaves not spine-tipped
13. Perianth-segments winged in fruit
+ Perianth-segments not winged in fruit
14. Perennial shrubs; leaves tipped with deciduous spines (bristles)
+ Annual herbs; leaves and bracts tipped with sharp persistent spines
15. Leaves succulent, subterete
+ Leaves rigid, not terete
16. Perianth-segments with conspicuous membranous wings in fruit
+ Perianth-segments without conspicuous membranous wings in fruit
17. Leaves and branches all opposite; leaves cylindrical, thickening towards the tip; branches usually white-glossy; fruiting perianth wings unequal; staminodes 5, glandular-ciliate, fused with the bases of the filaments into a ring
+ Leaves alternate, or if opposite not with the above combination of characters
18. Leaves perfoliate, subglobular, giving the stems a jointed appearance
+ Leaves not perfoliate, stems not appearing jointed
19. Perianth-lobes hairy or fleecy, leaves densely villous or hirsute
+ Perianth-lobes glabrous or mealy; leaves glabrous or rarely the juvenile hairy but soon glabrescent, sometimes with tufts of minute hairs in the leaf axils
20. Leaf bases distinctly constricted and soon becoming indurate, the leaves with a tuft of minute hairs at the axils; stamens alternating with small, fleshy staminode-like appendages; perianth-tube usually well-developed
18. **Anabasis**
16. **Haloxylon**
17. **Noaea**
8
- 9
12
- 10
11
3. **Atriplex**
4. **Krascheninnikovia**
1. **Beta**
2. **Chenopodium**
- 13
16
- 14
15
20. **Agathophora**
14. **Salsola kali**
13. **Traganum**
19. **Cornulaca**
- 17
18
15. **Seidlitzia**
14. **Salsola**
6. **Halopeplis**
19
5. **Bassia**
20
12. **Sevada**

- + Leaf bases not indurate; leaves without a tuft of hairs in the axils; staminode-like appendages absent; perianth-tube inconspicuous 11. **Suaeda**

1. **Beta** L.

Annual or perennial herbs; stems striate; leaves alternate, petiolate; flowers in clusters of 2-4 in the leaf-axils, forming a spicate inflorescence; perianth-segments 5, stamens 5; ovary fused to the base of perianth and receptacle, the connate receptacles of adjacent flowers falling as one unit in fruit; stigmas 2-3(-5); fruit fleshy or indurate; seeds horizontal, lenticular or reniform, glossy. 6 species, mostly Mediterranean region.

1. **Beta vulgaris** L., Sp. Pl., ed. 1, 222 (1735) subsp. **maritima** (L.) Arcang., Comp. Fl. Ital. 593 (1882).
 Syns. *Beta maritima* L., Sp. Pl., ed. 2, 322 (1762).
Beta perennis (L.) Halácsy, Consp. Fl. Graec. 3: 41 (1904).

Annual or short-lived perennial herb, 20-80 cm; stems erect or decumbent, branched at the base, green or reddish; leaves 2-10 x 1-5 cm, fleshy, glabrous, the basal in a rosette, ovate-cordate, long-petiolate, the cauline ovate-deltoid or rhombic, petiolate, uppermost bracteate; flowers in clusters of 2-4, in leafy spikes; perianth segments 2-2.5 mm, green, fleshy, indurate in fruit; stamens 5; ovary adherent to the base of the perianth; seeds black, reticulate.

N, O, M, De, S; moist saline soils, edges of cultivation. Atlantic Islands, coasts of West Europe, Mediterranean region, West Asia, Sri Lanka.

2. **Chenopodium** L.

Annual or short-lived perennial herbs (our species) or small shrubs; stems usually striate or angled; leaves alternate, petiolate, lobed, dentate or entire, mealy or glandular and aromatic; inflorescence of small cymose clusters; flowers bisexual or female, sessile, bractless; perianth-segments 5, rarely 2-4, green, free or variously united, persistent, not accrescent in fruit; stamens 5, rarely 1-4; stigmas 2, rarely 3-5, simple, rarely 2-lobed; fruit depressed-globular, with a thin membranous pericarp; seeds lenticular, horizontal, rarely vertical. About 100 species, temperate regions, mostly weeds.

- | | |
|---|---------------------------|
| 1. Plant strongly aromatic, with yellow glands or glandular-hairy, not farinose | 2 |
| + Plant not aromatic (smelling of decaying fish in <i>C. vulvaria</i>), glabrous or white-farinose, eglandular | 3 |
| 2. Plant glandular-hairy, almost leafless at seed maturity; inflorescence of small dichasial cymes in the axils of leaves or bracts | 3. C. botrys |
| + Plant with sessile glands, leafy at seed maturity; inflorescence paniculate, the cymes sessile | 2. C. ambrosioides |
| 3. Leaves entire, not toothed or lobed (a lobe-like basal angle may be present); plant smelling strongly of decaying fish | 1. C. vulvaria |
| + Leaves toothed or lobed; plant not smelling of decaying fish | 4 |
| 4. Plant 2-3 m, the young parts conspicuously tinged with reddish-purple; leaves to 12 x 12 cm, rhombic-deltate | 8. C. giganteum |

- + Plant not as above 5
- 5. Inflorescence leafy almost to top 6
- + Inflorescence leafless in the upper part 7
- 6. Leaves 0.3-1 cm, elliptic to lanceolate, sinuate to serrate, glaucous or white-farinose beneath 9. **C. glaucum**
- + Leaves 1-5 cm, broadly triangular or rhombic, coarsely or irregularly toothed, not glaucous or white-farinose beneath 4. **C. murale**
- 7. Lower and middle leaves as wide as long or slightly longer than wide, rarely exceeding 5 cm in length 5. **C. opulifolium**
- + Lower and middle leaves distinctly longer than wide, up to 10 cm in length 8
- 8. Pericarp persistent; seeds *c.* 1.2 mm diam. 6. **C. ficifolium**
- + Pericarp easily detached; seeds 1.2-1.6 mm diam. 7. **C. album**

1. **Chenopodium vulvaria** L., Sp. Pl., ed. 1, 220 (1753).

Annual herb 10-50 cm, grey-farinose, smelling strongly of decaying fish; stems erect, ascending or procumbent, branched, ridged or angled; leaves 1-2.5 x 0.5-2 cm, rhombic or deltoid-ovate, grey-farinose especially on the lower surface, entire; inflorescence of terminal and axillary leafy cymes; perianth-segments 5, united at the base, densely mealy, acute; stamens 1-5, absent in female flowers; seeds 1-1.25 mm diam., horizontal, black, glossy, slightly keeled.

S; weed of cultivation and waste ground. North Africa, Europe, Asia; introduced into North America and Australia.

2. **Chenopodium ambrosioides** L., Sp. Pl., ed. 1, 219 (1753).

Aromatic annual or short-lived perennial herb, 20-80 cm, green; stems erect, branched, striate; leaves 2-10 x 0.5-3 cm, with yellow glands on the lower surface; lower leaves large, elliptic-lanceolate, sinuate-dentate, the upper small and narrow; inflorescence a much-branched panicle, with elongated spike-like clusters of sessile flowers; perianth of 3-5 segments, connate at the base; stamens 4-5; seeds 0.6-0.9 mm, horizontal or vertical, reddish-brown, glossy.

N, O, M, S; moist ground and canal banks, naturalized. Tropical and subtropical regions; native of America, widely introduced as a vermifuge and naturalized.

3. **Chenopodium botrys** L., Sp. Pl., ed. 1, 219 (1753).

Aromatic annual herb, 10-60 cm, green, glandular-hairy; stems erect, branched, angled, almost leafless at seed-maturity; leaves 1-5 x 0.5-2 cm, ovate to elliptic, with stalked yellow glands especially beneath, pubescent especially along the veins and margins, irregularly pinnate, obtuse; basal leaves long-petiolate, progressively smaller towards the top, the uppermost leaves reduced to small bracts; inflorescence of small dichasial cymes 0.5-3 cm, in the axils of leaves and bracts; perianth-segments 5, free, almost to the base, the apex mucronate; stamens 1-2 or absent; pericarp not persistent; seeds 0.75 mm, mostly horizontal, keeled, blackish, glossy.

N (Cairo), S; weed of cultivation, naturalized. Mediterranean region, West Europe, Asia; introduced into Central Europe and North America.

4. **Chenopodium murale** L., Sp. Pl., ed. 1, 219 (1753).

Annual herb 10-70 cm, dark green, the juvenile growth farinose, otherwise glabrous; stems erect or ascending, branching at the base, angular, striate; leaves 1.5-10 x 1-6 cm, rather fleshy, ovate-rhombic or deltoid, sometimes elliptic-lanceolate, coarsely dentate but not lobed; basal leaves long-petiolate, becoming progressively short-petiolate towards the top; inflorescence of terminal and axillary leafy cymes; perianth segments 5, connate to $\frac{1}{3}$ of their length, papillose, keeled near the tip, the margins narrowly scarious; stamens 5; pericarp firmly adherent to the seed; seeds 1.2-1.5 mm, horizontal, strongly keeled, black, glossy.

N, O, M, D, R, GE, S; weed of cultivation and waste ground, sandy deserts. Cosmopolitan.

5. **Chenopodium opulifolium** Schrad. ex Koch & Ziz, Cat. Pl. Palat. 6 (1814).

Annual or short-lived herbaceous perennial with woody base, 0.2-1.5 m, whitish-green, mealy; stems much branched, striate; leaves 2-5 x 1.5-4 cm, the lower and middle leaves ovate-rhombic to 3-lobed, densely mealy on the lower surface; upper leaves smaller, almost entire; inflorescence terminal and lateral, of dense or lax paniculate cymes, densely grey-mealy; perianth-segments 5, connate at the base, papillose on the outer surface and margins; stamens 5; pericarp somewhat persistent; seeds 1.2-1.5 mm, horizontal, black, glossy.

N, S; weed of cultivation and waste ground. Europe, Mediterranean region, Africa, Asia; introduced into North America.

6. **Chenopodium ficifolium** Sm., Fl. Brit. 1: 276 (1800).

Annual herb 25-80 cm, whitish-green, mealy; stems erect or ascending, branched, angled, striate; leaves 2-10 x 0.5-3 cm, distinctly longer than wide, mealy beneath, some 3-lobed with lateral lobes triangular and shorter than the median, the apex obtuse, the margins coarsely toothed; inflorescence of terminal and lateral paniculate cymes, mealy, dense at first, becoming lax in fruit; perianth-segments 5, connate for $\frac{1}{2}$ of their length, densely farinose, keeled towards the tip, the margins membranous; stamens usually 5; pericarp firmly adherent to the seed; seeds 1.2 mm, horizontal, keeled, black, glossy.

N, De; weed of cultivation and waste ground. Egypt, Europe, Asia.

7. **Chenopodium album** L., Sp. Pl., ed. 1, 218 (1753).

Annual herb 0.15-1.2 m, grey-farinose; stems erect or ascending, much branched, green or tinged with red, ridged or angled, striate; leaves 1-8 x 1-5 cm, rhombic-ovate to narrowly lanceolate, typically longer than broad, the margins dentate-sinuate to entire; inflorescences almost leafless, terminal and axillary, mealy; flowers few in compact paniculate cymes; perianth-segments 5, free almost to the base, papillose, strongly keeled, the margins membranous; stamens 5; pericarp free, easily detached; seeds 1.2-1.6

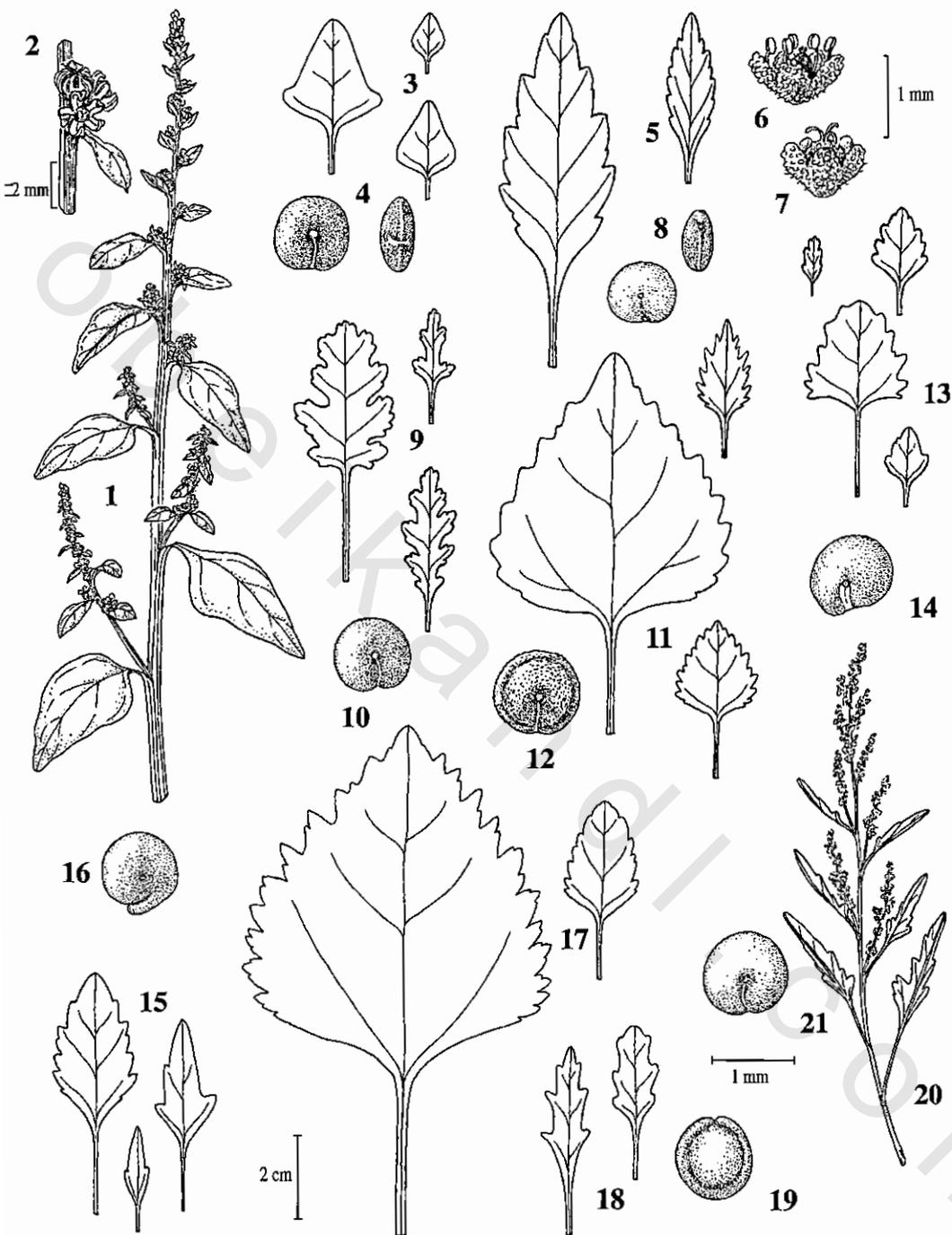


Plate 19. CHENOPODIACEAE: *Beta vulgaris* subsp. *maritima* 1, flowering branch; 2, fruiting branch. *Chenopodium vulvaria* 3, leaf variation; 4, seed. *Chenopodium ambrosioides* 5, leaf variation; 6, male flower; 7, female flower; 8, seed. *Chenopodium botrys* 9, leaf variation; 10, seed. *Chenopodium murale* 11, leaf variation; 12, seed. *Chenopodium opulifolium* 13, leaf variation; 14, seed. *Chenopodium album* 15, leaf variation; 16, seed. *Chenopodium giganteum* 17, leaf variation; *Chenopodium glaucum* 18, leaf variation; 19, seed. *Chenopodium ficifolium* 20, flowering and fruiting branch; 21, seed. All drawings to the same scale except enlarged parts (scale given), all seeds (scale 1mm).

mm, horizontal, slightly keeled, black, glossy.

N, O, M, D, S; weed of cultivation, waste ground. Cosmopolitan.

8. **Chenopodium giganteum** D. Don, Prodr. Fl. Nepal. 75 (1825).

Syns. *Chenopodium amaranticolor* (Coste & Reyn.) Coste & Reyn., Bull. Soc.

Bot. France 54: 181 (1907).

Chenopodium moquintianum, sensu Täckh., Stud. Fl. Egypt, ed. 2, 107 (1974).

Annual herb, like *C. album* but 2-3 m, the young parts conspicuously tinged reddish-purple and leaves to 12 x 12 cm, rhombic-deltate.

N, M; waste ground near cultivation. North India; naturalized in South France, Crete, Libya and other warm temperate regions.

9. **Chenopodium glaucum** L., Sp. Pl., ed. 1, 220 (1753).

Annual herb 10-40 cm, glaucous, glabrous except on the lower surface of leaves; stems erect, ascending or procumbent, branched at the base, angular, striate; leaves 1-5 x 0.3-1 cm, elliptic, lanceolate or ovate, green and glabrous on the upper surface, glaucous and farinose on the lower, the margins sinuate-serrate; basal and median leaves petiolate, the uppermost almost sessile; inflorescence of terminal and axillary spike-like cymes; perianth-segments 2-4, connate at the base, the margins broadly membranous; stamens 2-3; pericarp thin, loose; seeds 0.8-1 mm, vertical, occasionally horizontal in lateral flowers, reddish-brown, glossy.

N, M; moist waste ground, edges of cultivation. Europe, Mediterranean region, Asia.

3. **Atriplex** L.

Annuals, herbaceous perennials or shrubs, with mealy crust; leaves mostly alternate; flowers unisexual, on monoecious or dioecious plants, in terminal or axillary clusters, spikes or panicles; male flowers with 5 deeply lobed segments and without bracteoles, stamens 5; female flowers without a perianth but with 2 bracteoles which enlarge and enclose the fruit; pericarp membranous; seeds vertical, the embryo annular, endosperm absent. About 300 species, temperate and warm regions.

- | | |
|--|-------------------------------|
| 1. Woody shrubs | 2 |
| + Annuals or short-lived perennials | 9 |
| 2. All leaves opposite | |
| + All leaves alternate, sometimes a few opposite at the base | 18. A. portulacoides 3 |
| 3. Leaves narrow, linear or linear-lanceolate | 4 |
| + Leaves broad, not linear | 5 |
| 4. Fruiting bracteoles pubescent, rounded, with a deep sinus at the apex and sharply sinuate-dentate margins | 16. A. canescens |
| + Fruiting bracteoles glabrous, longer than wide, with a tooth on each side | 11. A. glauca |

5. At least some leaves auriculate at the base 15. **A. farinosa**
+ Leaves not auriculate 6
6. Flowers in axillary and terminal leafy inflorescences 12. **A. leucoclada**
+ Flowers in terminal almost leafless inflorescences 7
7. Fruiting bracteoles quadrangular, 3-dentate at apex, tuberculate 14. **A. coriacea**
+ Fruiting bracteoles suborbicular, orbicular-cordate, not tuberculate 8
8. Leaves suborbicular, finely and sharply dentate 17. **A. nummularia**
+ Leaves ovate-triangular or ovate-rhombic, tapering at both ends, entire or sharply-lobed 13. **A. halimus**
9. Flowers in small axillary clusters 10
+ Flowers in axillary and terminal spicate or paniculate inflorescences 14
10. Leaves to 3.5 cm broad, ovate to ovate-deltoid 11
+ Leaves to 1.5 cm broad, oblong, oblong-lanceolate or rhombic 12
11. Annual; stems delicate, prostrate or ascending, to 30 cm; leaves entire 3. **A. dimorphostegia**
+ Annual or short-lived perennial; stems decumbent or erect, to 1 m, forming a bushy growth to 60 cm; leaves coarsely and irregularly sinuate-dentate or lobed 6. **A. suberecta**
12. Fruiting bracteoles conspicuously nerved, not spongy 9. **A. semibaccata**
+ Fruiting bracteoles not nerved, spongy 13
13. Fruiting bracteoles 8 mm, subglobose; leaves 1-2 cm, elliptic to narrowly elliptic 1. **A. lindleyi** subsp. **inflata**
+ Fruiting bracteoles 0.8-1.2 cm, sessile, fused, globose to obovoid; leaves 1.5-3 cm, deltoid to narrowly rhomboid 2. **A. holocarpa**
14. Bracteoles becoming hard in fruit; stems smooth; leaves whitish-grey-mealy 15
+ Bracteoles not becoming hard in fruit; stems strongly ridged; leaves green or thinly mealy 16
15. Cymes in terminal leafless spikes or panicles 4. **A. tatarica**
+ Cymes axillary or in leafy panicles 5. **A. rosea**
16. Leaves narrowly linear 8. **A. littoralis**
+ Leaves ovate-oblong or hastate 17
17. All leaves hastate with distinct basal lobes; inflorescence usually leafy 7. **A. prostrata**
+ Leaves ovate-oblong, upper without distinct basal lobes; inflorescence usually leafless 10. **A. patula**

1. **Atriplex lindleyi** Moq. subsp. **inflata** (F. Muell.) P. G. Wilson, Fl. Australia 4: 323 (1984).
Syns. *Atriplex inflata* F. Muell., Trans. & Proc. Philos. Inst. Victoria 2: 75

(1858).

Blackiella inflata (F. Muell.) Aellen, Bot. Jahrb. Syst. 68: 426 (1938).

Annual herb 15-30 cm, monoecious; leaves 1-2 x 0.5-1.2 cm, elliptic to narrowly elliptic, remotely sinuate-dentate; flowers in axillary small clusters; fruiting bracteoles 8 x 8 mm, subglobose, the base rounded to obtuse, the upper surface flat but curved laterally with the margins sometimes slightly inflated into a narrow wing; free apex of bracteoles 1 mm, narrowly-triangular.

N, M, D, S; sandy soils, waste ground; introduced from Australia, naturalized.

2. ***Atriplex holocarpa*** F. Muell., Rep. Pl. Babbage's Exp. 19 (1859).

Syns. *Senniella spongiosa* (F. Muell.) Aellen var. *holocarpa* (F. Muell.) Aellen, Bot. Jahrb. Syst. 68: 418 (1938).

Atriplex spongiosa F. Muell. var. *holocarpa* (F. Muell.) J. Black, Fl. S. Australia, ed. 2, 300 (1948).

Annual or short-lived perennial herb, 10-30 cm, monoecious; leaves 1.5-3 x 0.5-1.2 cm, scurfy on both surfaces, deltoid to rhombic, acute, the margins sinuate to serrate; flowers in axillary clusters; fruiting bracteoles 0.8-1.2 cm, sessile, fused, globular to obovoid, shortly apiculate, inflated, scurfy to glabrous; seeds broadly elliptic.

M; roadsides and waste ground; introduced from Australia, naturalized.

3. ***Atriplex dimorphostegia*** Kar. & Kir., Bull. Soc. Imp. Nat. Moscou 15: 438 (1842).

Annual herb 10-30 cm, monoecious; stems delicate, prostrate or ascending, branched from the base, glabrous, whitish; leaves 1.5-5 x 1-4 cm, broadly ovate to deltoid, entire, green and almost glabrous on the upper surface, greyish-green and scurfy-mealy on the lower; flowers in axillary clusters; fruiting bracteoles of upper flowers triangular-ovate, those of the lower orbicular-cordate.

D, S; sandy plains, slightly saline soils. North Africa, Sinai, Palestine, Arabia to Afghanistan and Pakistan.

4. ***Atriplex tatarica*** L., Sp. Pl., ed. 1, 1053 (1753).

Annual herb 15-60 cm, monoecious; stems erect or ascending, branched; leaves 2-6 x 1-3.5 cm, alternate above, opposite at the base, petiolate, broadly or narrowly triangular to lanceolate-hastate, sinuate-dentate or lobed; flowers in clusters forming leafless spikes or panicles, sometimes with female flowers solitary in the leaf axils; fruiting bracteoles 5-7 x 2-4.5 mm, suborbicular to oblong-rhombic, dentate or entire, often with appendages on the dorsal side.

N, O, S; edges of cultivation, waste ground. Mediterranean region, Southwest and Central Asia.

5. ***Atriplex rosea*** L., Sp. Pl., ed. 2, 1493 (1763).

Annual herb 20-60 cm, monoecious, stems erect or ascending, branched, mealy; leaves 3-6 x 1-3 cm, deltoid to ovate-rhombic, sinuate or dentate; upper leaves ovate-oblong;

flowers in axillary or leafy panicles, the upper of mixed female and male flowers, the lower female only; fruiting bracteoles 0.4-1.1 cm, leathery, triangular or rhombic, irregularly toothed to lobed, reticulately veined, tuberculate on the back; seeds 1.8-3 mm, lenticular, brown, smooth, glossy.

N, O, S; edges of cultivation, waste ground. South and Central Europe, Mediterranean region, Sinai, Arabia to Central Asia.

6. *Atriplex suberecta* Verd., Bothalia 6: 418 (1954).

Annual or short-lived perennial, monoecious; stems decumbent or erect, to 1 m, forming bushy growth to 60 cm; leaves 1-5 x 0.5-3.5 cm, ovate or rhomboid, cuneate into a short petiole, coarsely and irregularly sinuate-dentate or lobed; flowers in axillary clusters; fruiting bracteoles 2-5 mm, shortly stipitate, rhomboid, acute, connate in the lower half, scurfy-pubescent, margins entire in the lower half, 2- to 4-toothed in the upper; seeds rounded.

S; stony wadis. Introduced from South Africa, South Australia.

7. *Atriplex prostrata* Boucher ex DC. in Lam. & DC., Fl. Fr., ed. 3, 3: 387 (1815).

Syns. *Atriplex triangularis* Willd., Sp. Pl., ed. 4, 4: 963 (1806).

Atriplex hastata, sensu Täckh., Stud. Fl. Egypt, ed. 2, 111 (1974).

Annual herb 20-80 cm, monoecious; stems erect or decumbent, branched; leaves 1.5-6.5 x 0.5-4.5 cm, broadly or narrowly deltoid, acute, with distinctly hastate-lobed base, margins entire or irregularly dentate, petiolate; flowers in paniculate leafy inflorescences; fruiting bracteoles 2-4 x 2-3.5 mm, deltoid to elliptical-deltoid, often mealy, roughly tuberculate, connate along basal margins; seeds 1.5-2 mm, dimorphic, the smaller 1.5 mm, lenticular, with blackish striate testa, the larger 2 mm, with distinct submarginal rim, reddish-brown.

N, M, S; sandy soils, edges of cultivation. Europe, Mediterranean region, Sinai to Central Asia.

8. *Atriplex littoralis* L., Sp. Pl., ed. 1, 1054 (1753).

Syn. *Atriplex serrata* Huds., Fl. Angl., ed. 1, 377 (1762).

Annual herb 30-80 cm, monoecious; stems erect, branched, strongly ridged; leaves 4-10 x 0.2-0.5 cm, narrowly-linear, entire to toothed; flowers in long spicate inflorescences, leafy only at the base; fruiting bracteoles 3 x 3-3.5 mm, rhombic-ovate, dentate or entire, mucronate on the back; seeds 1.5 mm, lenticular, black.

M, S; coastal sands. Europe, North Africa, West and Central Asia.

9. *Atriplex semibaccata* R. Br., Prodr. 406 (1810).

Annual herb 40-80 cm; stems procumbent or ascending, much branched; leaves 2-4 x 0.5-1 cm, oblong-lanceolate, entire or sinuate-toothed; flowers in small axillary clusters; fruiting bracteoles 2-4.5 x 2-3.5 mm, deltoid or rhombic, connate in the lower half, conspicuously nerved, entire or toothed; seeds 1-2 mm, brown.

N, M, Dw; waste ground; introduced from Australia, naturalized.

10. **Atriplex patula** L., Sp. Pl., ed. 1, 1053 (1753).

Annual herb 50-80 cm, mealy, monoecious; stems erect or ascending, strongly ridged, much branched; lower leaves 3-12 x 1-6 cm, rhombic-hastate; upper linear-lanceolate, the smaller, without distinct basal lobes; flowers in spicate or paniculate, lax, leafless inflorescences; fruiting bracteoles 4-6 mm, broadly rhombic, entire or toothed, smooth or tuberculate on the dorsal side; seeds 2 mm, smooth, brown, glossy.

N, M, S; saline soils, waste ground. North Africa, Europe, Asia.

11. **Atriplex glauca** L., Cent. Pl. 1: 34 (1755).

Syns. *Atriplex alexandrina* Boiss., Fl. Orient. 4: 914 (1879).

Atriplex crystallina Boiss., Fl. Orient. 4: 915 (1879).

Atriplex palaestina Boiss., Diagn. Pl. Orient., ser. 1, 2, (12): 96 (1853).

Atriplex stylosa Viv., Pl. Aegypt. 23 (1830).

Shrub to 50 cm, monoecious, grey-green to whitish; stems many, erect or ascending; first green becoming silver- to white-hairy; leaves 1-2(-3) x 0.5 cm, oblong-lanceolate, entire or dentate, slightly fleshy, silvery, sometimes grey-green on the upper surface; flowers in long spicate inflorescences; fruiting bracteoles 4-5 mm, ovate-rhombic to ovate-deltoid, entire, dentate or 3-lobed, with appendages on the dorsal side; seeds 2-3 mm, lenticular, brownish-black.

M, De, S; sandy soils. Spain, Portugal, North Africa, Sinai.

12. **Atriplex leucoclada** Boiss., Diagn. Pl. Orient., ser. 1, 2 (12): 95 (1853).

Shrub 30-80 cm, monoecious; stems decumbent to erect, branched mainly from the base; leaves 0.5-2.5 x 0.2-2 cm, petiolate to sessile, triangular-deltoid to broadly ovate-cordate, entire, undulate or sinuate-dentate, the base hastate to almost rounded; flowers in axillary and terminal spicate and paniculate inflorescences, the axillary pistillate, the terminal staminate and pistillate; fruiting bracteoles 3-5 x 2-5 mm, deltoid, quadrangular or campanulate, lobed or toothed, connate only at the base; seeds 2 mm, dark brown.

Two varieties occur in Egypt:

var. **inamoena** (Aellen) Zohary, Fl. Palaest. 1: 147 (1966).

Syn. *Atriplex inamoena* Aellen, Bot. Jahrb. Syst. 70: 20 (1939).

Leaves to 1.5 cm, ovate-cordate, sessile or subsessile, entire or undulate; fruiting bracteoles triangular-deltoid with 5 apical lobes.

O, M, De, S; stony and sandy ground. Egypt, Palestine, Arabia, Iran to Afghanistan.

var. **turcomanica** (Moq.) Zohary, Fl. Palaest. 1: 147 (1966).

Syns. *Atriplex laciniata* L. var. *turcomanica* Moq. in DC., Prodr. 13(2): 93 (1849).

Atriplex leucoclada Boiss. subsp. *turcomanica* (Moq.) Aellen, Bot. Jahrb. Syst. 70: 22 (1939).

Leaves to 3.5 cm, triangular-deltoid, petiolate, sinuate-dentate; fruiting bracteoles quadrangular to campanulate.

S; stony and sandy deserts. Sinai, Palestine, Arabia, eastwards to Afghanistan.

13. **Atriplex halimus** L., Sp. Pl., ed. 1, 1052 (1753).

Shrub 0.5-1.2 m, monoecious; stems woody at the base, much branched, whitish; leaves 1.5-4.5 x 0.5-3.5 cm, sessile or short-petiolate, ovate-rhombic or ovate-triangular, tapered at both ends, entire or sharply lobed, silvery-white; flowers in dense, almost leafless, spicate, terminal panicles; fruiting bracteoles 2.5-4 x 2.5-4.5 mm, reniform to broadly triangular-ovate, connate at the base, the free upper part slightly dentate; seeds 1-2 mm, lenticular, dark brown.

M, D, S; wadis, sandy soils, edges of saline depressions. Mediterranean region, Sinai, Arabia, East Africa.

14. **Atriplex coriacea** Forssk., Fl. Aegypt.-Arab. 175 (1775).

Syns. *Atriplex ocymifolium* Viv., Pl. Aegypt. Dec. 23 (1831).

Obione coriacea (Forssk.) Moq., Chenop. Monogr. Enum. 71 (1840).

Shrub 0.5-1.2 m, monoecious, yellowish-white tomentose; leaves 0.5-3 x 0.4-1.2 cm, ovate-elliptic, thick, coriaceous, entire, the apex acute or obtuse, the midrib prominent on the lower surface; flowers in terminal leafless panicles; fruiting bracteoles 4 x 4 mm, quadrangular, with 2-3 appendages on each side; seeds 1.5 mm, brownish.

M, S; coastal plains. North Africa, Sinai, Arabia.

15. **Atriplex farinosa** Forssk., Fl. Aegypt.-Arab. CXXIII (1775).

Shrub 0.5-1.2 m, densely mealy all over, whitish-grey; leaves 1.5-4 x 1-2 cm, ovate-elliptic, petiolate, entire, obtuse at the apex, cordate or auriculate at the base; flowers in terminal leafless panicles; fruiting bracteoles 4-7 x 3-6 mm, obconical to broadly-elliptic, entire, connate at the base.

R, S; coastal sandy soils. Arabia, Sinai, tropical Northeast Africa.

16. **Atriplex canescens** (Pursh) Nutt., Gen. N. Amer. Pl. 1: 197 (1818).

Syn. *Calligonum canescens* Pursh, Fl. Amer. Sept. 2: 370 (1814).

Shrub 0.5-1.5 m, monoecious; stems many, erect, branched, yellowish; leaves 0.8-5 cm, linear to oblanceolate, densely white-scaly; flowers in terminal paniculate inflorescences; fruiting bracteoles 0.5-2.5 cm, ovoid to spherical, hard, fused to near the apex; wings 4, 3-6 mm, wavy to deeply and sharply dentate; seeds 1.5-2.5 mm.

M, D; sandy soils; naturalized. Native of Northwest America.

17. **Atriplex nummularia** Lindl. in T. L. Mitchell, J. Exped. Trop. Australia 64 (1848.)

Shrub 1.5-2.5 m, dioecious; stems erect, many; leaves 3-4.5 x 3-4.5 cm, suborbicular to broadly elliptic, thick, finely and sharply dentate; petiole 0.5-1 cm; male flowers in

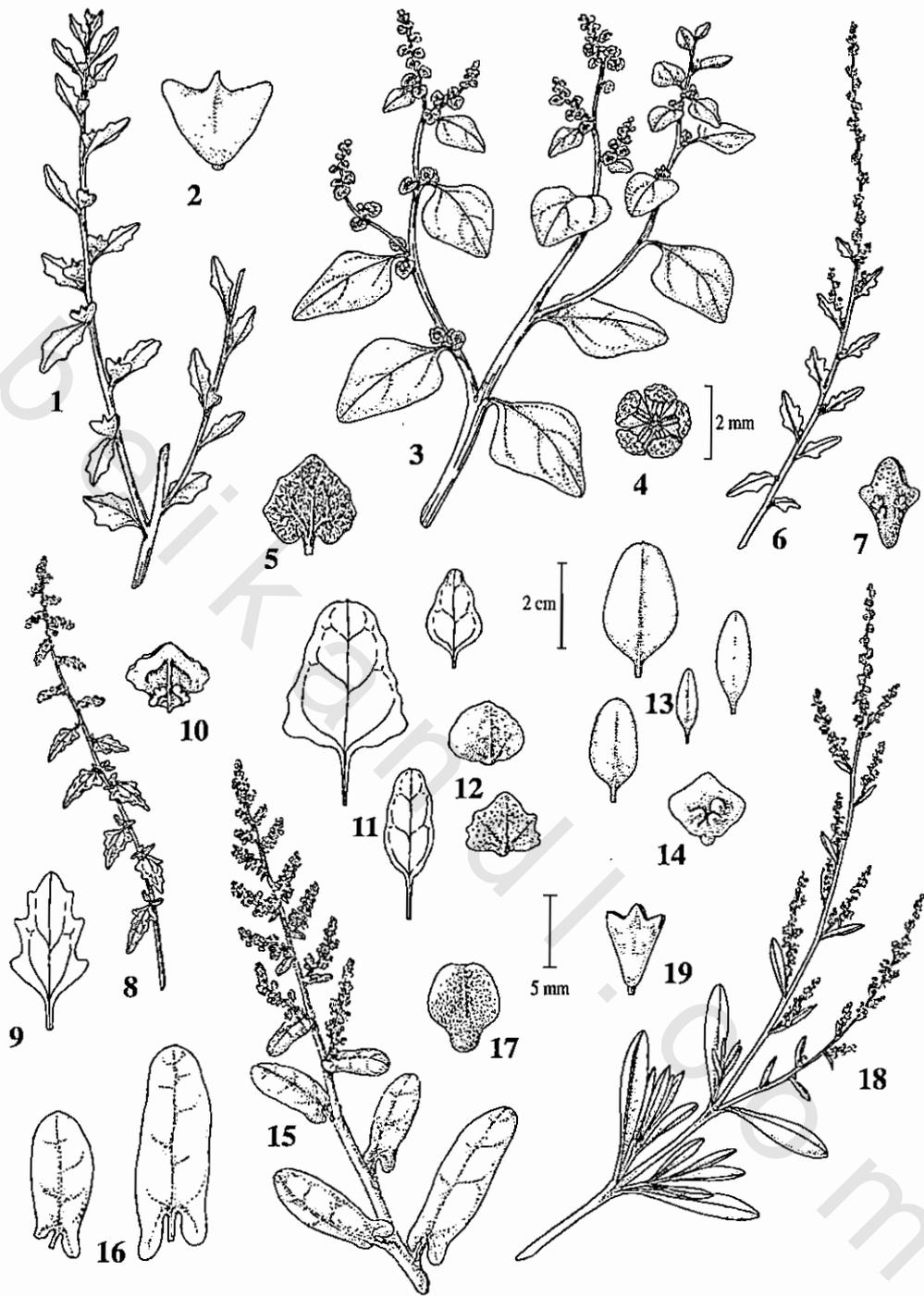


Plate 20. CHENOPODIACEAE: *Atriplex lindleyi* subsp. *inflata* 1, fruiting branch; 2, fruiting bracteole. *Atriplex dimorphostegia* 3, flowering and fruiting branch; 4, male flower; 5, fruiting bracteole. *Atriplex glauca* 6, flowering branch; 7, fruiting bracteole. *Atriplex leucoclada* var. *turcomanica* 8, flowering branch; 9, leaf; 10, fruiting bracteole. *Atriplex halimus* 11, leaf variation; 12, fruiting bracteoles. *Atriplex coriacea* 13, leaf variation; 14, fruiting bracteole. *Atriplex farinosa* 15, flowering branch; 16, leaf variation; 17, fruiting bracteole. *Atriplex portulacoides* 18, flowering branch; 19, fruiting bracteole. All drawings to the same scale except enlarged parts (scale given), all fruiting bracteoles (scale 5 mm).

disjunct clusters, 5-6 mm diam., in panicles; female flowers in compact clusters in panicles of 20 cm; fruiting bracteoles 0.5-1.5 x 0.5-1.2 cm, papery, sessile; valves free, orbicular to rhomboid, entire or denticulate, rounded at the apex, cuneate to cordate at the hardened base.

N, O, M, Dw; alluvial and sandy soils; naturalized. Native of Australia.

18. **Atriplex portulacoides** L., Sp. Pl., ed. 1, 1053 (1753).

Syns. *Obione portulacoides* (L.) Moq., Chenop. Monogr. Enum. 75 (1840).

Halimione portulacoides (L.) Aellen, Verh. Naturf. Ges. Basel 49: 126 (1938).

Shrub 40-80 cm, monoecious, glabrescent; stems procumbent, branches ascending, striate; leaves 1-5 x 0.3-1.2 cm, opposite, rather fleshy, greyish, short-petiolate, oblong-elliptic to linear-lanceolate, cuneate at the base, acute to obtuse or apiculate at the apex; flowers in clusters, forming terminal and axillary spikes, in paniculate inflorescences; fruiting bracteoles 3-4 x 2-2.5 mm, obdeltate, 3-lobed, connate almost to the apex; seeds 1.5 mm.

M, S; sandy and stony ground. Europe, Mediterranean region, West Asia, South Africa, North America.

4. **Krascheninnikovia** Gueldenst.

Monoecious perennial herbs or shrubs with dense stellate hairs; leaves flat, alternate, lanceolate to elliptic-ovate; flowers in clusters; male flowers with 4 hairy membranous perianth-segments; stamens 4; female flowers without a perianth but with 2 stellate-hairy persistent bracteoles united to above the middle; style short; stigmas 2, filiform; fruit silky-hairy, enclosed in the persistent enlarged bracteoles; seeds vertical, the pericarp membranous; embryo green, thick, horseshoe-shaped. 8 species, Mediterranean region, Asia, western North America.

1. **Krascheninnikovia ceratoides** Gueldenst., Novi Comment. Acad. Sci. Petrop. 16: 555 (1772).

Syns. *Axyris ceratoides* L., Sp. Pl., ed. 1, 979 (1753).

Eurotia ceratoides (L.) C. A. Mey. in Ledeb., Fl. Alt. 4: 239 (1833).

Ceratoides papposa Botsch. & Ikonn., Novosti Sist. Vyss. Rast. 6: 267 (1970).

Ceratoides latens (J. F. Gmel.) Reveal & N. H. Holmgren, Taxon 21: 209 (1972).

Shrub 30-80 cm, monoecious, with grey or reddish-brown hairs; leaves 1-4 cm, linear-oblong or lanceolate, attenuate into a short petiole, the margins revolute; flowers densely tomentose; fruiting bracteoles 3 mm, obovate, pubescent.

De (Northern Galala), S (Gebel Igma); stony ground. Egypt, eastern Europe, Asia.

5. **Bassia** All.

Syns. *Chenolea* Thunb.; *Kochia* Roth; *Londesia* Fisch. & Mey.;

Chenoleoides (Ulbr.) Botsch.

Annual or perennial herbs, sometimes with woody base; leaves alternate, subsessile,

linear, entire, hairy; flowers unisexual or bisexual, in the axils of leaf-like bracts, in leafy spikes or panicles; perianth membranous, of 5 segments connate above the middle; stamens (3-)5; style short; stigmas 2-3, exerted; fruiting perianth with horizontal wings, spines or lobes, or without appendages; fruit compressed, with a membranous pericarp; seeds horizontal or vertical; embryo annular; endosperm mealy or absent. 25 species, warm regions.

1. Fruiting perianth with 5 stellate spines 2. **B. muricata**
 + Fruiting perianth not spiny 2

2. Dwarf shrubs, to 30 cm; the stems woody at the base 1. **B. arabica**
 + Annual herbs to 1.8 m; the stems herbaceous 3

3. Flowers hidden in dense white fluffy hairs 3. **B. eriophora**
 + Flowers exposed 4. **B. indica**

1. **Bassia arabica** (Boiss.) Maire & Weiller in Maire, Fl. Afr. Nord 8: 54 (1962).
 Syns. *Chenolea arabica* Boiss., Diagn. Pl. Orient., ser. 1, 2(12): 97 (1853).
Chenoleoides arabica (Boiss.) Botsch., Bot. Zhurn. (Moscou & Leningrad) 61: 1409 (1976).

Dwarf shrub 15-30 cm; stems woody at the base, prostrate or decumbent, woolly-canescens; leaves 0.4-1.2 x 0.1-0.2 cm, linear-oblong, sessile, obtuse; flowers bisexual, in axillary clusters, forming dense leafy spikes; perianth 3 mm, densely woolly; segments 5, hemispherical, obtuse; seeds horizontal, endosperm small or absent.

O (Wadi Natrun), M, D, S; stony ground, desert wadis. North Africa, Southwest Asia.

2. **Bassia muricata** (L.) Asch. in Schweinf., Beitr. Fl. Aethiop. 187 (1867).
 Syns. *Salsola muricata* L., Mant. 54 (1767).
Kochia muricata (L.) Schrad., Neues. J. Bot. 3, 3, 4: 86 (1809).

Annual herb 20-50 cm, densely villous; stems erect or decumbent, branched from the base; leaves 0.2-1.5(-2) x 0.1-0.2 cm, linear-lanceolate; male and female flowers mixed in axillary clusters forming leafy spikes; fruiting perianth-segments connate at the indurate base to form a yellowish 5-armed stellate structure; arms 2-3.5 mm, needle-like; seeds 1 mm, discoid, smooth, greyish.

O, M, D, S; sandy and stony ground, roadsides and waste land. North Africa, East Mediterranean region, Sinai, Arabia to Iran.

3. **Bassia eriophora** (Schrad.) Asch. in Schweinf., Beitr. Fl. Aethiop. 187 (1867).
 Syns. *Kochia eriophora* Schrad., Neues. J. Bot. 3, 3, 4: 86, t. 3 (1809).
Kochia latifolia Fresen., Mus. Senckenb. 1: 179 (1834).
Bassia latifolia (Fresen.) Asch. in Schweinf., Beitr. Fl. Aethiop. 187 (1867).

Annual herb 15-60 cm, all parts villous; stems erect or ascending, much branched from the base; leaves 0.5-2 x 0.2-0.4 cm, oblong-linear, elliptic or lanceolate, green, thinly hairy, fleshy; flowers hidden in dense fluffy hairs, forming dense leafy spikes; fruiting perianth curved at the tip, the lobes with short appendages; seeds 1 mm, discoid, brown.

De, S; sandy soil, desert wadis. Southeast Mediterranean region, Southwest Asia to Pakistan.

4. **Bassia indica** (Wight) A. J. Scott, Feddes Repert. 89: 108 (1978).

Syns. *Kochia indica* Wight, Icon. Pl. Ind. Orient., t. 1791 (1852).

Bassia joppensis Bornm. & Dinsm., Repert. Spec. Reg. Veg. 17: 274 (1921).

Kochia scoparia (L.) Schrad. subsp. *indica* (Wight) Aellen, Mitt. Basler Bot. Ges. 2: 15 (1954).

Annual herb 0.5-1.8 m, pilose-pubescent; stems erect, richly branched, the branches spreading or ascending; leaves 0.5-2.5 x 0.2-0.6 cm, oblong-elliptic to linear-lanceolate, softly hairy especially on the lower surface; upper leaves small, densely white-hairy; flowers in small clusters forming leafy spike; stamens 5, exerted, anthers yellow; perianth segments 5, white-hairy, connate for most of their length, with 1 mm spreading wings in fruit.

N, O, M, D, S; waste ground, roadsides; naturalized. North and East Africa, Southwest Asia to India.

6. **Halopeplis** Bunge ex Ung.-Sternb.

Annual herbs or low shrubs; stems not jointed but appearing so because of the perfoliate leaves; leaves alternate, perfoliate, succulent; flowers bisexual or female, in small clusters of 3, often connate and adnate to the subtending bract, in spikes; perianth segments 3, not winged; stamens 1-2; ovary pear-shaped; stigmas 2; fruit included, pericarp membranous; seeds ellipsoid, the embryo hook-shaped. 3 species, warm temperate regions of the Old World.

1. Annual herb
+ Woody shrublet

1. **H. amplexicaulis**
2. **H. perfoliata**

1. **Halopeplis amplexicaulis** (Vahl) Ung.-Sternb. ex Ces. in Ces., Pass. & Gibelli, Comp. Fl. Ital. 271 (1874).
Syn. *Salicornia amplexicaulis* Vahl, Symb. Bot. 2: 1 (1791).

Annual herb 10-25 cm, glabrous, glaucous; stems thin, branched from the base, procumbent to ascending, not jointed; leaves 2.5-3.5 mm, alternate, clasping, subglobose, obtuse; flowers in lateral and terminal 3-flowered clusters, forming dense cylindrical spikes 0.5-2 x 0.25-0.4 cm; bracts 1.5 mm, fleshy, ovate-orbicular, acute; perianth segments connate, membranous; stamen 1, seeds 0.8 mm, papillose, brown.

N (northern delta), O, M, S; edges of salt marshes. Mediterranean region, Sinai.

2. **Halopeplis perfoliata** (Forssk.) Bunge ex Asch. in Schweinf., Beitr. Fl. Aethiop. 289 (1867).
Syn. *Salicornia perfoliata* Forssk., Fl. Aegypt.-Arab. 3 (1775).

Shrublet 20-50 cm; stems richly branched, the older branches and stems leafless and woody; leaves 3-8 x 4-8 mm, perfoliate, glabrous, fleshy, green to reddish, threaded-like beads around young branches to give them a jointed appearance; flowers red, fleshy, in

alternate spikes, anthers yellow; fruit 1-seeded; seed 0.8 mm.

M, R, S; coastal salt marshes. Egypt, Arabia, eastwards to South and Southwest Pakistan.

7. *Halocnemum* M. Bieb.

Halophytic glabrous shrubs; old stems woody; young stems jointed, succulent, with numerous opposite bud-like branches; leaves opposite, succulent, decussate, leaf blades reduced to fleshy cups, connate at the base; bracts opposite; free, deciduous; flowers bisexual, clustered, forming short lateral cone-like spikes; perianth segments 3, unequal, united at the base; stamen 1, with flattened filament and ovoid anther; style short, thick; stigmas 2, filiform; fruit ovoid, enclosed within the perianth; seeds vertical; endosperm 0; embryo arcuate. 1 species, Southern Europe, North Africa to Central Asia.

1. *Halocnemum strobilaceum* (Pall.) M. Bieb., Fl. Taur.-Cauc. 3: 3 (1819).

Syns. *Salicornia strobilacea* Pall., Reise Russ. Reich. 1: 412 (1771).

Salicornia cruciata Forssk., Fl. Aegypt.-Arab. 2 (1775).

Shrub 20-60 cm, often forming rounded hummocks to 2 m diam., old stems entangled, with brownish bark; young stems much branched, erect to ascending; leaves 1 mm, obovate, with scarios margins; flowers in clusters of 2-3 on short lateral and terminal branches; perianth-segments 1-1.25 mm, broadly oblong, hyaline, the apex truncate; stamen 2 mm; fruit 1.25 mm, compressed-ovoid; seeds brown, compressed.

N (northern delta), M, D, R, S; coastal salt marshes, saline plains. Southern Europe, North Africa, Sinai to Central Asia.

8. *Arthrocnemum* Moq.

Subshrubs or herbaceous perennials, glabrous, stems articulate; leaves reduced to short cupules at the tips of the stem-segments; flowers sessile, immersed in spike-like 3-flowered terminal clusters, enclosed by a pair of bracts, the central flower bisexual; lateral flowers unisexual, often male; perianth tubular; stamens 2 or 1; fruiting perianth spongy, pericarp hyaline or woody; seeds suborbicular, testa hard, glabrous; embryo straight or U-shaped, endosperm present. 3 species, coastal salt marshes, cosmopolitan.

1. *Arthrocnemum macrostachyum* (Moric.) K. Koch, Hort. Dendrol. 96, No. 3 (1853).

Syns. *Salicornia macrostachya* Moric., Fl. Venet. 2 (1820).

Salicornia glauca Delile, Descr. Egypte, Hist. Nat. 49 (1814), non Stokes, Bot. Mat. Med. 1: 8 (1812).

Arthrocnemum macrostachyum (Moric.) Moris, Enum. Sem. Hort. Taur. 1854: 35 (1854).

Arthrocnemum glaucum (Delile) Ung.-Sternb., Atti Cong. Bot. Firenze 1874: 283 (1876), nom illeg.

Small shrub 30-60 cm, stems much branched, erect to ascending; young stems succulent, glaucous, old stems woody; inflorescence 4-6 cm; flowers slightly exceeding the subtending bracts, perianth 2 x 1 mm; stamens 2; anthers yellow, 1 mm; pericarp membranous; seeds 1 mm, papillose, black, glossy.

N, O, M, De, R, S; coastal salt marshes. South Portugal, North Africa, East

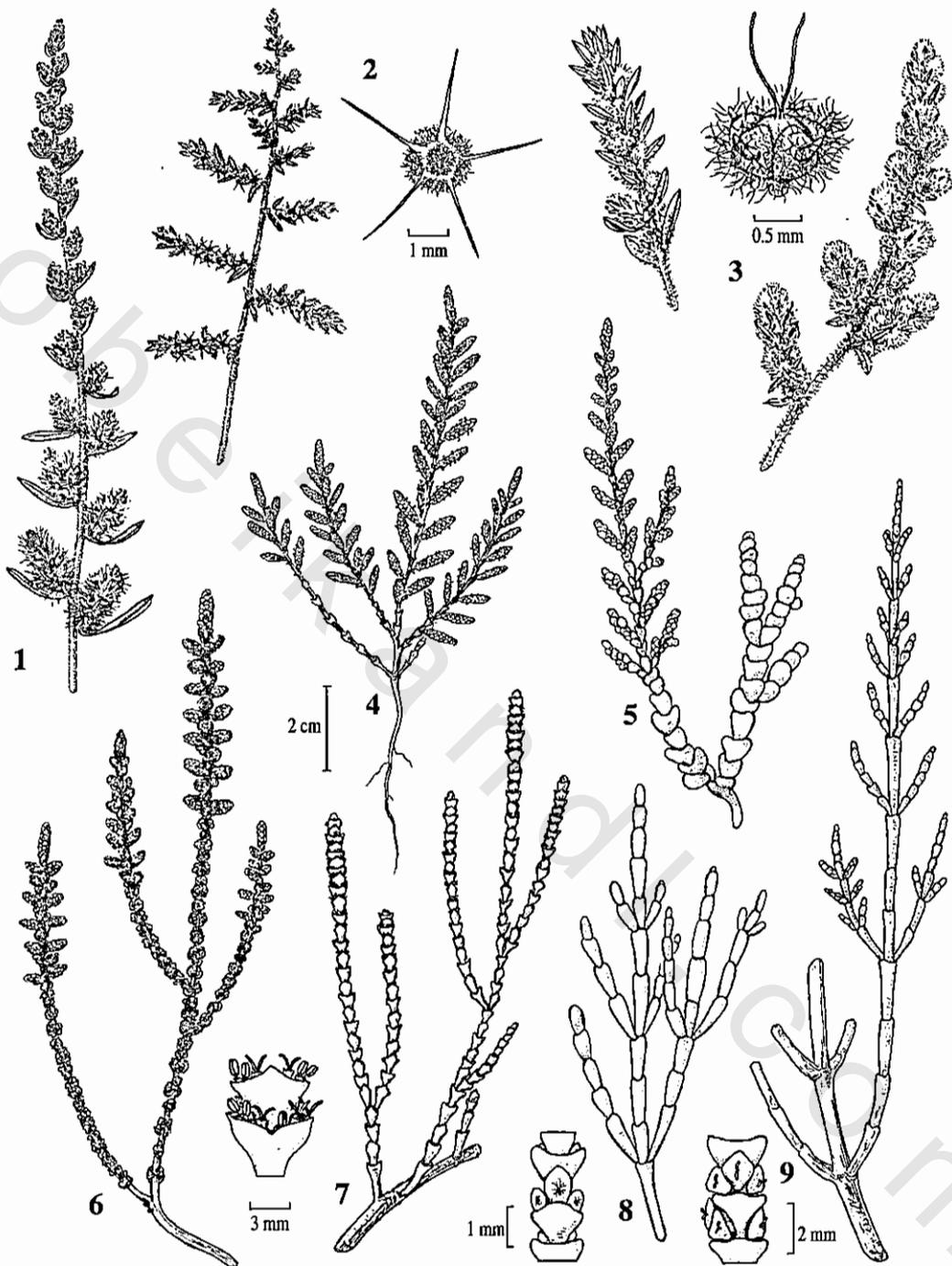


Plate 21. CHENOPODIACEAE: *Krascheninnikovia ceratoides* 1, flowering and fruiting branch. *Bassia muricata* 2, flowering and fruiting branch and fruit. *Bassia eriophora* 3, flowering branch (left); fruit (middle); fruiting branch (right). *Halopeplis amplexicaulis* 4, habit. *Halopeplis perfoliata* 5, flowering branch. *Halocnemum strobilaceum* 6, flowering branch. *Arthrocnemum macrostachyum* 7, flowering branch and flowers (left). *Salicornia europaea* 8, vegetative branch and flowers (left). *Sarcocornia fruticosa* 9, flowering branch and flowers (left). All drawings to the same scale except enlarged parts (scale given).

Mediterranean region, Sinai, eastwards to Iran and the Indus Delta.

9. *Salicornia* L.

Succulent halophytic glabrous annual herbs; stems erect, jointed, much branched, the branches opposite; leaves connate, forming a cup around the stem; flowers axillary, solitary or in 2- to 3-flowered cymes immersed in cavities in the stems, forming terminal spikes; perianth segments fused into 3-4 lobed cup-like structure; stamens 1-2; anthers exerted; ovary ovoid; style short; stigmas 2, filiform; fruit an achene, included in the spongy perianth with the membranous pericarp; seeds greenish or brownish, endosperm 0. 28 species, cosmopolitan except Australia.

1. *Salicornia europaea* L., Sp. Pl., ed. 1, 3 (1753).

Syns. *Salicornia herbacea* (L.) L., Sp. Pl., ed. 2, 5 (1762).

Salicornia obscura P. W. Ball & Tutin, Watsonia 4: 204 (1959).

Annual herb 10-50 cm, slightly woody and reddish at maturity, the main stem much branched from the base, with the branches appressed-ascending; flowers in 3-flowered cymes, the central 1.5 mm, deltoid, larger than the 2 laterals, each with 1 stamen; anthers 0.5 mm; stigmas 1 mm; seeds 1-1.25 mm, ovoid, compressed, brownish, with short hairs.

N, O, M, S; edges of salt marshes and coastal mud flats. Europe, Mediterranean region, Sinai, eastwards to Central Asia.

10. *Sarcocornia* A. J. Scott

Perennial monoecious or dioecious herbs or small shrubs, glabrous; stems branched; branches cup-shaped or 2-lobed at the apex, succulent; bracts united in opposite pairs; flowers bisexual or unisexual, in 3- to 12-flowered sessile cymes in the axils of bracts, forming lateral and terminal spike-like inflorescences; perianth succulent, 3- to 4-lobed; lobes fused at the base, apex truncate and exposed; stamens 2; fruiting perianth spongy, pericarp membranous; seeds ovate to orbicular; testa membranous, hairy; embryo horseshoe-shaped; endosperm absent. 15 species, cosmopolitan.

1. Plant erect, glaucous; stigmas 2; middle flower of cyme not reaching the top of joint; seeds with conical protuberances

1. *S. fruticosa*

+ Plant prostrate with erect or ascending branches greenish to reddish; stigmas usually 3; middle flower of cyme almost reaching the top of joint; seeds covered with hooked hairs

2. *S. perennis*

1. *Sarcocornia fruticosa* (L.) A. J. Scott, Bot. J. Linn. Soc. 75: 367 (1977).

Syns. *Salicornia europaea* L. var. *fruticosa*, Sp. Pl., ed. 1, 3 (1753).

Salicornia fruticosa (L.) L., Sp. Pl., ed. 2, 5 (1762).

Arthrocnemum fruticosum (L.) Moq., Chenop. Monogr. Enum. 111 (1840).

Perennial subshrub, glabrous, glaucous, 20-80 cm; stems erect or ascending, woody at the base; branches cylindrical, 0.5-1.5 cm; bracts 2 mm, scarious-margined, forming a cupular sheath; cymes 3-flowered, forming lateral and terminal cylindrical spikes; stigmas 2, middle flower of cyme not reaching the top of joint; seeds grey, covered with conical protuberances.

N, O, M, De, S; salt marshes. Mediterranean region, Sinai.

2. **Sarcocornia perennis** (Mill.) A. J. Scott, Bot. J. Linn. Soc. 75: 367 (1977).

Syns. *Salicornia perennis* Mill., Gard. Dict., ed. 8, no. 2 (1768).

Salicornia radicans Sm., Engl. Bot. 24, t. 1691 (1807).

Salicornia lignosa Woods, Proc. Linn. Soc. London 2: 111 (1851).

Arthrocnemum perenne (Mill.) Moss, J. South Afr. Bot. 14: 40 (1948).

Perennial subshrub, glabrous, greenish to reddish, 10-25 cm; stems prostrate, rooting at the nodes; branches erect or ascending; bracts 2 mm, forming a cupular sheath; flowers in 3-flowered cymes, the middle flower projecting above the laterals; stigmas usually 3; seeds subglobular, covered with hooked hairs.

M, S; salt marshes. West Europe, Mediterranean region, West Asia.

11. **Suaeda** Forssk. ex Scop., nom. conserv.

Syn. *Schanginia* C. A. Mey.

Annual or perennial herbs, shrubs or rarely small trees, glabrous or slightly hairy on the juvenile parts; leaves alternate, succulent, terete, subterete, subglobose or flattened; flowers bisexual or unisexual, solitary or in clusters, sometimes forming panicles; bracts 2-3, scarious, persistent; perianth-segments 5, herbaceous or succulent; stamens 5, inserted on the perianth segments, reduced to staminodes in female flowers; ovary sessile, free or sometimes adnate to the perianth; male flowers with a rudimentary ovary; stigmas 2-3(-5); fruiting perianth unchanged or becoming succulent and spongy; fruit free or adnate to the perianth; seeds horizontal or vertical; embryo spiral. 100 species, coasts and salt steppe, cosmopolitan.

- | | |
|---|-------------------------|
| 1. Small tree or shrub 2-4 m, with insect-galls frequently found on stems and less often on leaves | 2. S. monoica |
| + Shrub to 0.5-1.5 m, or annual, or short-lived perennial herb, without insect-galls | 2 |
| 2. Upper part of the fruit swollen and spongy, the lower fused to the perianth at maturity | 1. S. aegyptiaca |
| + Fruit thin-walled, not spongy, enveloped by the perianth at maturity but not fused to it | 3 |
| 3. Annual | 4 |
| + Perennial | 6 |
| 4. Flowers sessile, borne on the leaf petiole | 7. S. altissima |
| + Flowers in axillary clusters or solitary, borne in the leaf axils | 5 |
| 5. Perianth-segments 1.5 mm, ovate; bracts 2 mm, lanceolate; leaves terete to subulate ending in a short caducous bristle | 6. S. splendens |
| + Perianth-segments 0.8 mm, deltoid; bracts 0.5 mm, deltoid-ovate; leaves almost flat, acute or subacute, without a bristle | 8. S. maritima |
| 6. Flowers solitary in the upper parts of branches, leaves arcuate to semicircular | 9. S. palaestina |
| + Flowers in clusters of 2-5, rarely solitary; leaves not arcuate or semicircular | 7 |

7. Stigmas flat, lobed or disc-shaped, becoming capitate upon drying + Stigmas filiform or linear 4. *S. vera*
8

8. Leaves 2-6(-8) x 0.5 mm, crowded on the stems, flat above, rounded beneath 5. *S. pruinosa*
+ Leaves to 2(-3) x 0.1-0.4 cm, spaced on the stems, obovate-oblong to subglobose, terete 3. *S. vermiculata*

1. ***Suaeda aegyptiaca*** (Hasselq.) Zohary, J. Linn. Soc. London, Bot. 55: 635 (1957).
Syns. *Chenopodium aegyptiacum* Hasselq., Iter Palaest. 460 (1757).
Suaeda hortensis Forssk., Fl. Aegypt.-Arab. 71 (1775), nom inval. ex J. F. Gmel., Syst. Nat., ed. 13, 2: 503 (1791).
Suaeda baccatta Forssk. ex J. F. Gmel., Syst. Nat., ed. 13, 2: 503 (1791).
Schanginia bacata (Forssk. ex J. F. Gmel.) Moq., Chenopod. Monogr. Enum. 119 (1840).
Schanginia hortensis (Forssk. ex J. F. Gmel.) Moq., Chenopod. Monogr. Enum. 119 (1840).
Schanginia aegyptiaca (Hasselq.) Aellen in Rech. f., Fl. Lowland Iraq 195 (1964).

Succulent annual herb or short-lived perennial, 50-80 cm, often with a woody base, glabrous, glaucous; stems erect or decumbent, terete, whitish-yellow; leaves 1-2.5 x 0.1-0.25 cm, subterete to linear, fleshy; flowers bisexual and female, sessile or short-pedicellate, in dense axillary clusters, forming leafy spikes; bracts 1 mm, deltoid-ovate, with scarious margins; perianth-segments of bisexual flowers 1.75 mm, deeply divided and incurved, greenish, with scarious margins; perianth-tube adnate to the ovary; stigmas 2-3(-4), female flowers with minute staminodes; fruit 1 mm, thin-walled, immersed in the spongy receptacle; fruiting perianth-lobes swollen and spongy; seeds 1 mm, reticulate, black, glossy.

N, O, M, De, S; borders of salt marshes, coastal sandy soils, edges of cultivation. Cyprus, North and East Africa, Southwest Asia; naturalized in South Australia.

2. ***Suaeda monoica*** Forssk. ex J. F. Gmel., Syst. Nat., ed. 13, 2: 503 (1791).

Small tree or shrub 2-4 m, trunk 10(-25) cm in girth at the base; stems much branched, frequently with conspicuous insect-galls; leaves 1-3.5 x 0.1-0.3 cm, sessile or short-petiolate, flattened on both sides, linear-oblong to linear, obtuse to subacute; flowers unisexual, solitary or 2-6 in axillary clusters, forming loose leafy spikes; bracts 1 mm, deltoid-ovate, membranous, ciliate; male flowers developing first, with 5 stamens and a rudimentary ovary, perianth-segments fused in the basal 1/3; stamens 2 mm; anthers 1 mm; female flowers much smaller, with perianth-segments fused to the apex, and with minute staminodes; ovary ovoid, stigmas 3-4; fruit 1.5-2 mm, tightly enclosed within the membranous perianth; seeds 1.5-1.75 mm, vertical, compressed, black, smooth, glossy.

O, De, R, GE, S; coastal and inland sandy soils, edges of salt marshes. Cape Verde Islands, Chad, East Africa from Mozambique to Sudan and Egypt, south of Dead Sea, Arabia, Iran, Sri Lanka.

3. ***Suaeda vermiculata*** Forssk. ex J. F. Gmel., Syst. Nat., ed. 13, 2: 503 (1791).

Syns. *Suaeda fruticosa* Forssk. ex J. F. Gmel., Syst. Nat., ed. 13, 2: 503 (1791).

Salsola mollis Desf., Fl. Atlant. 1: 218 (1798).

Suaeda mollis (Desf.) Delile, Descr. Egypte, Hist. Nat. 57 (1814).

Suaeda volkensii C. B. Clarke in Dyer, Fl. Trop. Afr. 6(1): 92 (1909).

Suaeda monodiana Maire, Bull. Soc. Hist. Nat. Afr. Nord 28: 377 (1937).

Suaeda mesopotamica Eig, Pal. J. Bot., Jerusalem ser., 3: 127 (1945).

Shrub 0.5-1.2 m, glabrous to glabrescent; stems woody at the base, much branched; leaves 0.2-2(-3) x 0.1-0.4 cm, very short-petiolate to sessile, succulent, spaced on the stems, ovate-oblong to subglobose, terete or flattened on one side only, usually drying black; flowers bisexual, in 2-5-flowered clusters, sometimes solitary, in axillary and terminal leafy spikes or lax panicles; bracts 1 mm, deltoid-ovate, scarious, denticulate; perianth segments 1.25 mm, succulent, connate at the base, the tips incurved; ovary free from the perianth except at the extreme base; stigmas 2-4(-5); stamens 1.75-2 mm, anthers 0.75 mm, oblong; fruit thin-walled; seeds vertical, black, glossy.

N, O, M, D, R, S; coastal and inland sandy soils, edges of salt marshes. Macaronesia, Senegal, Mauritania, North and East Africa, Southwest Asia to India and Sri Lanka.

4. ***Suaeda vera*** Forssk. ex J. F. Gmel., Syst. Nat., ed. 13, 2: 503 (1791).

Syns. *Chenopodium fruticosum* L., Sp. Pl., ed. 1, 221 (1753).

Salsola fruticosa (L.) L., Sp. Pl., ed. 2, 324 (1762).

Suaeda fruticosa (L.) Dumort., Fl. Belg. 22 (1827), non Forssk. (1775),
nom. illeg.

Suaeda fruticosa subsp. *vera* (Forssk. ex J. F. Gmel.) Maire & Weiller in
Maire, Fl. Afr. Nord 8: 114 (1962).

Small shrub 20-50 cm, glabrescent or slightly mealy; stems woody, erect or ascending, much branched; leaves 0.5-2 x 0.1-0.2 cm, sessile, dense, fleshy, linear to lanceolate, semiterete to flattened, the apex rounded; bracts 2-2.5 mm, leafy, oblong-linear; bracteoles scarious; flowers 1.5-2 mm, solitary or 2-3 in a cluster, forming dense leafy spikes; perianth-segments ovate, obtuse, connivent in fruit; ovary pear-shaped; style dilated in its upper part; stigmas usually 4-5, flat, lobed or disc-shaped; becoming capitate upon drying; fruit enveloped by the fruiting perianth but free from it; seeds smooth, vertical.

N (Northern delta), M, De, S; saline depressions and coastal sands. Mediterranean region, Sinai.

5. ***Suaeda pruinosa*** Lange, Vidensk. Meddel. Dansk. Naturhist. Foren. Kjöbenhavn 1861: 45 (1861).

Like *S. vermiculata* but leaves shorter and narrower, 2-6(-8) x 0.5 mm, crowded on the stems, almost imbricate, pruinose, flat on the upper surface, rounded on the lower, obtuse, minutely apiculate; flowers minute; pistil pear-shaped; style dilated at the tip to a disc, on which 3 filiform stigmas are inserted; seeds 1.2 x 0.9 mm, ovoid-reniform, glossy, black.

M, S; edges of salt marshes. Spain, Sicily, North Africa, Sinai.

6. **Suaeda splendens** (Pourr.) Gren. & Godr., Fl. Fr. 3: 30 (1855).

Syns. *Salsola splendens* Pourr., Hist. & Mém. Acad. Roy. Sci. Toulouse 3: 327 (1788).

Suaeda setigera (DC.) Moq., Ann. Sci. Nat. (Paris) 23: 309 (1831).

Annual herb 20-50 cm, glabrescent; stems erect, branched; leaves 1-2 x 0.1 cm, succulent, terete to subulate, acuminate, ending in a short caducous bristle; flowers in axillary 3- to 5-flowered clusters, forming long, loose spikes; bracts leafy, longer than the flowers, lanceolate, acuminate; bracteoles shorter than the flowers, membranous; flowers bisexual; perianth-segments 1.5 mm, fleshy, ovate, obtuse; fruiting perianth inflated, appressed to utricle; seeds 0.8 mm, vertical or horizontal, lenticular, short-beaked, black, glossy.

N, M, S; saline soils, coastal plains. Mediterranean region, Sinai.

7. **Suaeda altissima** (L.) Pall., Ill. Pl. 49 (1803).

Syn. *Chenopodium altissimum* L., Sp. Pl., ed. 1, 221 (1753).

Annual herb 50-80 cm; stems erect, branching; leaves 1-3 x 0.05 cm, filiform, acute; flowers sessile, on the leaf petiole, forming lax cymes; fruiting perianth not inflated; seeds 1 mm, vertical or horizontal, smooth, blackish.

M; coastal sand. Southeast Europe, Egypt.

8. **Suaeda maritima** (L.) Dumort., Fl. Belg. 22 (1827).

Syns. *Chenopodium maritimum* L., Sp. Pl., ed. 1, 221 (1753).

Chenopodium salsum L., Sp. Pl., ed. 1, 221 (1753).

Suaeda salsa (L.) Pall., Ill. Pl. 52 (1803).

Suaeda indica (Willd.) Moq., Ann. Sci. Nat., ser. 1, 23: 316 (1831).

Annual herb 15-60 cm, glabrous, glaucous, drying greyish-green to brownish; stems erect or ascending, terete to slightly angled; leaves 1-2.5 x 0.05-0.1 cm, green to reddish, fleshy, almost flat, acute or subacute, without a bristle; flowers bisexual, rarely female, in axillary 2- to 5-flowered clusters, each cluster subtended by a bract; clusters forming leafy spikes or lax panicles; perianth-segments 1 mm, deltoid, fused at the base; ovary pyriform, slightly narrowed to a short beak; stigmas 0.25 mm, filiform; anthers 0.25 mm, subglobose; fruit thin-walled; seeds 1.2-1.5 mm, compressed, horizontal, black, smooth, glossy.

N, O (Bahariya), M, De; salt marshes, coastal sand and mud-flats. Canary Islands, Europe, Mediterranean region, Caucasus, Asia, Australia, northeast coast of North America, Argentina.

9. **Suaeda palaestina** Eig & Zohary, Pal. J. Bot., Jerusalem, ser. 3: 126 (1945).

Dwarf shrub 20-50 cm, glabrous; stems divaricately branched; leaves 0.5-1.2 x 0.1-0.25 cm, sessile, glaucous, fleshy, semi-terete to slightly flattened on the upper surface, arcuate to semicircular, the margins scarios; flowers bisexual, solitary, in the upper parts of the branches; bracteoles 2, lanceolate, scarios, much shorter than the perianth; perianth-segments 2 mm, ovate-oblong, narrowly white-margined; stamens shorter than the perianth; stigmas 3, subulate, 0.6 mm; seeds vertical, beaked, glossy.

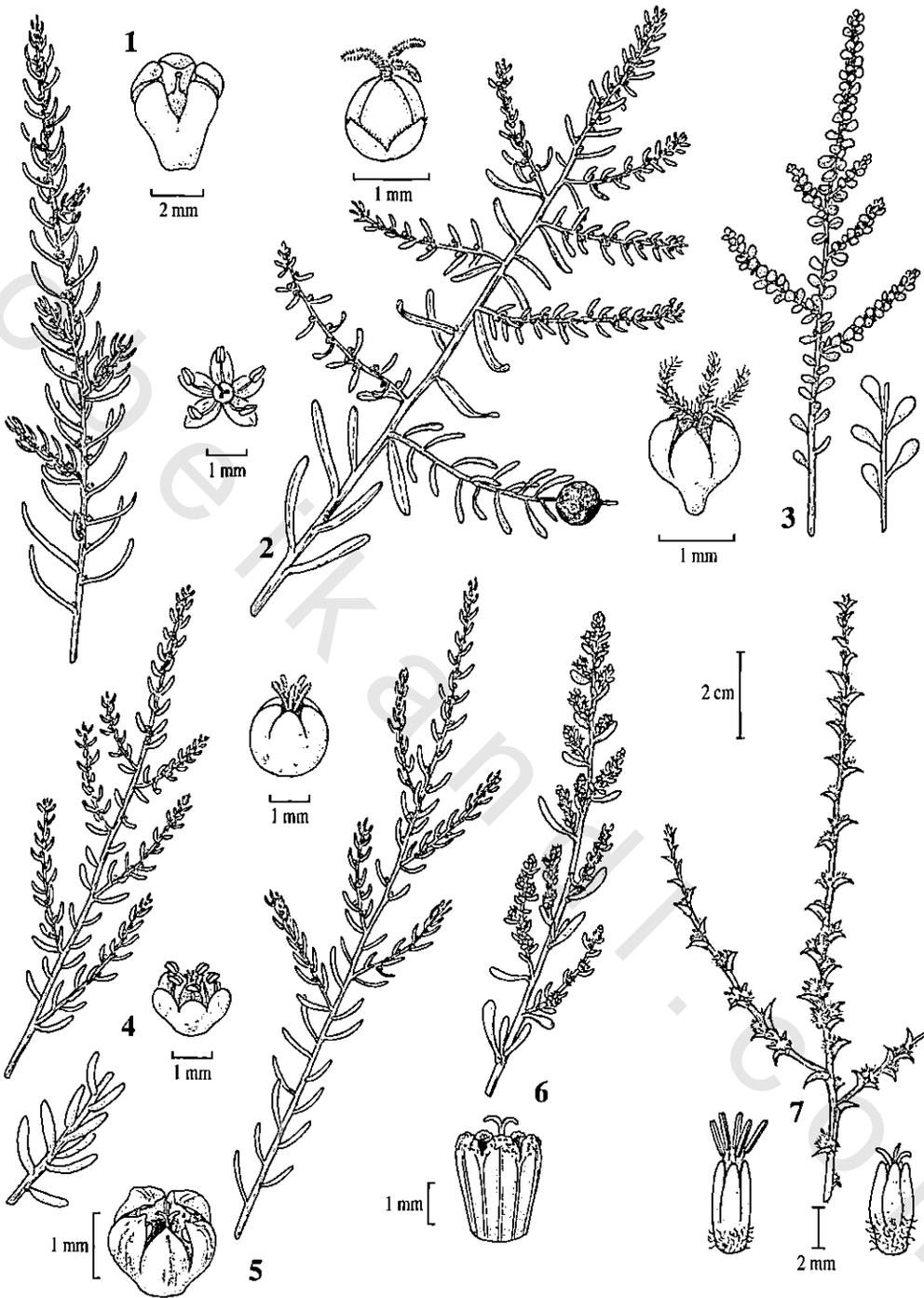


Plate 22. CHENOPODIACEAE: *Suaeda aegyptiaca* 1, flowering and fruiting branch; female flower (up right). *Suaeda monoica* 2, flowering and fruiting branch; female flower (up left); male flower (down left). *Suaeda vermiculata* 3, flowering and fruiting branch; flower (down left); leafy branch (down right). *Suaeda vera* 4, flowering and fruiting branch; fruit (up right); flower (down right); leafy branch (down). *Suaeda maritima* 5, flowering and fruiting branch; flower (down left). *Suaeda schimperii* 6, flowering and fruiting branch; fruit (down). *Traganum nudatum* 7, flowering and fruiting branch; flower (down left); fruit (down right). All drawings to the same scale except enlarged parts (scale given).

M, S; salt marshes, drain sides. Egypt, Palestine.

12. *Sevada* Moq.

Small shrubs; leaves alternate or opposite, often in axillary clusters, with a short indurate base; flowers bisexual and female, in dense axillary and terminal spikes or panicles; bracteoles small, scarious; perianth-segments 5, fused into a short tube; stamens 5, with exerted anthers, alternating with the small staminodal scales; ovary free; stigmas 2-3; fruit ovoid, with acute beak; seeds vertical. 1 species, Arabia, tropical east Africa from Egypt to Ethiopia and Somalia.

1. *Sevada schimperi* Moq. in DC., Prodr. 13(2): 154 (1849).

Syns. *Suaeda schimperi* (Moq.) Martelli, Nuovo Giorn. Bot. Ital. 20: 367 (1888).

Suaeda vermiculata Forssk. ex J. F. Gmel. var. *puberula* C. B. Clarke in Dyer, Fl. Trop. Afr. 6 (1): 92 (1909).

Small shrub 15-40 cm, glabrous or papillose; stems woody, the branches entangled, the older stems with fissured bark; leaves 0.2-1.5 x 0.1-0.2 cm, linear, terete, glaucous, succulent, with a constricted short indurate base and an axillary tuft of short white hairs; flowers in clusters of 3-10, forming short axillary spikes or panicles; perianth segments 1 mm, subglobose; stamens 1.5 mm; anthers 0.5 mm, yellow; fruiting perianth 2 mm, the tube longitudinally ribbed, slightly constricted towards the expanded base; fruit ovoid, with an acute beak.

De, R, GE; sandy coastal areas and stony wadis. Egypt, Arabia, tropical East Africa to Ethiopia and Somalia.

13. *Traganum* Delile

Shrubs; stems cottony at the nodes; leaves semiterete, alternate, sessile, succulent; flowers bisexual, solitary or 2-3 in axillary clusters; floral bracts 2; perianth-segments 5, scarious; stamens 5, exerted; anthers sagittate; staminodes obscure or absent; stigmas 2, subulate; fruiting perianth thickened and indurate, with 2 horn-like teeth; fruit a utricle, subglobose, embedded in the perianth; pericarp free, membranous; seeds horizontal. 2 species, Canary Islands, Sahara, North Africa, Sinai, Arabia.

1. *Traganum nudatum* Delile, Descr. Egypte, Hist. Nat. 204 (1814).

Shrub, 30-80 cm; stems much branched, whitish, glabrous except at the cottony nodes; old branches spinescent with longitudinally cracked bark; leaves 0.4-1 x 0.2-0.4 cm, forming dense clusters, oblong to narrowly triangular, recurved, clasping and slightly decurrent at the base; flowers solitary or 2-3 in axillary clusters; perianth-segments 3 mm, oblong-lanceolate; fruiting perianth 3.5 mm, thickened, indurate, with dorsal horns.

M, O, D, S; stony and sandy wadis and plains. North Africa, Southwest Asia.

14. *Salsola* L.

Shrubs, subshrubs, perennial herbs or annuals; leaves small, often succulent, alternate or opposite, sessile, entire, the base sometimes clasping; flowers bisexual, rarely unisexual, solitary in leaf axils or in clusters forming loose or dense spikes or panicles, each

subtended by 2 bracts; perianth-segments 5, rarely 4, scarious, usually developing a prominent transverse wing in fruit; stamens 5, rarely 4; the anthers sometimes with appendages; staminodes rarely present; stigmas 2(-3); fruit with a disc-shaped to subglobose utricle included within the persistent fruiting perianth, this obconical with a narrow base, usually not indurate; seeds horizontal, subglobose, testa membranous, embryo spiral. About 150 species, cosmopolitan, especially sea-coasts and saline habitats.

1. Annual herbs, sometimes with woody base at maturity 2
+ Shrubs or subshrubs, the branches woody at least at the base 4
2. Plants glabrous or glabrescent to hispid-puberulent; leaves mucronate-spiny 3. *S. kali*
+ Plants villous or mealy; leaves not mucronate-spiny 3
3. Plant smelling of decaying fish when bruised; stems and leaves villous, with rough hairs; fruiting perianth forming a pubescent cone above the wings 4. *S. volkensii*
+ Plant with no particular smell when bruised; mature stems with mealy indumentum or papillose-mealy, young stems and leaves pilose to villous; fruiting perianth appressed above the wings, scurfy 5. *S. inermis*
4. Leaves 1.2-2.5(-3) cm, glabrous 5
+ Leaves 2-8 mm, hairy 7
5. Leaves alternate (the lowermost opposite); flowers 2-5 in the leaf axils 10. *S. schweinfurthii*
+ All leaves opposite; flowers solitary 6
6. Shrub 0.5-2 m; wings of fruiting perianth unequal, 2 small to 4 mm diam., and 3 large to 9 mm diam., overlapping; staminodes absent 11. *S. oppositifolia*
+ Low shrub to 0.4 m; wings of fruiting perianth equal, 5-6 mm diam., slightly overlapping; staminodes present 12. *S. longifolia*
7. Leaves 0.4-1.2 cm, yellowish-villous, with denticulate hairs 2. *S. villosa*
+ Leaves 1.5-2.5 mm, not villous 8
8. Leaves opposite, decussate, densely imbricate 9
+ Leaves alternate, imbricate, or densely crowded into small cone-like knots 10
9. Plant usually decumbent; leafy shoots cylindrical or indistinctly 4-angled; perianth segments 4, 1.5-2 mm 6. *S. tetrandra*
+ Plant erect; leafy shoots sharply 4-angled by the keeled leaves; perianth segments 5, 3-3.5 mm. 7. *S. tetragona*
10. Leaves alternate, imbricate, fleshy; plant smelling of decaying fish when bruised; branches not spinescent 1. *S. imbricata*
+ Leaves densely crowded into small cone-like knots; plants with no particular smell when bruised; branches spinescent 11
11. Indumentum of young leaves and shoots smooth, of simple sessile hairs; staminal appendages large, semicircular 9. *S. cyclophylla*
+ Indumentum of young leaves and shoots rough, of stalked medifixed hairs; staminal

appendages absent

8. *S. spinescens*

1. *Salsola imbricata* Forssk., Fl. Aegypt.-Arab. CVII, CVIII, 57 (1775); Forssk., Icon. Rer. Natur., t. VIIIc (1776).

Shrub 0.3-1.5 m high, variable, sometimes to 2 m across, greyish-green, smelling of decaying fish when bruised, much branched; young plants with reddish stems and linear hairy leaves to 1.5 cm, caducous; mature leaves 1.25 x 1.5 mm, alternate, imbricate, ovate-orbicular, succulent, with narrow scarious margins; flowers solitary, in short dense spikes, often forming panicles; bracts 1.5-2.5 x 2 mm; perianth-segments 1.5 x 1.25 mm, connivent, obtuse; fruiting perianth 3.5-5.5 mm diam. including the wings.

Two subspecies occur in Egypt:

subsp. *imbricata*

Syns. *Chenopodium baryosmum* Schult. ex Roem. & Schult., Syst. Veg. 6: 269 (1820).

Salsola foetida Delile ex Spreng., Syst. Veg. 1: 925 (1824).

Caroxylon imbricatum (Forssk.) Moq. in A. DC., Prodr. 13(2): 177 (1849).

Salsola baryosma (Roem. & Schult.) Dandy in F. W. Andrews, Fl. Pl. Anglo-Egypt. Sudan 1: 111 (1950).

Upper leaves, bracts, bracteoles and dorsal side of perianth-segments glabrous.

N, O, D, GE, S; borders of salt marshes, sandy and stony wadis. Syria, Palestine, Egypt, Sudan, Kenya, Ethiopia, Somalia, Socotra, Arabia to India.

subsp. *gaetula* (Maire) Boulos, Fl. Egypt Checklist 24 (1995).

Syns. *Salsola foetida* var. *gaetula* Maire, Bull. Soc. Hist. Nat. Afr. Nord 27: 257 (1936).

Salsola gaetula (Maire) Botsch., Novosti Sist. Vyss. Rast. 12: 164 (1975).

Salsola baryosma subsp. *gaetula* (Maire) Freitag, Flora 183: 159 (1989), comb. inval.

Leaves, bracts, bracteoles and outer perianth-segments villous, with long curved white hairs.

M, O, D, S; sandy and stony wadis and coastal plains, near the edges of salt marshes. Central African Republic, Chad, Niger, Mali, Senegal, Mauritania, North Africa from Morocco to Northwest Egypt, Sinai.

2. *Salsola villosa* Schult., Syst. Veg. 6: 232 (1820).

Syns. *Salsola vermiculata* L. var. *villosa* (Schult.) Moq., Chenop. Monogr. Enum. 141 (1840).

Salsola vermiculata L. subsp. *villosa* (Schult.) Eig, Pal. J. Bot., Jerusalem ser. 3: 132 (1945).

Salsola delileana Botsch., Novosti, Sist. Vyss. Rast. 1: 371 (1964).

Salsola libyca Botsch., Bot. Zhurn. 60(4): 501 (1975).

Salsola mandavillei Botsch., Bot. Zhurn. 60(4): 502 (1975).

Salsola palaestina Botsch., Bot. Zhurn. 60(4): 503 (1975).

Salsola damascena Botsch., Bot. Zhurn. 60(4): 500 (1975).

Salsola chaudharyi Botsch., Bot. Zhurn. 65: 687 (1984).

Shrub 25-80 cm, woody at the base; stems much branched; young branches herbaceous, yellowish-villous, becoming glabrous and indurate with age; lower leaves 0.4-1.2 cm, alternate, narrowly triangular to linear-subulate, slightly clasping at the base, yellow-villous, with denticulate hairs; upper leaves 1-4 mm, closely imbricate, triangular, appressed-hairy; flowers solitary, in loose or congested spikes; bracts suborbicular, keeled, scarious-margined; perianth-segments pubescent, with scarious margins; fruiting perianth 0.8-1.2 cm including the wings, almost free; wings straw-yellow, often with purplish veins.

O, D, S; stony ground and sandy plains. Southwest Sahara, North Africa, Southwest Asia to western India.

NOTE: A variable species, known in several variants throughout its geographical area.

3. *Salsola kali* L., Sp. Pl., ed. 1, 222 (1753).

Annual herb 15-60 cm, glabrous or glabrescent to hispid-puberulent, succulent; stems ascending, angular, branched at the base; leaves 0.5-2.5(-4) x 0.2-0.3 cm, fleshy, semiterete, linear-subulate, slightly clasping at the base, mucronate-spiny; spines sharp, persistent; flowers 1-3 in the leaf axils, forming loose leafy spikes; bracts 3-4 mm, spine-tipped, membranous; stamens (4-)5; stigmas 2-3; fruiting perianth 0.6-1 cm diam. including the wings, forming a pubescent cone above the imbricate wings.

N, M, S; coastal sandy areas, waste ground. Northern hemisphere, especially shorelines.

4. *Salsola volkensis* Schweinf. & Asch. in Asch. & Schweinf., Mém. Inst. Egypt. 2: 130 (1887).

Annual herb 10-50 cm, white-glaucous, becoming brownish-yellow on drying, smelling of decaying fish when bruised, villous with rough hairs; stems erect or ascending, branched; leaves 3-8 x 1.5-2.5 mm, alternate, succulent, semiterete, linear-subulate, hairy; flowers solitary in the leaf-axils, forming loose or dense spikes; bracts 2 x 1.5 mm, suborbicular, succulent; bracteoles equalling or longer than the bracts, succulent; perianth-segments 3 x 1.5 mm, oblong-lanceolate to ovate, acute, connivent, villous; fruiting perianth 6-9 mm including the wings and forming a pubescent cone above the wings; wings imbricate, broadly obovate.

N, M, D, S; sandy wadis and plains, edges of salt marshes. Egypt, Palestine, Saudi Arabia, Iraq.

5. *Salsola inermis* Forssk., Fl. Aegypt.-Arab. 58 (1775).

Annual herb 10-25 cm, sprawling, sometimes with woody base, mature plants densely papillose-mealy, younger parts pilose or villous; stems much branched from the base, wiry, slender; leaves 0.2-1.2 x 1-1.25 mm, clasping at the base; flowers solitary, in loose dense spikes; bracts 1.5-2 mm, suborbicular, caducous in fruit; perianth-segments ovate-triangular, mealy; fruiting perianth 5-8 mm diam. including the wings; wings broadly obovate, slightly overlapping.

N, M, De, S; sandy slightly saline soils. Egypt, Southwest Asia.

6. **Salsola tetrandra** Forssk., Fl. Aegypt.-Arab. 58 (1775).

Syns. *Halogeton tetrandrus* (Forssk.) Moq., Chenop. Monogr. Enum. 160 (1840).
Salsola pentandra Botsch., Novosti Sist. Vyss. Rast. 9: 152 (1972).

Shrub 20-50 cm; villous-tomentose; stems loosely branched, decumbent, the leafy shoots cylindrical or indistinctly 4-angled; older stems woody; leaves 2 x 2 mm, opposite, decussate, densely imbricate, broadly ovate-triangular, rounded at the dorsal side, succulent, villous, with scarious margins; flowers either bisexual (few), with 5 perianth segments 3-3.5 mm, and 5 stamens, or staminate (many) with 4 perianth-segments 1.5-2 mm, 4 stamens and 4 staminodes; ovary pyriform; fruiting perianth 4-5 mm diam. including the wings, connivent and forming a short cone above the wings; wings poorly developed or almost absent, pinkish or white.

O (Uweinat), M, D, S; salt marshes and depressions, rocky wadis. Canary Islands, North Africa, Sinai, Palestine.

7. **Salsola tetragona** Delile, Descr. Egypte, Hist. Nat. 203 (1814).

Syn. *Salsola pachoi* Volkens & Asch. in Asch. & Schweinf., Mém. Inst. Egypt. 2: 130 (1887).

Shrub 20-40 cm, white and villose-tomentose; stems erect, densely branched; leafy shoots sharply 4-angled; leaves 2-3 x 2-3 mm, opposite, coriaceous, densely appressed hairy, ovate-rhombic, strongly keeled on the dorsal side, slightly clasping at the base, apex mucronate; flowers bisexual, solitary, axillary, sessile; perianth-segments 5, 3-3.5 mm, free, silky-villose, the margins broadly-scarious and glabrous; stigmas 2, subulate, papillose; fruiting perianth 0.8-1 cm diam. including the wings; wings well developed.

M, O, D; calcareous ridges, saline soils. North Africa, Palestine.

8. **Salsola spinescens** Moq. in DC., Prodr. 13(2): 179 (1849).

Syns. *Salsola forsskaolii* Schweinf., Bull. Herb. Boissier 2, app. II: 160 (1896).
Salsola congesta N. E. Br., Bull. Misc. Inform. 1909: 50 (1909).
Salsola aethiopica Botsch., Bot. Zhurn. 60: 498 (1975).

Shrub 0.25-1.2 m; stems rigid, older stems and branches strongly spinescent; young shoots minute, bud-like, formed of overlapping leaves; leaves 1.5-2 x 1.5 mm, scale-like, alternate, ovate; young shoots and leaves densely covered with appressed rough, stalked, medifixed hairs; flowers 1.5-2.5 mm diam., solitary; bracts leaf-like; perianth-segments 1.5-2.5 mm; stamens 5, staminal appendages absent; fruiting perianth 3.5-5 mm including the wings; wings pinkish-white.

R; sandy coastal soils. Southeast Egypt, Northeast Sudan, Djibouti, Ethiopia, Arabia.

9. **Salsola cyclophylla** Baker, Bull. Misc. Inf. Kew 1894: 340 (1894).

Shrub 20-60 cm; stems woody with cracked whitish-grey bark at the base, the older branches spinescent; leaves 1.5-2 x 1.5 mm, suborbicular to broadly triangular, crowded into knots on the main and lateral branches; young shoots and leaves densely appressed with smooth, simple, sessile, silvery hairs; flowers in small, dense, lateral spikes; bracts

1-1.5 x 1.2-1.5 mm; perianth-segments 2 mm, connivent, densely hairy above and below the wings; stamens 5; staminal appendages large, semicircular; fruiting perianth 3-5 mm including the wings, densely hairy and projecting above the wings.

De, R, S; rocky slopes, especially limestone and sandstone. Egypt, Arabia, Iraq, Sudan, Ethiopia.

10. **Salsola schweinfurthii** Solms, Bot. Zeitung (Berlin) 59: 173 (1901).

Syn. *Darniella schweinfurthii* (Solms) Brullo, Webbia 38: 313 (1984).

Shrub 20-50 cm, glabrous; stems branched, ascending; young branches white, smooth; old branches brownish, with longitudinally fissured bark; leaves 0.5-2.5 x 0.2-0.3 cm, alternate, the lowermost opposite, sessile, sometimes curved, apiculate with a caducous bristle at the tip, slightly decurrent and with a distinct white pulvinus at the base, with a tuft of short woolly hairs in the axils; flowers 2-5 in the leaf axils, forming a loose or dense spike; bracts suborbicular, succulent; perianth-segments with white margins; stamens inconspicuous; fruiting perianth 3.5-7.5 mm diam. including the subequal wings.

M, De, S; limestone and sandstone slopes. Egypt, Palestine, Saudi Arabia, Oman.

11. **Salsola oppositifolia** Desf., Fl. Atlant. 1: 219 (1798).

Shrub 0.5-2 m; stems erect or ascending; leaves 1-1.5 x 0.2-0.3 cm, opposite, sessile, triangular-lanceolate, base slightly decurrent but without a distinct white pulvinus; flowers solitary in the axils of the opposite, leaf-like bracts; bracteoles 3-3.5 mm, linear-oblong, acute, scarious-margined towards the base; perianth-segments 3-3.5 mm, elliptic with rounded apex; stamens 4-5 mm, exerted, staminodes absent; fruiting perianth 1-1.5 cm diam. including the wings; wings unequal, 2 small to 4 mm diam., and 3 large to 9 mm diam., overlapping.

M, S; calcareous coastal ridges and inland hilly deserts. Canary Islands, Spain, Balearic Islands, Sicily, South Italy, North Africa from Morocco to Egypt, Sinai, Palestine.

12. **Salsola longifolia** Forssk., Fl. Aegypt.-Arab. 55 (1775).

Syns. *Salsola sieberi* C. Presl, Abh. Königl. Böhm. Ges. Wiss., ser. 5, 3: 538 (1844).

Salsola sinaica Brullo, Willdenowia 12: 246 (1982).

Darniella longifolia (Forssk.) Brullo, Webbia 38: 307 (1984).

Darniella sinaica (Brullo) Brullo, Webbia 38: 308 (1984).

Low shrub 20-40 cm; stems erect or ascending; leaves 0.5-2.5(-3) x 2-3 mm, opposite, glabrous, linear-lanceolate; flowers solitary; bracts 3-3.5 mm, opposite, leaf-like; bracteoles 1.5-2 mm, ovate, acute; perianth white-yellowish; perianth-segments 3-3.5 x 1.5 mm, oblong with rounded apex; stamens 2.5 mm, included; staminodes present; fruiting perianth 1-1.5 cm diam. including the membranous wings; wings 5-6 mm diam., slightly overlapping.

M, De, S; calcareous and limestone ridges. Egypt, Libya.

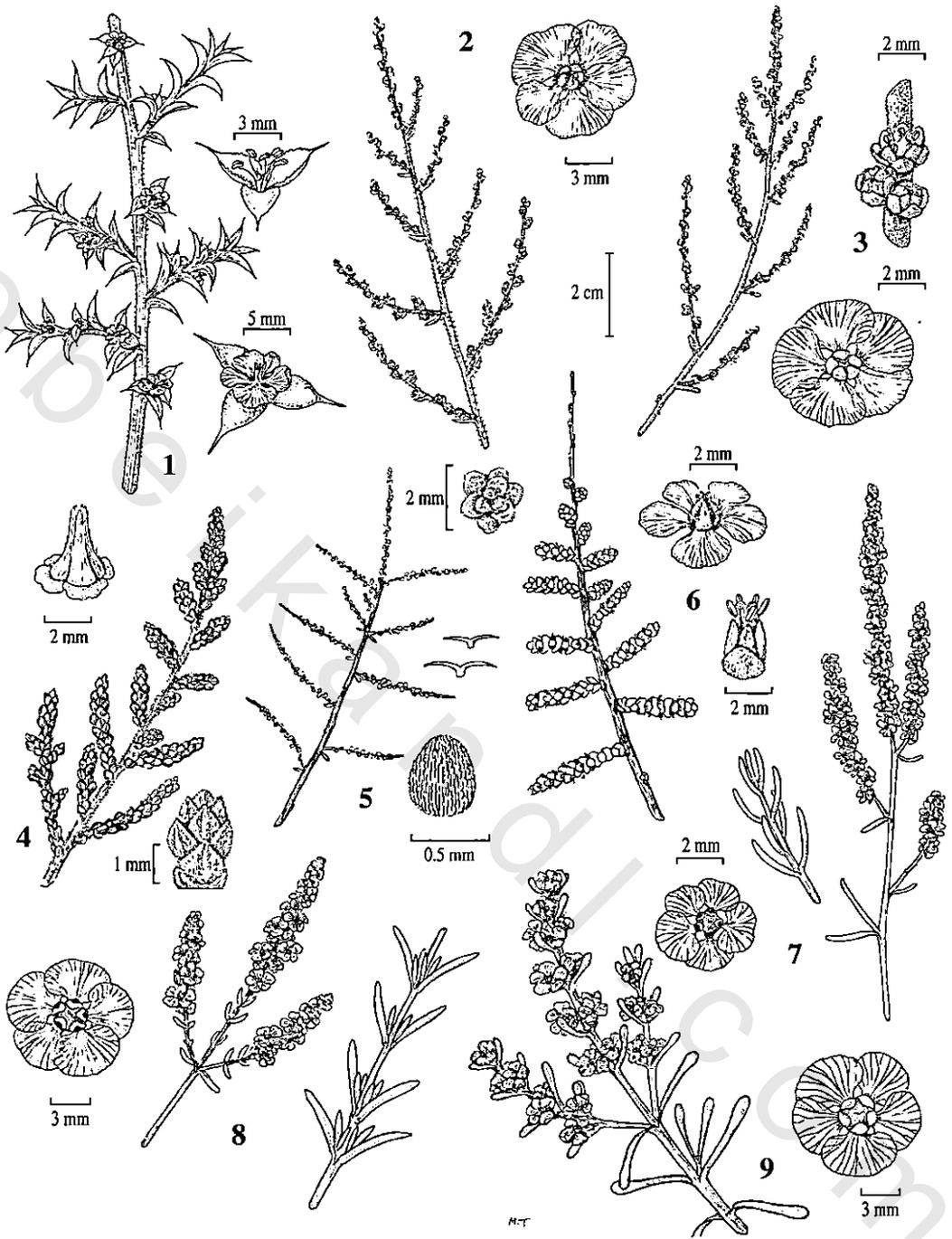


Plate 23. CHENOPODIACEAE: *Salsola kali* 1, flowering and fruiting branch; flower (up right); fruit (down right). *Salsola volkensis* 2, flowering and fruiting branch; fruit (up right). *Salsola inermis* 3, flowering and fruiting branch; flowering branch (up right); fruit (down right). *Salsola tetragona* 4, flowering and fruiting branch; fruit (up left); leafy branch (down right). *Salsola spinescens* 5, flowering and fruiting branch; medifixed hairs (up right); bract (down right). *Salsola cyclophylla* 6, flowering and fruiting branch; leaves (up left); fruit (up right); flower (down right). *Salsola schweinfurthii* 7, fruiting branch; leafy branch and fruit (left). *Salsola longifolia* 8, fruiting branch; fruit (left); leafy branch (right). *Seidlitzia rosmarinus* 9, fruiting branch; fruit (down right). All drawings to the same scale except enlarged parts (scale given).

15. *Seidlitzia* Bunge ex Bioss

Shrubs or annual herbs, glabrous; branches opposite; leaves opposite, cylindrical, succulent, thickening towards the tip; flowers bisexual, solitary or in axillary clusters; floral bracts 2; perianth-segments 5, connate at the base; stamens 5, exerted; staminodes 5, glandular-ciliate, fused into a disc with the bases of the filaments; stigmas 2; fruit a utricle; fruiting perianth spoon-shaped below the wings; wings subequal; seeds horizontal; embryo spiral. 7 species, Macaronesia, Mediterranean region, Sinai to Central Asia and Iran.

1. *Seidlitzia rosmarinus* Bunge ex Bioss., Fl. Orient. 4: 951 (1879).

Syns. *Suaeda rosmarinus* Ehrenb. ex Bioss., Fl. Orient. 4: 951 (1879), pro syn.

Salsola rosmarinus (Bunge ex Boiss.) Solms, Bot. Zeitung (Berlin) 59: 171 (1901).

Shrub 30-80 cm; stems much branched; younger branches white, glossy; leaves 0.5-3.5 x 0.1-0.3 cm, opposite, sessile, cylindrical, thickening towards the rounded tip, tapering towards the clasping and decurrent base, often curved, with a tuft of white hairs in the axil; flowers 2-5 in axillary clusters; perianth-segments obtuse; fruit 0.8-1.1 cm diam., including the wings.

De, S; stony wadis, saline soils. Egypt, Southwest Asia eastwards to Afghanistan.

16. *Haloxylon* Bunge

Syn. *Hammada* Iljin

Herbs with woody base (not in Egypt), shrubs or small trees; stems cylindrical, jointed; leaves opposite, connate, scale-like or rudimentary; flowers solitary, axillary, small, bisexual or male, bracteoles 2; perianth-segments 5, membranous, free or connate at the base; fruiting perianth developing horizontal wings near the middle; stamens 5, the filaments connate at the base on a hypogynous disc; staminodes 5, connate with the filaments; styles 2-3, short, thick; stigmas 2-5, filiform; fruit included in the perianth; seeds horizontal; embryo spiral. 25 species, Mediterranean region, Asia.

1. Small tree to 3 m; staminodes thin, glabrous; stigmas 5 1. *H. persicum* 2
+ Shrubs to 60 cm; staminodes thick, papillose-glandular; stigmas 2-3

2. Plants velvety-canescens; leaves 0.8-1 cm 4. *H. negevensis* 3
+ Plants glabrous; leaves reduced to minute scales forming a cup at the joint

3. Branches becoming blackish by age; fruiting perianth 4-6 mm diam. including the wings, flower-spikes 2-3 cm 3. *H. scoparium*

+ Branches becoming yellowish-white by age; fruiting perianth 6-8 mm diam. including the wings; flower-spikes 3-6 cm 2. *H. salicornicum*

1. *Haloxylon persicum* Bunge, Nouv. Mém. Soc. Imp. Naturalistes Moscou 12: 189 (1860).

Small tree or shrub to 3 m, trunk 10-25 cm in girth; stems richly branched, glabrous; young branches slender, green; leaves 0.5-1.25 mm, scale-like, acute, connate into a cup, with a tuft of short hairs in the axil; flowers on short spicate branchlets; stamens

exserted; staminodes thin, membranous, glabrous; stigmas 5, sessile; fruiting perianth with wings 7-9 mm diam., entire, almost equal.

De, S; stony wadis. Egypt, Southwest and Central Asia.

2. **Haloxylon salicornicum** (Moq.) Bunge ex Boiss., Fl. Orient. 4: 949 (1879).

Syns. *Caroxylon salicornicum* Moq. in A. DC., Prodr. 13(2): 174 (1849).

Hammada articulatum (Cav.) Bunge, Mém. Sav. Etr. Pétersb. 7: 468 (1851), nom. illeg.

Hammada salicornica (Moq.) Iljin, Bot. Zhurn. 33: 583 (1984).

Haloxylon schweinfurthii Asch., Mém. Inst. Egypt. 2: 128 (1887).

Hammada elegans (Bunge) Botsch., Novosti Sist. Vyss. Rast. 1: 362 (1964).

Shrub 25-60 cm; stems richly branched, the old branches with yellowish-white cracking bark; leaves scale-like, shortly triangular, connate into a cup, the margins membranous, densely woolly in the axils; flowers in dense slender spikes 3-6 cm; staminodes linear-ovate, papillose at the tip; stigmas 2, club-shaped; fruiting perianth 6-8 mm diam. including the wings; wings unequal, ovate-orbicular, overlapping greenish-yellow, pink or pale brown; seeds 1.25 mm.

O, M, D, R, S; sandy and stony deserts and wadis. North Africa, Northwest Asia.

3. **Haloxylon scoparium** Pomel, Nouv. Mat. Fl. Atlant. 335 (1875).

Syns. *Salsola articulata* Cav., Icon. 3: 43, t. 284 (1794), non Forssk., Fl.

Aegypt.-Arab. 55 (1775).

Hammada scoparia (Pomel) Iljin, Bot. Zhurn. 33: 583 (1948).

Haloxylon articulatum (Cav.) Bunge, Mém. Sav. Etr. Pétersb. 7: 468 (1851), nom. illeg.

Shrub 20-40 cm, glabrous; stems erect, woody, richly branched, the branches fleshy, greyish-green, becoming blackish by age; leaves reduced to minute triangular scales, connate into a cup, minutely villose; flowers with 2 bracteoles; perianth-segments scarious-margined; stamens 5, alternating with 5 semiglobular staminodes, papillose on the margins; stigmas 2-3; fruiting perianth 4-6 mm including the wings; wings almost equal, broadly-obovate to suborbicular.

M, D, S; stony and sandy deserts. Spain, North Africa, East Mediterranean region, Sinai.

4. **Haloxylon negevensis** (Iljin & Zohary) Boulos, Fl. Egypt Checklist 26 (1995).

Syn. *Hammada negevensis* Iljin & Zohary, Novosti Sist. Vyss. Rast. 1: 71 (1964).

Shrub 20-40 cm, velvety-canescens; stems erect, with woody base; branchlets succulent, internodes remote; leaves 0.8-1 cm, thick, linear, soon deciduous; flowers in the axils of short bracts, forming terminal spikes on the young branches; bracteoles (1-)2, equalling the flowers, ovate-orbicular, margins ciliate; perianth-segments 2-3 mm, ovate, apiculate, hairy inside; staminodes with papillose margins; fruiting perianth 7-8 mm including the wings; wings almost equal.

S; stony deserts. Sinai, South Palestine.

17. *Noaea* Moq.

Shrubs or annual herbs; stems rigid, the branches thorny; leaves alternate; flowers bisexual, solitary; floral bracts 2; perianth-segments 5, shortly connate at the base; stamens 5, on a fleshy lobed disc; anthers sagittate; staminodes 0; stigmas 2, recurved; fruiting perianth winged, membranous; fruit a utricle, included but not adherent to the perianth; seeds vertical, compressed, orbicular; embryo spiral. 3 species, Europe, North Africa, West Asia.

1. *Noaea mucronata* (Forssk.) Asch. & Schweinf., Mém. Inst. Egypt. 2: 131 (1887).

Syns. *Salsola mucronata* Frossk., Fl. Aegypt.-Arab. 56 (1775).

Noaea spinosissima (L. f.) Moq. in A. DC., Prodr. 13(2): 209 (1849).

Shrub 20-80 cm; stems sprawling, branched, the old branches with greyish fissured bark, young branches glabrous, terminating in a sharp spine; leaves 0.3-1.2 x 0.1-0.2 cm, narrowly-linear, semiterete, mucronate, slightly decurrent at the base, caducous; flowers axillary, in loose or dense spikes; floral bracts 3-4 x 1.5-2 mm, apiculate; perianth-segments 4 mm; fruiting perianth winged; wings 5-7 mm diam., membranous, whitish or reddish; seeds 2 mm, discoid; testa membranous.

M, De, S; rocky wadis. North Africa, East Mediterranean region, Sinai, Saudi Arabia to Central Asia.

18. *Anabasis* L.

Shrubs, subshrubs or perennial herbs; stems articulate, often succulent; leaves opposite, fleshy, connate and amplexicaul or reduced to scales; flowers bisexual and female, axillary, solitary or rarely in clusters, subtended by 2 bracteoles; perianth-segments 5, free, with 2 dense fleece bundles within, in fruit 3 or 5 of them developing a transverse wing on the back; stamens 5, staminodes 5; stigmas 2; fruit a fleshy utricle, included within the winged perianth; seeds vertical, lenticular; endosperm absent; embryo spiral. 42 species, Mediterranean region, West and Central Asia.

1. Leaves 0.5-1.5 cm; lateral branches fleshy; flowers 3-7, in clusters **1. *A. setifera***
+ Leaves reduced to cupules; lateral branches not or slightly fleshy; flowers solitary,
not in clusters 2

2. Fruiting perianth 3-winged; ovary smooth **4. *A. syriaca***
+ Fruiting perianth 5-winged; ovary papillose 3

3. Nodes pale green, thick, to 9 x 4 mm; leaves obtuse-mucronate; woolly hairs
in leaf axils dense **2. *A. articulata***
+ Nodes green, thin, to 1.2 x 0.2 cm; leaves ending with a cuspidate,
often recurved tip; woolly hairs in leaf axils few **3. *A. oropediorum***

1. *Anabasis setifera* Moq., Chenop. Monogr. Enum. 164 (1840).

Subshrub 30-60 cm, glabrous; stems richly branched, the old branches woody with split bark, the lateral branches fleshy, 4-angled, papillose; leaves 0.5-1.5 cm, cylindrical or clavate, usually spreading, with a terminal caducous bristle; flowers 3-7, in axillary clusters on the upper parts of the stems; perianth-segments 1.2 mm; stamens 1 mm;

staminodes minute; ovary papillose; fruiting perianth 5 mm diam. including the wings; wings 5, unequal, membranous, yellowish-white; seeds vertical.

De, R, GE, S; sandy and stony wadis. Egypt, Palestine, Arabia, eastwards to Pakistan.

2. **Anabasis articulata** (Forssk.) Moq. in A. DC., Pordr. 13(2): 212 (1849).

Syn. *Salsola articulata* Forssk., Fl. Aegypt.-Arab. 55 (1775).

Shrub 30-80 cm; stems with split bark; branches opposite, brittle; nodes pale green, thick, to 9 x 4 mm; leaves reduced to a 2-lobed cupule, with obtuse-mucronate tips and dense woolly hairs in their axils; flowers solitary, opposite, in spikes at the ends of branches; perianth-segments membranous; stamens 5, exerted; staminodes, ovary and stigmas papillose; fruiting perianth membranous; wings 5, 5-7 mm diam., almost equal, ovate-orbicular, whitish to dull pinkish; utricle erect; seeds vertical.

O, M, D, S; stony and sandy wadis. South Spain, North Africa, Sinai, Palestine, Arabia.

NOTE: Heavily browsed by camels and goats.

3. **Anabasis oropediorum** Maire, Bull. Soc. Hist. Nat. Afr. Nord 29: 447 (1938).

Syn. *Anabasis articulata* subsp. *oropediorum* (Maire) Ozenda, Fl. Sahara 235 (1958).

Like *A. articulata* but nodes green, thin and longer, to 1.2 x 0.2 cm; leaf cupules longer, broadly scarious-margined, ciliate, ending with a well-developed cuspidate, often recurved tip; woolly hairs in the leaf axils few and wings of fruiting perianth 7-8 mm diam.

M, De, S; North Africa, Sinai.

NOTE: Not browsed by camels or goats.

4. **Anabasis syriaca** Iljin, Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk SSSR 7: 215 (1938).

Syns. *Anabasis zoharyi* Iljin, Novosti Sist. Vyss. Rast. 1: 74 (1964).

Anabasis syriaca var. *zoharyi* (Iljin) Zohary, Fl. Palaest. 1: 177 (1966).

Anabasis haussknechtii, sensu Täckh., Stud. Fl. Egypt, ed. 2, 128 (1974).

Anabasis aphylla, auct.

Shrublet 20-50 cm, glabrous, white-glaucous; stems woody in the lower parts, branched mainly from the base; branches long, herbaceous, slightly fleshy; internodes long, to 2.5 cm; leaves reduced to a short cupule with 2 triangular acute lobes; juvenile cupules longer, mucronate; leaf axils slightly woolly; inflorescence often much branched into a panicle of many spikes; flowers solitary, opposite; stamens exerted; staminodes thin below, thick at the apex; ovary smooth; fruiting perianth with 3 wings, 6 x 5-9 mm, subequal, semiorbicular-reniform; utricle erect, free, included; seeds vertical.

S; stony wadis. Sinai, Palestine, Syria.

19. *Cornulaca* Delile

Shrubs or perennial herbs, rarely annuals; leaves alternate, sessile, rigid, triangular or needle-like, aristate or spine-tipped, the axils with white woolly hair tufts; flowers bisexual, in 1- to 8-flowered axillary clusters, subtended by a leaf-like bract and 2 bracteoles; perianth-segments 5, hyaline, free, becoming indurate and fused in fruit; stamens 5; filaments short, elongating after anthesis, monadelphous; ovary ovoid; stigmas 2; seeds vertical; endosperm absent; embryo spirally coiled. 6 species, Sahara, Sinai, Arabia to Central Asia.

1. Erect shrub to 80 cm high; leaves not decurrent; desert plants
+ Sprawling shrub to 35 cm high, 2 m across; leaves decurrent;
coastal plants

1. *C. monacantha*

2. *C. ehrenbergii*

1. *Cornulaca monacantha* Delile, Descr. Egypte, Hist. Nat. 206, t. 22, f. 3 (1814).
Syn. *Cornulaca aucheri*, sensu Täckh., Stud. Fl. Egypt, ed. 2, 130 (1974).

Shrub to 80 cm, erect; stems woody, richly branched, usually with long internodes, old stems with cracking bark; leaves 0.3-1.1 cm, triangular or triangular-subulate, subulate or acicular, with a broad, rounded base; flowers 2-5 in axillary clusters, surrounded by dense tufts of white woolly hairs to 5 mm, the clusters usually well separated, rarely congested; bracts to 8 mm, triangular-subulate or -aristate, recurved; bracteoles shorter, straight; perianth-segments 2.5-3 mm; filaments 2-3 mm, fused in the basal part, with papillose appendages between the bases of the free tips; anthers 1.5 mm; ovary ovoid; fruiting perianth 3-4 mm, pyriform; seeds 1.25 mm, rounded, compressed, yellowish.

O, M, D, S; sandy plains and desert wadis. Tropical West Africa, Sahara, North Africa, Southwest Asia to Pakistan.

2. *Cornulaca ehrenbergii* Asch. in Schweinf., Beitr. Fl. Aethiop. 184 (1867).

Sprawling shrub to 35 cm high and 2 m across; stems richly branched, the older stems with flaking bark; leaves 6-9 mm, broadly triangular-ovate, leathery, decurrent; the base 4-6 mm, clasping and completely concealing the young stems, the free part 2-3 mm, with an acute spiny tip 1 mm; flowers solitary; perianth-segments 2-2.5 mm, linear-oblong, membranous, obtuse, pilose at the base; stamen filaments 1.75-2 mm; stigmas short; fruit not seen.

R (Cap Elba and islands); coastal dunes. Egypt, Sudan, Ethiopia, Somalia, Saudi Arabia, southern Yemen.

20. *Agathophora* (Fenzl) Bunge

Subshrubs, richly branched; leaves alternate, fleshy, subglobose to cylindrical or clavate, spine-tipped (spine sometimes caducous in older leaves); leaf axil with a thick tuft of long hairs and a few reduced leaves; flowers sessile, in glomerules, 2-bracteate; perianth-segments 5, free, membranous; stamens 5; stigmas 2; fruiting perianth with horizontal membranous wings, at or just above the middle; fruit ovoid; style persistent; pericarp membranous; seeds vertical; embryo spiral. 1 species, North Africa, Sinai, eastwards to Pakistan.

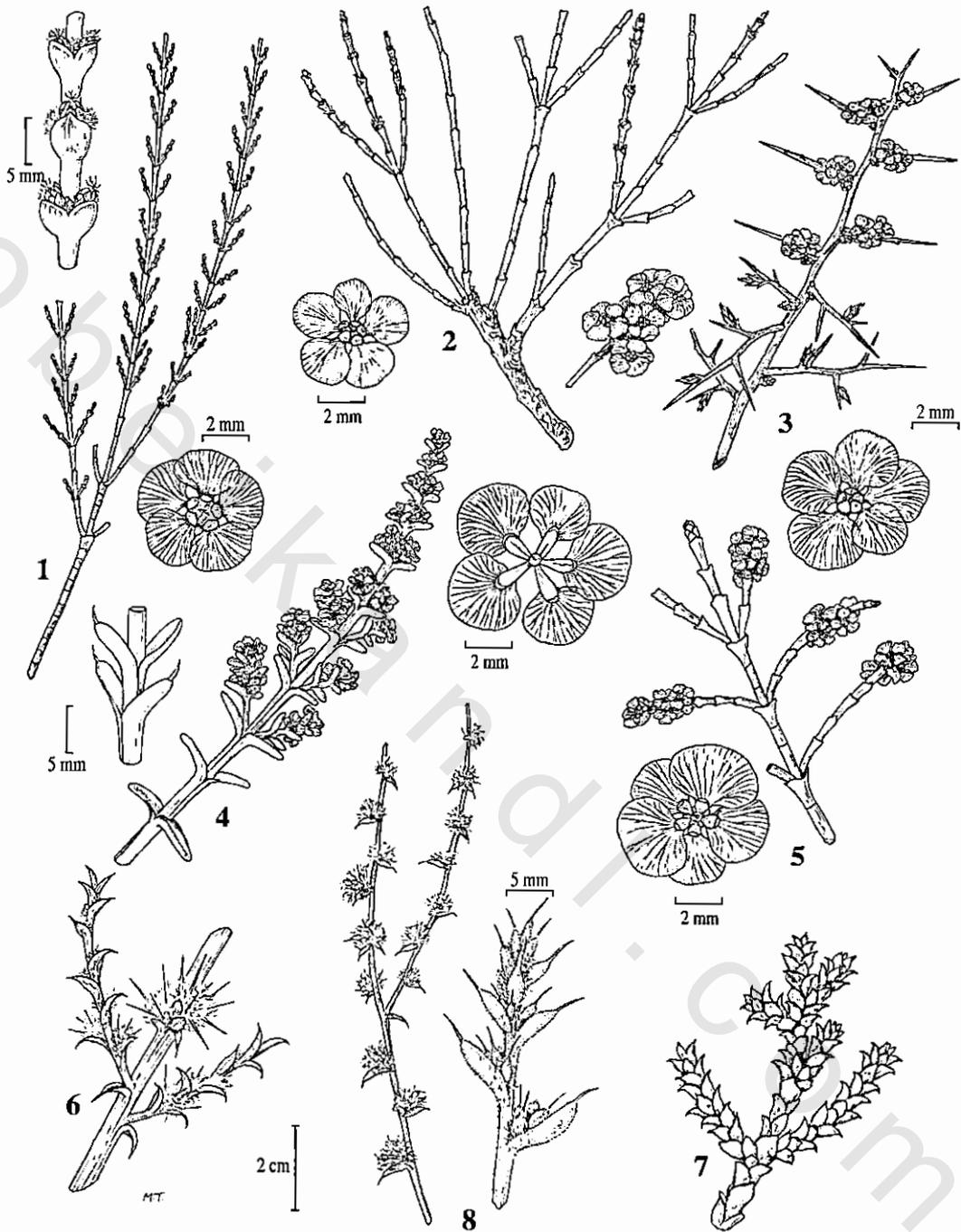


Plate 24. CHENOPODIACEAE: *Haloxylon persicum* 1, flowering branch; flowers (up left); fruit (down right). *Haloxylon salicornicum* 2, flowering branch; fruiting branch (down right); fruit (down left). *Noaea mucronata* 3, fruiting branch; fruit (down right). *Anabasis setifera* 4, fruiting branch; fruit (up right); leaves (down left). *Anabasis articulata* 5, fruiting branch; fruit (down left). *Cornulaca monacantha* 6, fruiting branch. *Cornulaca ehrenbergii* 7, leafy branch. *Agathophora alopecuroides* 8, flowering and leafy branches. All drawings to the same scale except enlarged parts (scale given).

1. **Agathophora alopecuroides** (Delile) Fenzl ex Bunge, Mém. Acad. Sci. Pétersb., sér. 7, 4(11): 92 (1862).

Syns. *Salsola alopecuroides* Delile, Descr. Egypte, Hist. Nat. 200, t. 21, f. 1 (1814).

Halogeton alopecuroides (Delile) Moq., Chenop. Monogr. Enum. 161 (1840).

Anabasis alopecuroides (Delile) Moq. in A. DC., Prodr. 13(2): 210 (1849).

Subshrub 20-50 cm; stems richly branched, young branches white; leaves 1.3-1.8 cm, spine-tipped; flowers in glomerules of 3-10(-15) flowers in the leaf axils of upper branches; bracts ovate, fleshy, spine-tipped, with a tuft of hairs in the axil; fruiting perianth 3-5 winged, 3 wings of equal size and the other 2, if developed, much smaller.

Two varieties occur in Egypt:

var. alopecuroides

Syns. *Salsola postii* Eig, Pal. J. Bot., Jerusalem ser., 3(3): 131, f. 4 (1945);

Aellenia postii (Eig) Aellen in Mouterde, Fl. Djebel Druze 87 (1953).

Agathophora postii (Eig) Botsch., Bot. Zhurn. 62(10): 1449 (1977).

Agathophora galalensis Botsch., Bot. Zhurn. 62(10): 1450 (1977).

Branches and leaves glabrous; upper part of leaves around glomerules terete, twice as long as wide.

D, S; stony and sandy wadis, escarpments and desert plains. North Africa, Sinai, eastwards to Pakistan.

var. papillosa (Maire) Boulos, Kew Bull. 47: 284 (1992).

Syns. *Halogeton alopecuroides* (Delile) Moq. var. *papillosus* Maire, Bull. Soc.

Hist. Nat. Afr. Nord 34: 190 (1934).

Halogeton alopecuroides var. *papillosus* Eig, Pal. J. Bot., Jerusalem ser.

3(3): 137 (1945).

Agathophora iraqensis Botsch., Bot. Zhurn. 62(10): 1451 (1977).

Agathophora algeriensis Botsch., Bot. Zhurn. 62(10): 1452 (1977).

Branches and leaves papillose-hispid; upper part of leaves around glomerules terete, twice as long as wide.

D, S; stony and sandy plains, wadis and escarpments. North Africa, Sinai, eastwards to Pakistan.

AMARANTHACEAE

Annual and perennial herbs, rarely shrubs; leaves simple, alternate or opposite, entire; flowers bisexual, or unisexual on monoecious or dioecious plants, in spicate or capitate, bracteate inflorescences, or in few-flowered cymes; perianth dry and scarious, usually 4- or 5-merous; perianth-segments free or connate at the base; stamens 1-5, opposite the perianth-segments; ovary superior, 1-locular; fruit an achene or small nut or 1-seeded capsule, with a membranous, rarely fleshy wall; seeds with rich starchy perisperm. 71 genera, 800 species, tropical and warm regions, some cosmopolitan weeds.

1. Leaves alternate	2
+ Leaves opposite (alternate leaves may occur in <i>Psilotrichum</i>)	4
2. Flowers densely white-woolly	3. Aerva
+ Flowers not densely white-woolly	3
3. Flowers unisexual	1. Amaranthus
+ Flowers bisexual	2. Digera
4. Sterile flowers present, modified into sharply hooked spines	4. Pupalia
+ Sterile flowers absent, all flowers fertile	5
5. Inflorescence sessile, axillary	7. Alternanthera
+ Inflorescence not sessile and axillary	6
6. Fruits distinctly deflexed; perianth-segments glabrous, obscurely nerved	5. Achyranthes
+ Fruit not distinctly deflexed; perianth-segments multinerved, with short appressed hairs	6. Psilotrichum

1. **Amaranthus L.**

Annual or rarely perennial herbs, monoecious or dioecious; leaves alternate, simple, entire or sinuate; inflorescence cymose, bracteate, consisting of dense or lax axillary clusters, or upper clusters leafless forming a spike or panicle; flowers 2-bracteolate; perianth-segments 3-5, free or connate at the base, membranous, slightly accrescent in fruit in female flowers; stamens free, usually equal in number of perianth-segments; style short or absent; stigmas 2-3, ovule 1, erect; fruit a 1-seeded indehiscent capsule, irregularly rupturing or dehiscent by a circumscissile lid; seeds usually black, glossy; testa thin; embryo annular, endosperm present. About 60 species, tropical and warm regions, few cosmopolitan weeds.

1. Leaf axils with 2 spines	4. A. spinosus
+ Leaf axils without spines	2
2. Plants dioecious	10. A. palmeri
+ Plants monoecious	3
3. Inflorescence composed of cymose clusters	5. A. tricolor
+ Inflorescence of spikes	4
4. Spikes all axillary	5
+ Spikes axillary and terminal	7
5. Perianth of female flowers 4- to 5-merous, rarely 3-merous	11. A. blitoides
+ Perianth of female flowers 3-merous	6
6. Bracteoles twice as long as the perianth, spinose	6. A. albus
+ Bracteoles shorter than the perianth	7. A. graecizans
7. Perianth 3-merous; capsule indehiscent	8

+ Perianth 5-merous; capsule dehiscent

9

8. Fruit strongly muricate, subglobose, equalling or slightly longer than the perianth

9. **A. viridis**

+ Fruit slightly rugose, broadly ellipsoid, distinctly exceeding the perianth

8. **A. lividus**

9. All spikes more or less equal in length; perianth-segments with a green midrib which ceases below the apex or excurrent in a short colourless mucro

3. **A. retroflexus**

+ Terminal spike much longer than the laterals; perianth-segments with a yellow or greenish midrib, excurrent in a reddish arista

10

10. Perianth-segments of female flowers broadly obovate or broadly spatulate, imbricate

1. **A. caudatus**

+ Perianth-segments of female flowers narrowly obovate or narrowly spatulate, not imbricate

2. **A. hybridus**

1. **Amaranthus caudatus** L., Sp. Pl., ed. 1, 990 (1753).

Syn. *Amaranthus sanguineus* L., Sp. Pl., ed. 2, 1407 (1763).

Annual herb 30-80 cm, usually reddish or purplish throughout; stems stout, not or sparingly branched, glabrous or thinly furnished with multicellular hairs; leaves 2.5-12 x 1-7.5 cm, glabrous or pilose along the margins and the lower surface, broadly ovate to ovate-elliptic, obtuse to subacute at the mucronate apex, base shortly cuneate to attenuate; flowers in axillary and terminal spikes formed of approximated cymose clusters; the terminal inflorescence a tail-like pendulous spike to 25 cm, or a panicle; male and female flowers intermixed; bracts and bracteoles 2-3 mm, deltoid-ovate, acuminate, with a long arista formed by the excurrent midrib; perianth-segments 5, in male flowers 2.5-3 mm, acute, aristate; in female flowers 1.5-2.75 mm, distinctly imbricate, the tip mucronate; stigmas 3, 1-2 mm; capsule 2-2.5 mm, ovoid-globose; seeds 1-1.25 mm, ovate, blackish, smooth, glossy, with a thick margin.

N, O, M, S; weed of cultivation, naturalized; native of South America.

NOTE: Often cultivated as an ornamental plant in gardens and less frequently as a grain crop.

2. **Amaranthus hybridus** L., Sp. Pl., ed. 1, 900 (1753).

Annual herb 0.6-2 m, tinted green or reddish; stems stout, branched, angular, glabrous or furnished with multicellular hairs especially in the inflorescences; leaves 2-15 x 1-6 cm, glabrous or thinly pilose on the margins and lower surface, broadly lanceolate, rhomboid or ovate, obtuse to acute at the mucronate tip, the base attenuate or shortly cuneate; flowers in yellowish, reddish or purplish axillary and terminal spikes formed of cymose clusters; the terminal inflorescence a single spike or a much-branched panicle; male and female flowers intermixed; bracts and bracteoles deltoid-ovate to lanceolate, pale, membranous, acuminate, with a long erect arista formed by the stout excurrent midrib; bracteoles of female flowers equalling or much exceeding the perianth; perianth-segments 5, 1.5-3 mm, narrowly spatulate to lanceolate or oblong, acute-aristate; stigmas (2-)3, 0.5-1.25 mm; capsule 2-3 mm, subglobose to ovoid; seeds 0.75-1.25 mm, almost smooth, black, glossy or pale, faintly reticulate around the margins.

Two subspecies occur in Egypt:

subsp. **hybridus**

Syns. *Amaranthus hypochondriacus* L., Sp. Pl., ed. 1, 991, (1753).
Amaranthus chlorostachys Willd., Hist. Amaranth., 34, t. 10, f. 19 (1790).
Amaranthus patulus Bertel., Comment. It. Neap. 19, t. 2 (1837).

Longer bracteole of female flowers 1½-2 times as long as the perianth-segments.

N, O, M, S; weed of cultivation, naturalized.

subsp. **cruentus** (L.) Thell., Fl. Adv. Montpellier 205 (1912).

Syns. *Amaranthus cruentus* L., Syst. Nat., ed. 10, 2: 1269 (1759).
Amaranthus paniculatus L., Sp. Pl., ed. 2, 1406 (1763).

Longer bracteole of female flowers 1-1½ times as long as the perianth-segments.

N, O, M, S; weed of cultivation, naturalized.

Area of the species: Tropical and subtropical America, naturalized elsewhere.

3. **Amaranthus retroflexus** L., Sp. Pl., ed. 1, 991 (1753).

Syns. *Amaranthus delilei* Loret, Bull. Soc. Bot. Fr. 13: 316 (1866).

Annual herb 15-80 cm; stems erect or ascending; leaves 3.5-10 x 3-6 cm, ovate-rhombic; base cuneate to attenuate; petiole to 6 cm; inflorescence spicate, stout, short and dense; bracteoles 4-6 mm, stout, spinescent, 1½-2 times as long as the perianth; perianth-segments 5, 2-3 mm, oblong-spathulate, obtuse or emarginate, with a short mucro; stigmas 2-3; capsule 2 mm, subglobose, dehiscent transversely; seeds 1 mm, black or reddish-brown, glossy, slightly compressed, reticulate along the margins.

N, M, S; weed of cultivation, naturalized; native of North America.

4. **Amaranthus spinosus** L., Sp. Pl., ed. 1, 991 (1753).

Annual herb 20-80 cm; stems erect, simple or branched, angular; leaves 1.5-6 x 1-3 cm, ovate-rhomboid, elliptic or lanceolate, the apex blunt or retuse, with a fine mucro, the base cuneate or attenuate; petiole 1-4 cm; each leaf axil with a pair of stout spines 0.5-1.2 cm; inflorescence axillary and terminal, spicate, often with remote axillary clusters, lower clusters pistillate, the upper staminate; bracts and bracteoles deltoid-ovate, with a reddish awn formed by the excurrent midrib; perianth-segments 5, 1-2.25 mm; stigmas (2-)3, 1-1.5 mm; capsule 1.5-2 mm, ovoid-urceolate, dehiscent transversely; seeds 0.75-1 mm, lenticular, black, glossy, faintly reticulate.

N (Cairo); weed of cultivation, naturalized, of American origin.

5. **Amaranthus tricolor** L., Sp. Pl., ed. 1, 989 (1753).

Syns. *Amaranthus tristis* L., Sp., Pl., ed. 1, 989 (1753).
Amaranthus melancholicus L., Sp. Pl., ed. 1, 989 (1753).
Amaranthus mangostanus L., Cent. Pl. 1: 32 (1755).

Amaranthus gangeticus L., Syst. Nat., ed. 10, 1268 (1759).

Annual herb 0.3-1.2 m; stems erect or ascending, branched, angular; leaves 4-8.5 x 2.5-4.5 cm, broadly ovate to lanceolate-oblong, the apex obtuse or acute, the base cuneate to attenuate; petiole 2.5-5 cm; flowers green or crimson, in axillary globose clusters; bracts and bracteoles shorter than the perianth; perianth-segments 3, 3-5 mm, oblong-elliptic or elliptic; stigmas 3, to 2 mm; capsule 2.5-3 mm, ovoid, dehiscent transversely, obscurely wrinkled; fully matured seeds rare.

N, M; grown as a summer garden plant, also an escape from cultivation, native of tropical Asia.

NOTE: The plant is cultivated in the tropics as an ornamental and pot herb.

6. *Amaranthus albus* L., Syst. Nat., ed. 10, 2: 1268 (1759).

Annual herb 20-60 cm; stems erect or procumbent, much-branched; leaves 2-3 x 2-6 cm, oblong or spatulate; margin undulate; apex obtuse to slightly emarginate, mucronate, base cuneate; inflorescence of short, axillary cymose clusters; bracteoles twice as long as the perianth-segments, with spinose apex; perianth-segments 3, narrowly elliptic; capsule 1.5-1.75 mm, dehiscent transversely, slightly muricate.

N, O; weed of cultivation. Temperate regions of the world..

7. *Amaranthus graecizans* L., Sp. Pl., ed. 1, 990 (1753).

Syns. *Amaranthus angustifolius* Lam., Encycl. 1: 115 (1783), nom. illeg.

Amaranthus aschersonianus (Thell.) Chiov., Nuovo Giorn. Bot. Ital., ser. 2, 25, 103 (1919).

Annual herb 15-70 cm; stems erect, branched, glabrous; leaves 1-5.5 x 0.5-2.5 cm, broadly ovate to narrowly linear-lanceolate; apex obtuse to acute or retuse and mucronate; the base cuneate to long-attenuate; petiole 0.5-4.5 cm; flowers in globose axillary clusters; the male flowers more in upper whorls; bracteoles slightly shorter than the perianth-segments, ovate, mucronate; perianth-segments 3, 1.25-2 mm, ovate-lanceolate, acute; capsule 2-2.5 mm, subglobose, dehiscent transversely, with greenish longitudinal veins before ripening; seeds 1-1.5 mm, compressed, black or dark brown, glossy, slightly reticulate.

Three subspecies occur in Egypt:

- | | |
|--|-----------------------------|
| 1. Leaves less than 2½ times as long as broad | subsp. silvestris |
| + Leaves at least 2½ times, as long as broad | 2 |
| 2. Bracteoles and perianth-segments abruptly narrowed above, with a mucro to 0.25 mm | subsp. graecizans |
| + Bracteoles and perianth-segments gradually narrowed above, with a mucro 0.3-0.8 mm | subsp. thellungianus |

subsp. **graecizans**

N, O, R, GE, S; weed of cultivation and waste ground.



Plate 25. AMARANTHACEAE: flowering and fruiting branches of: *Amaranthus hybridus* subsp. *hybridus* 1; 2, capsule. *Amaranthus retroflexus* 3; 4, capsule. *Amaranthus spinosus* 5. *Amaranthus albus* 6. *Amaranthus graecizans* subsp. *graecizans* 7. *Amaranthus viridis* 8; 9, capsule. *Amaranthus blitoides* 10; 11, part of the inflorescence showing the bracts and bracteoles. All drawings to the same scale except enlarged parts (scale given).

subsp. **thellungianus** (Nevski) Gusev, Bot. Zhurn. 57: 462 (1972).

Syns. *Amaranthus thellungianus* Nevski, Acta Inst. Bot. Acad. Sci. USSR, ser. 1, 4: 311 (1937).

Amaranthus polygonoides, sensu Täckh., Stud. Fl. Egypt, ed. 2, 133 (1974).

N, R, S; weed of cultivation and waste ground.

subsp. **silvestris** (Vill.) Brenan, Watsonia 4: 237 (1961)

Syns. *Amaranthus silvestris* Vill., Cat. Pl. Jard. Strasbourg 111 (1807).

N, M, S; weed of cultivation and waste ground.

Area of the species: Warm temperate and tropical regions of the Old World.

8. **Amaranthus lividus** L., Sp. Pl., ed. 1, 990 (1753).

Syns. *Amaranthus blitum* L., Sp. Pl., ed. 1, 990 (1753).

Amaranthus oleraceus L., Sp., Pl., ed. 2, 1403 (1763).

Amaranthus ascendens Loisel., Not. Fl. France 141 (1810).

Annual herb 15-60 cm; stems ascending or erect, branched; leaves 1.5-7.5 x 0.5-5.5 cm, rhombic to broadly ovate, with dark spots on the upper surface, the margins usually undulate, the apex truncate or emarginate; inflorescence of axillary cymose clusters, forming a dense leafless spike towards the apex; bracteoles about 1/2 as long as the perianth, ovate, acute; perianth-segments 3, 1-2 mm, oblong-linear to spatulate; capsule 1.5-2 mm, broadly ellipsoid, indehiscent or dehiscent irregularly; seeds 1-1.75 mm, compressed.

N, M, S; weed of cultivation. Warm and tropical regions of the world.

9. **Amaranthus viridis** L., Sp. Pl., ed. 2, 1405 (1763).

Syns. *Amaranthus gracilis* Poir. in Lam., Encycl. Suppl. 1: 312 (1810).

Albersia caudata (Jacq.) Boiss., Fl. Orient. 4: 992 (1879).

Annual herb 15-75 cm; stems erect to ascending, angular; leaves 1.5-6.5 x 1.5-3 cm, deltoid-ovate to ovate-rhombic; the apex obtuse or slightly emarginate; petiole to 8 cm; flowers in axillary cymose clusters, forming a paniculate terminal inflorescence; bracteoles shorter than the perianth-segments, ovate, acuminate; perianth-segments 3, 1-1.75 mm, ovate-oblong; capsule 1-1.5 mm, subglobose, irregularly dehiscent or indehiscent, strongly muricate.

N, O, M, De, S; cultivated and waste ground and canal banks; the most widespread *Amaranthus* species in Egypt. Tropical, subtropical and temperate regions of the world.

10. **Amaranthus palmeri** S. Watson, Proc. Amer. Acad. Arts 12: 274 (1877).

Dioecious annual herb 0.3-1.5 m; stems stout, erect, branched, sulcate-angular; leaves 2.5-5.5 x 1-2 cm, glabrous, ovate to rhombic, apex obtuse to acute or retuse with a mucro to 1.5 mm; petiole 1-4 cm; inflorescence spicate, leafless, to 25 cm; upper part uninterrupted, composed of male flowers; the lower part interrupted and composed of

female flowers; bracts 2-3 mm; bracteoles 3-5 mm; male flowers with 5 perianth segments; stamens 5, shorter than the perianth; perianth-segments of female flowers unequal, the outer 1.75-3 mm, the inner 1.25-2 mm; stigmas 2, 1.25-1.75 mm.

N (Kom Ombo); weed of cultivation, naturalized from USA and Mexico.

11. **Amaranthus blitoides** S. Watson, Proc. Amer. Acad. Arts 12: 273 (1877).

Annual herb 10-50 cm; stems prostrate or decumbent, much-branched, glabrous, densely leafy; leaves 0.4-1 x 0.1-0.5 mm, white-nerved on the lower surface, obovate to linear-lanceolate, obtuse; the margins membranous; petiole 2-4 mm; inflorescence of short, axillary cymose clusters, leafy to apex; bracteoles shorter than the perianth, lanceolate; perianth-segments 3-5, unequal, similar to the bracteoles, the longest 2-2.5 mm; capsule subglobose, dehiscent transversely; seeds glossy, black or reddish, reticulate.

M, S; weed of cultivated and waste ground, naturalized from Central and western North America.

2. **Digera** Forssk.

Annual herbs, the branches and leaves alternate; flowers small, in long axillary spicate, bracteate racemes; each bract subtending a partial inflorescence of a central fertile flower and 2 highly modified sterile unibracteolate lateral flowers; perianth-segments (4-)5, the outer pair firm, nervose, mucronate, the inner delicate and hyaline; stamens (4-)5, free or slightly connate at the base; filaments filiform; ovary with 1 ovule; style filiform; stigmas 2; fruit indehiscent, the nutlet enclosed by the persistent perianth and falling together with the sterile flowers and bracteoles. 1 species, tropical Asia and Africa.

1. **Digera muricata** (L.) Mart., Nov. Act. Nat. Cur. 13: 285 (1826).

Syns. *Achyranthes muricata* L., Sp. Pl., ed. 2, 295 (1762).

Achyranthes alternifolia L., Mant. 50 (1767).

Digera arvensis Forssk., Fl. Aegypt.-Arab. 65 (1775).

Digera alternifolia (L.) Asch. in Schweinf., Beitr. Fl. Aethiop. 180 (1867).

Annual herb 15-60 cm; stems erect, simple or with ascending branches; leaves 2-6.5 x 0.5-3.5 cm, linear to ovate, the apex acute; petiole to 5 cm; flowers glabrous, white, tinged with pink to red, in long slender or shorter and denser axillary racemes to 30 cm; bracts 1-2.5 mm, persistent, each subtending a partial inflorescence of 3 flowers; central flowers fertile, with 2 firm outer perianth-segments 3-4 mm, 3-10-nerved, the 2-3 inner segments shorter, more delicate, 1- to 3-nerved; stamens subequalling the style; style 2-4 mm; stigmas 2, recurved; lateral flowers appressed, 1-bracteolate, increasingly reduced or absent in the upper part of the spike, modified into scales with lateral lobes; fruit 2-2.5 mm, subglobose, slightly compressed, bluntly keeled along the sides, verrucose; style persistent.

N; waste ground. Tropical Asia and Africa.

NOTE: Occurrence in Egypt needs to be confirmed by new collections.

3. *Aerva* Forssk., nom. conserv.

Perennial herbs or shrubs; stems erect or prostrate; leaves alternate, entire; flowers bisexual or unisexual, dioecious, 2-bracteolate, in axillary and terminal, sessile or pedunculate bracteate spikes, one flower in the axil of each bract; perianth-segments 5, with membranous margins and a green centre, the perianth deciduous with the fruit but bracts and bracteoles persistent; stamens 5, shortly connate at the base, alternating with the pseudostaminodes; ovary with 1 ovule; style short to slender and distinct; stigmas 2; capsule thin-walled, bursting irregularly; seed reniform, compressed, black or brown. 10 species, warm and tropical Old World, mainly Africa.

1. Flowers dioecious, on male or female plants, in long leafless spikes; midrib of outer 2 perianth-segments ceasing well below the apex 1. *A. javanica*
+ Flowers bisexual or unisexual, in separate spikes on the same plant, in short leafy axillary spikes; midrib of outer perianth-segments excurrent 2. *A. lanata*

1. *Aerva javanica* (Burm. f.) Juss. ex Schult. in Roem. & Schult., Syst. Veg., ed. 15, 5, 565 (1819).
Syn. *Iresine javanica* Burm. f., Fl. Ind. 212 (1768).

Shrubs or subshrubs, 0.5-1.5 m, dioecious; stems terete, striate, densely tomentose, white to yellowish; leaves alternate, very variable in size and form, narrowly linear to suborbicular, densely tomentose, sessile or short-petiolate; flowers in sessile spikes to 10 cm, cylindrical, dense and stout, or slender and interrupted with lateral globose clusters; male plants with more slender spikes, upper spikes forming leafless terminal panicles; bracts and bracteoles shorter than the perianth, deltoid-ovate, acute, hyaline, densely lanate, persistent; male flowers small, the outer perianth-segments 1.5-2.25 mm; stamens 5, anthers longer than the filaments and alternating with the triangular or teeth-like pseudostaminodes; rudimentary ovary flask-shaped, with reduced styles and stigmas; female flowers larger; outer 2 tepals 2-3 mm, obovate to spatulate, the inner 3 narrower and shorter; ovary hemispherical; style slender and distinct; stigmas 2, filiform; rudimentary stamens without anthers; capsule 1-1.5 mm, compressed; seed 1-1.25 mm, slightly compressed, black or brown, glossy, smooth or faintly reticulate.

Two varieties occur in Egypt:

var. *javanica*

Spikes cylindrical, dense, usually with terminal panicles in female plants; outer perianth-segments of female flowers c. 3 mm; leaves 2.5-10 x 0.4-2.5 cm, oblong-linear, lanceolate or obovate.

N, O, De, R, GE, S; sandy and stony wadis and desert plains.

var. *bovei* Webb in Hook., Niger Fl. 173 (1849).

Syns. *Aerva bovei* (Webb) Edgew., J. Proc. Linn. Soc. Bot. 6: 206 (1862).

Aerva tomentosa Forssk., Fl. Aegypt.-Arab. CXXII (1775), nom. inval.

Spikes slender, often interrupted, with lateral clusters; outer perianth-segments of female flowers c. 2 mm; leaves 0.8-3 x 0.2-0.5 cm, linear to narrowly linear.

N (Nubia), O, De, R, GE, S; sandy and stony deserts and wadis.

Area of the species: Dry tropics and subtropics of the Old World.

2. **Aerva lanata** (L.) Juss. ex Schult. in Roem. & Schult., Syst. Veg., ed. 15, 5: 564 (1819).

Syns. *Achyranthes lanata* L., Sp. Pl., ed. 1, 204 (1753).

Aerva elegans Moq. in A. DC., Prodr. 13(2): 303 (1849).

Perennial herb, often woody at the base, densely lanate; stems erect or ascending, branched mainly from the base; leaves 1-4.5 x 0.5-2.5 cm, alternate, ovate, suborbicular to lanceolate-elliptic, the apex rounded and apiculate to acute; base cuneate, petiole 0.2-1.5 cm; flowers bisexual or unisexual, in separate spikes on the same plant, in leafy short axillary spikes; male flowers with rudimentary ovary; female flowers with sterile stamens bearing no anthers; bracts and bracteoles 1.25-1.75 mm, ovate to deltoid-ovate, acuminate; tepals 5, 1.75-2.5 mm; bisexual flowers with the outer 2 tepals hyaline, contracted at the tip to a distinct mucro formed by the excurrent nerve; inner 3 tepals shorter and narrower; all tepals densely lanate on the dorsal side; stamens 5, shorter than the tepals, alternating with the pseudostaminodes; ovary subglobose; capsule 1 mm, subglobose; seed 0.7-0.9 mm, the testa faintly reticulate around the margin.

R, GE; stony wadis and sandy coastal plains. Dry tropics and subtropics of the Old World.

4. **Pupalia** A. Juss., nom. conserv.

Annual or perennial herbs or subshrubs; leaves opposite; inflorescence spicate, bracteate; each bract subtending one bisexual flower and 2 modified bracteolate sterile flowers consisting of sharply hooked spines, these at first small, rapidly becoming accrescent and finally in 3 or more stalked clusters of 5-15 spines; tepals 5; stamens 5, connate at the base into a cup; pseudostaminodes absent; style slender; stigma capitate; fruit 1-seeded, irregularly rupturing, shed with the hooked spines of the sterile flowers, serving to distribute of the seed. 4 species, tropical and subtropical regions of the Old World.

1. **Pupalia lappacea** (L.) Juss., Ann. Mus. Hist. Nat. Paris 2: 132 (1803) var. **velutina** (Moq.) Hook f., Fl. Brit. Ind. 4: 724 (1885).

Syns. *Pupalia velutina* Moq. in DC., Prodr. 13(2): 333 (1849).

Pupalia distantiflora A. Rich., Tent. Fl. Abyss. 2: 217 (1850).

Perennial herb 0.5-1.2 m, sparingly to densely hairy; stems erect or prostrate; leaves 1.5-12 x 1-5 cm, ovate, ovate-elliptic to orbicular or oblong; the apex acute or acuminate; petiole 0.2-2.5 cm; inflorescence to 30 cm, elongating in fruit to 50 cm; tepals 4-6 mm, oblong-ovate, lanate on the dorsal side; style 0.8-1 mm, slender; stigma capitate; capsule 2 mm, ovoid; seed oblong-ovoid, brown, the testa faintly reticulate, glossy.

GE; stony wadis and rocky slopes. Tropics of the Old World.

5. **Achyranthes** L.

Perennial herbs; leaves opposite, entire, petiolate; flowers bisexual, becoming deflexed and appressed to the axis, in elongate terminal and axillary spikes; bracts and bracteoles

spine-tipped, with an excurrent midrib; perianth-segments 5, free, indurate at the base in fruit; stamens 5; filaments fused at the base into a short cupule, alternating with the oblong pseudostaminodes; style filiform; stigma truncate-capitate; fruit 1-seeded, indehiscent, falling with the bracteoles and perianth; seed with a smooth testa. 6 species, warm temperate and tropical regions of the world.

1. **Achyranthes aspera** L., Sp. Pl., ed. 1, 204 (1753).

Perennial herb 0.35-1.5 m; stems stiff, erect, ascending or sprawling; branches opposite; leaves 3-12 x 1.5-5 cm, elliptic, ovate to broadly ovate, sparingly to densely appressed-pubescent; petiole 0.5-2 cm; spikes to 25 cm, elongating to 40 cm in fruit; flowers dense and erect, becoming deflexed and distant; perianth-segments 3-8 mm, lanceolate, acute, the outer longer; pseudostaminodes fimbriate; style 1-5 mm, slender; capsule 1-3(-4.5) mm, oblong-ovoid; seed cylindrical, smooth.

Two varieties occur in Egypt:

var. **sicula** L., Sp. Pl., ed. 1, 204 (1753).

Syns. *Achyranthes argentea* Lam., Encycl. 1: 545 (1785).

Achyranthes aspera var. *argentea* (Lam.) Boiss., Fl. Orient. 4: 994 (1879).

Plants slender; leaves 2-4.5 x 1-2.5 cm, ovate to ovate-elliptic; bracteoles 2.5-3.25 mm; perianth-segments 3-4.5 mm; pseudostaminodes cup-shaped; apex without a band; style \pm equalling the ovary.

N (Cairo region), GE; weed of cultivation and sandy plains.

var. **pubescens** (Moq.) C. C. Towns., Kew Bull. 29:473 (1974).

Syn. *Achyranthes fruticosa* Lam. var. *pubescens* Moq. in A. DC., Prodr. 13(2): 314 (1849).

Plants robust; leaves 3-7 x 2-4 cm, oblong to narrowly ovate-elliptic; bracteoles 3.75-4.25 mm; perianth-segments 5-6.5 mm; pseudostaminodes with a band at the apex; style much longer than the ovary.

N (Aswan region); Nile banks.

Area of the species: tropical and warm regions of the world.

6. **Psilotrichum** Blume

Perennial herbs or subshrubs; leaves opposite, entire; flowers bisexual, in axillary and terminal bracteate spikes; flowers solitary in the axil of each bract; perianth-segments 5, free; stamens 5, shortly connate at the base; pseudostaminodes absent; style slender; stigma capitate; capsule 1-seeded, thin-walled, irregularly rupturing; seed ovoid, brownish. 18 species, tropical Africa and Asia.

1. **Psilotrichum gnaphalobryum** (Hochst.) Schinz, Viert. Nat. Ges. Zürich 57: 550 (1912).

Syns. *Psilostachys gnaphalobryum* Hochst., Flora 27, Beil 6 (1844).

Psilotrichum cordatum Moq. in DC., Prodr. 13(2): 280 (1849).

Perennial herb 0.5-1.5 m; stems erect or scrambling, richly branched from the base, glabrescent, with tufted hairs at the nodes; leaves 2-5 x 0.5-2.5 cm, ovate, or ovate-lanceolate, the upper linear above, appressed-hairy; flowers in lax terminal and axillary spikes, 1-to 3-branched; bracts 0.5-1 mm, deltoid-lanceolate, acuminate, persistent; bracteoles 1-1.25 mm, deltoid-ovate, deciduous; perianth-segments 5, 3-4 mm, subequal, 3-nerved, the inner with broad membranous margins; ovary 1.5 mm; style 1-1.5 mm, filiform; capsule thin-walled; seed 1.5 mm, faintly reticulate.

GE; mountain slopes and gorges. Egypt, Sudan, Ethiopia, Somalia, Kenya, Arabia.

7. *Alternanthera* Forssk.

Annual or perennial herbs; leaves opposite, entire; flowers bisexual, solitary in the axil of a bract and 2 bracteoles; bracts persistent, bracteoles persistent or not; perianth-segments 5, free, equal or unequal, glabrous or hairy; stamens 2-5, some occasionally without anthers; filaments connate at the base into a cup or tube, alternating with the pseudostaminodes; ovary with 1 ovule; style short, stigma capitate; capsule indehiscent, thin-walled; seeds lenticular. About 100 species, tropical and warm regions of the world.

- | | |
|---|------------------------|
| 1. Perianth-segments very dissimilar in form | 1. A. pungens |
| + Perianth-segments similar in form | 2 |
| 2. Leaves to 1.5 cm broad; perianth-segments 3-5.5 mm, unequal; fruit yellowish, about 1/2 the length of perianth-segments | 2. A. nodiflora |
| + Leaves to 3 cm broad; perianth-segments 1.5-2.5 mm, equal; fruit reddish, equalling or slightly longer than the perianth-segments | 3. A. sessilis |

1. ***Alternanthera pungens*** Kunth in Humb., Bonpl. & Kunth, Nov. Gen. Sp. 2: 206 (181).
Syn. *Achyranthes repens* L., Sp. Pl., ed. 1, 205 (1753).

Perennial herb; stems 20-50 cm, prostrate, mat-forming, densely villous, becoming glabrescent with age; leaves 1.5-4 x 0.4-2.5 cm, broadly ovate or rhomboid-ovate; apex rounded or apiculate; petiole 0.2-1 cm; bracts and bracteoles spine-tipped; tepals dissimilar, outer pair 5 mm, lanceolate, spine-tipped; inner tepal 3 mm, oblong, dentate at the apex; inner pair 2 mm, with tufts of barbed hairs at the base; stamens 5, all bearing anthers; fruit 2 mm, compressed; seed 1.25 mm, discoid, brown, glossy, faintly reticulate.

N (Samanoud area, Nile delta); waste ground. Tropics and subtropics, worldwide.

2. ***Alternanthera nodiflora*** R. Br., Prodr. Fl. Nov. Holl. 417 (1810).
Syn. *Alternanthera sessilis* (L.) DC. var. *nodiflora* (R. Br.) Kuntze, Rev. Gen. 2: 540 (1891).

Annual herb or short-lived perennial 20-60 cm; with a woody rootstock; stems ascending or prostrate, branched; leaves 1.5-8 x 0.5-1.5 cm, narrowly elliptic to linear-lanceolate; apex acute, mucronate, base cuneate; petiole 1-3 mm; flowers in axillary sessile clusters; bracts 1.5-2.5 mm, scarious, ovate-lanceolate; the apex acuminate; bracteoles 2-4 mm, lanceolate-oblong; perianth-segments 3-5.5 mm, unequal, apex acuminate, becoming prickly in fruit; stamens 3, alternating with 3 subulate pseudostaminodes; ovary 0.8-1

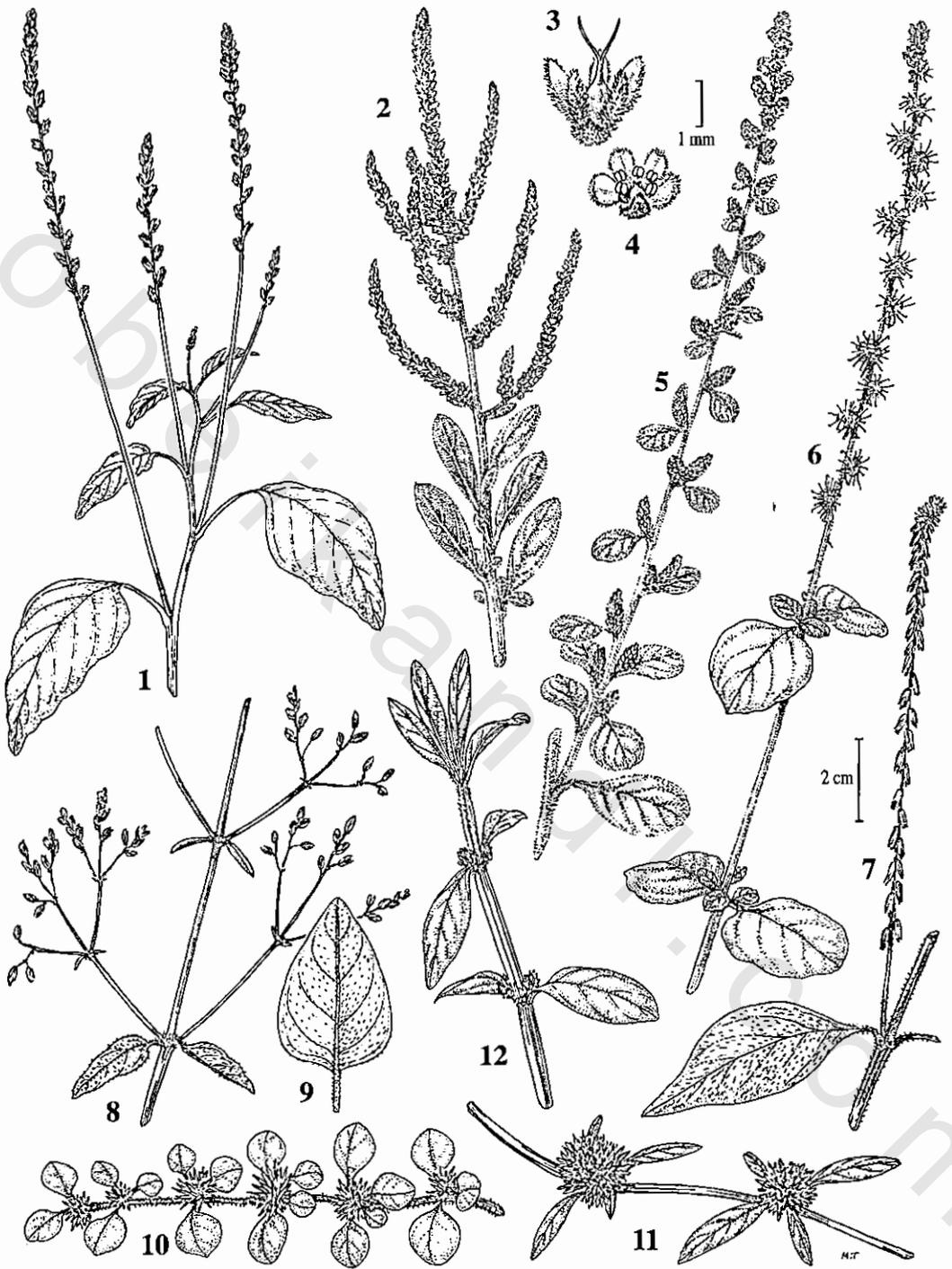


Plate 26. AMARANTHACEAE: flowering and fruiting branches of: *Digeria muricata* 1. *Aerva javanica* var. *javanica* 2; 3, female flower; 4, male flower. *Aerva lanata* 5. *Pupalia lappacea* 6. *Achyranthes aspera* 7. *Psilotrichum gnaphalobryum* 8; 9, leaf variation. *Alternanthera pungens* 10. *Alternanthera nodiflora* 11. *Alternanthera sessilis* 12. All drawings to the same scale except enlarged parts (scale given).

mm, obconical; style 0.25 mm; stigma capitate; fruit 1.5-2.25 x 2-2.5 mm; seed 1-1.25 mm, almost globose, smooth.

N (Helwan, near Cairo); Nile banks. Tropical Africa and Asia, naturalized elsewhere.

3. **Alternanthera sessilis** (L.) DC., Cat. Hort. Monsp. 77 (1813).

Syns. *Gompherna sessilis* L., Sp. Pl., ed. 1, 225 (1753).

Alternanthera repens J. F. Gmel., Syst. Nat., ed. 13, 2(1): 106 (1791).

Annual or short-lived perennial herb, 10-40 cm; stems erect or ascending, rooting at the nodes, sometimes to over 1 m, glabrous or with 2 lines of white hairs; leaves 1-7.5 x 0.5-3 cm, elliptic to oblanceolate; the apex acute, the base attenuate, sessile; flowers in axillary clusters; bracts and bracteoles mucronate; perianth-segments 1.5-2.5 mm, equal, glabrous, lanceolate, acute, mucronate; stamens 5, 2 without anthers; fruit 2-2.5 mm, reddish, strongly compressed; seed 1-1.25 mm, globose, with thick margins.

N, M, O, De; wet ground, canal banks. Tropics and subtropics worldwide.

RANUNCULACEAE

Annual or perennial herbs (our species) or woody climbers; leaves alternate, usually exstipulate; flowers usually bisexual, actinomorphic or zygomorphic, hypogynous; perianth petaloid or sepaloid, often with petaloid structure bearing nectaries (honey-leaves); stamens numerous, spirally arranged; carpels 1 to numerous, usually free and spirally arranged; fruit 1 or more follicles or a head of achenes. 62 genera, 2450 species, mainly temperate and boreal regions.

- | | |
|--|----------------------|
| 1. Flowers zygomorphic, spurred | 2 |
| + Flowers actinomorphic, not spurred | 3 |
| 2. Fruit of 3 or more follicles | 5. Delphinium |
| + Fruit of 1 follicle | 6. Consolida |
| 3. Perianth petaloid | 2. Anemone |
| + Perianth of calyx and corolla | 4 |
| 4. Fruit many-seeded, partly fused follicles | 4. Nigella |
| + Fruit a group of 1-seeded achenes | 5 |
| 5. Petals with a basal nectariferous pit | 1. Ranunculus |
| + Petals without basal nectariferous pits | 3. Adonis |

1. **Ranunculus** L.

Annual or perennial, sometimes aquatic herbs; leaves mostly simple, usually exstipulate, alternate, often compound and deeply lobed or dissected; flowers regular, usually yellow, sometimes white or red; sepals 3-5, free; petals 5-8 or more, with a basal nectariferous pit; stamens numerous, spirally arranged; carpels numerous, spirally arranged, uniovulate; achenes compressed or subglobose, often with a prominent persistent style, smooth, wrinkled or spiny. About 600 species, temperate and boreal regions.

1. Aquatic plants with finely dissected leaves; petals white or yellow only at the base 2
+ Terrestrial or marsh plants; petal yellow, white or red 5
2. Floating leaves present, 3- to 5-lobed; achenes 2-6 1. **R. peltatus** subsp. **fucooides**
+ Floating leaves absent, all leaves finely dissected; achenes 30-90 3
3. Achenes c. 30, to 1.8 mm 3. **R. trichophyllus**
+ Achenes 50-90, to 1 mm 4
4. Sepals 3-6 mm; petals 1-5 cm 1. **R. peltatus** subsp. **sphaerospermus**
+ Sepals 2-2.5 mm; petals 3.5-5 mm 2. **R. rionii**
5. Root tuberous; plants densely hairy 6
+ Root fibrous; plants glabrous or sparsely hairy 8
6. Some of the roots fleshy; petals c. 1 cm, yellow 4. **R. bulbosus**
+ Tubers numerous; petals to 3 cm, white, red or yellow 7
7. Basal leaves broadly ovate or 3-lobed, rarely dissected; petals to 3 cm,
red or yellow, rarely white, or rose 5. **R. asiaticus**
+ Basal leaves pinnatisect;
petals 1.5 cm, yellow 6. **R. millefolius** subsp. **hierosolymitanus**
8. Achenes 3 mm (including the beak) 8. **R. marginatus**
+ Achenes 5-7 mm 9
9. Achenes ovoid-globular, slightly wrinkled 7. **R. scleratus**
+ Achenes flattened, spiny or muricate 10
10. Basal leaves orbicular to reniform, shallowly-lobed or crenate; sepals deflexed;
margins of achenes 2-furrowed 9. **R. muricatus**
+ Basal leaves cuneate-obovate, 3-lobed or dentate; sepals spreading; achenes
with spiny or tuberculate margins 10. **R. arvensis**

1. **Ranunculus peltatus** Schrank, Baier. Fl. 2: 103 (1789).

Annual or short-lived perennial aquatic herb with stems to 1 m; floating leaves present or absent; submerged leaves 1-5 cm, short-petiolate or sessile, with numerous capillary segments; stipules to 8 mm, membranous; floating leaves 1-3 cm wide, long-petiolate, reniform or semicircular, hairy on the lower surface; peduncles usually longer than the submerged leaves; petals white or yellow-clawed; achenes 0.8-1.8 mm, glabrous or pilose, with a convex dorsal margin and a rounded or obscurely beaked apex.

Two subspecies occur in Egypt:

subsp. **fucooides** (Freyn) Muñoz Garm., Anales Jard. Bot. Madrid 41: 477 (1985).

Syns. *Ranunculus fucooides* Freyn in Willk. & Lange, Prodr. Fl. Hispan. 3: 912 (1880).

Ranunculus saniculifolius Viv., Fl. Libyc. Spec. 29 (1824).

Floating leaves present, 3- to 5-lobed; sepals 2-3 mm; petals 5-8 mm; achenes 2-6, 1.5-1.8 mm.

M (Alexandria); canals and ponds. Europe, coastal Mediterranean region.

subsp. **sphaerospermus** (Boiss. & Blanche) Meikle, Notes Roy. Bot. Gard. Edinb. 23: 16 (1959).

Syn. *Ranunculus sphaerospermus* Boiss. & Blanche in Boiss., Diagn. Pl. Orient., ser. 2, 5: 6 (1856).

Floating leaves absent, all leaves finely dissected, subsessile; sepals 3-6 mm; petals 1.5-2.5 cm; achenes numerous, 0.8-1 mm.

M; canals and ponds. East Mediterranean region.

2. **Ranunculus rionii** Lagger, Flora (Regensburg) 31: 49 (1848).

Syns. *Batrachium roinii* (Lagger) Nyman, Bot. Notiser 1852: 98 (1852).

Ranunculus trichophyllus Chaix var. *rionii* (Lagger) Rikli in Schinz & R. Keller, Fl. Schweiz 193 (1900).

Aquatic annual herb, glabrous or sparsely pilose; leaves to 6 cm, all submerged, subsessile, finely divided into linear segments; fruiting peduncle shorter than the subtending leaf; sepals 5; petals 3-5 mm, white with a yellow base; achenes 0.8-1 mm, slightly compressed, wrinkled, with a short beak at the tip.

N, O; in canals. North temperate regions, South Africa.

3. **Ranunculus trichophyllus** Chaix, Pl. Vap. 31 (1785).

Syn. *Ranunculus aschersonii* Freyn, Bot. Centralbl. 6, Beil. 26: 13 (1881).

Annual or short-lived perennial aquatic herb; leaves to 6(-8) cm, all submerged, subsessile, finely divided into slender linear segments; pedicels usually shorter than the leaves; petals 4-5 mm; stamens 6-15; fruiting pedicel recurved; achenes 0.8-1.8 mm, glabrous or hairy, convex, often keeled on the dorsal side and with a short-beaked acute apex.

N; canals. Europe, Mediterranean region, North and West Asia, Australia, New Zealand.

4. **Ranunculus bulbosus** L., Sp. Pl., ed. 1, 554 (1753).

Perennial herb 10-25 cm, softly villous; some of the roots fleshy; basal leaves 3-foliate, terminal leaflet stalked, the upper sessile with linear-lanceolate lobes; flowers 2-3 cm diam.; petals 1 cm, yellow; sepals reflexed; achenes 2-4 mm; margins keeled and grooved; beak short, curved.

N; weed of cultivation. Europe, Mediterranean region, Southwest Asia.

5. **Ranunculus asiaticus** L., Sp. Pl., ed. 1, 552 (1753).

Syns. *Ranunculus asiaticus* subsp. *latilobus* Vierh., Oesterr. Bot. Z. 84: 133 (1935).

Ranunculus asiaticus subsp. *tenuilobus* (Boiss.) Vierh., Oesterr. Bot. Z. 84: 134 (1935).

Perennial hirsute herb 10-25 cm; roots dimorphic, cylindrical and tuberous, short, thin and fibrous; lower leaves long-petiolate, broadly ovate or 3-lobed, rarely dissected; upper leaves dissected; scape solitary, sometimes slightly branched 1- to 4-flowered; petals to 3 cm, red or yellow, rarely white or rose; stamens numerous; achenes 2-3 mm, compressed, with a hooked beak.

M, S; in barley fields. East Mediterranean region, Southwest Asia.

6. **Ranunculus millefolius** Banks & Sol. in Russell, Nat. Hist. Aleppo, ed. 2, 2: 254 (1794) subsp. **hierosolymitanus** (Boiss.) P. H. Davis, Notes Roy. Bot. Gard. Edinb. 23: 150 (1960).
Syn. *Ranunculus hierosolymitanus* Boiss., Fl. Orient. 1: 36 (1867).

Perennial herb 10-25 cm, canescent; roots dimorphic, both tuberous, thick and cylindrical, and thin and fibrous; lower leaves pinnatisect with oblong to linear acute lobes, long-petiolate; upper leaves sessile, with fewer but longer lobes; flowers few, solitary, long-pedicelled, petals 1.5 cm, yellow; pedicels thickened in fruit; achenes 2-3 mm, obovate, flattened, usually smooth and glabrous.

M; cultivated ground. East Mediterranean region.

NOTE: The occurrence of this species in Egypt needs confirmation.

7. **Ranunculus sceleratus** L., Sp. Pl., ed. 1, 551 (1753).

Annual herb 20-60 cm, glabrous; stems erect, hollow, richly branched; lower leaves long-petiolate, palmately 3-lobed; lobes 2- to 3-lobed; upper leaves short-petiolate, with deeply divided lobes the uppermost sessile, not lobed; flowers 0.5-1 cm diam., pedicellate, numerous, yellow, in paniculate cymes; achenes 0.8 mm, ovoid-globular, slightly wrinkled, the beak minute.

N, O; moist ground, swamps, canal banks. Europe, Mediterranean region, Southwest and Central Asia, tropical Africa.

8. **Ranunculus marginatus** d'Urv., Mém. Soc. Linn. Paris 1: 318 (1822).
Syns. *Ranunculus trachycarpus* Fisch. & C. A. Mey. in Fischer *et al.*, Index Sem. Hort. Petrop. 3: 46 (1837).
Ranunculus guilelmi-jordanii Asch., Verh. Bot. Vereins Prov. Brandenb. 21: 64 (1880).

Annual herb 10-25 cm, glabrous or sparingly hairy; stems erect, grooved, branched; lower leaves long-petiolate, blade 2-5 cm, 3-lobed or much dissected; stem leaves with ovate-orbicular or oblong lobes; uppermost leaves few-lobed, the lobes oblong-linear; flowers yellow, to 1.5 cm diam.; sepals reflexed; achenes 10-20, 3-5 mm, flattened, ovate-orbicular, densely tuberculate, the beak 1 mm.

N, O; moist ground. South Europe, East Mediterranean region, North Iran.

9. **Ranunculus muricatus** L., Sp. Pl., ed. 1, 555 (1753).
Syn. *Ranunculus graecus* Griseb., Spic. F. Rumel 1: 314 (1843).



Plate 27. RANUNCULACEAE: *Ranunculus peltatus* subsp. *sphaerospermus* 1, flowering and fruiting branch, fruit and achene. *Ranunculus rionii* 2, flowering and fruiting branch and achene. *Ranunculus asiaticus* 3, habit, fruit and achene. *Ranunculus millefolius* subsp. *hierosolymitanus* 4, flowering and fruiting branch and achene. *Ranunculus marginatus* 5, flowering and fruiting branch, basal leaf and achene. *Ranunculus sceleratus* 6, flowering and fruiting branch and achene. *Ranunculus muricatus* 7, flowering and fruiting branch and achene. *Ranunculus arvensis* 8, flowering and fruiting branch and achene. All drawings to the same scale except enlarged parts (scale given).

Annual herb 10-20 cm, glabrous; stems erect or procumbent, branched; basal leaves orbicular to reniform, long-petiolate, undivided or shallowly crenate-lobed; stem leaves dissected; the uppermost short-petiolate, little divided; pedicels opposite leaves; flowers 1-1.5 cm diam., bright yellow; sepals 5, usually deflexed; petals longer than the sepals; stamens many; achenes 7-8 mm including the beak, compressed, ovate, the disc with prickly tubercles; margins 2-furrowed; beak curved, almost as long as or slightly shorter than the disc.

M; moist ground. North Africa, South Europe, Southwest Asia.

10. *Ranunculus arvensis* L., Sp. Pl., ed. 1, 555 (1753).

Annual herb 10-20 cm, glabrous, or sparingly hairy; stems erect, branched; basal leaves long-petiolate, cuneate-obovate, 3-lobed or dentate, becoming more dissected in the upper parts of the stem; flowers axillary and in terminal cymes, pedicels hairy; sepals 5, spreading, yellowish-green, shorter than the petals; petals 5, lemon-yellow; stamens 10 or more; achenes 5-8 mm including the beak, compressed, prickly, the margin with stiff spines longer than those on the disc, or spines sometimes reduced to tubercles; beak 2-3 mm.

M; moist ground, weed of cultivation. Europe, Mediterranean region, West Asia to India.

2. *Anemone* L.

Perennial herbs with tuberous rootstock; leaves radical, compound or lobed; scapes leafless, except for an involucre of 3(-4) leaves distant from the flowers; flowers conspicuous, bisexual, solitary or few in umbellate or head-like clusters; perianth of many petals, stamens numerous; carpels many, 1-ovuled; fruit numerous achenes; style of achene persistent. 144 species, subcosmopolitan, especially north temperate regions.

1. *Anemone coronaria* L., Sp. Pl., ed. 1, 539 (1753).

Perennial herb with tuberous rootstock; scapes 10-25 cm, usually 1-flowered; leaves radical, long-petiolate, compound; the segments deeply dissected into coarsely toothed lobes; involucre leaves 3(-4), sessile, dissected; flowers 5-8 cm diam., mauve, rose, crimson, blue or cream; anthers purple; achenes subglobose, densely woolly; style filiform, persistent.

M, S; barley fields, sand plains. Mediterranean region, Sinai.

3. *Adonis* L.

Annual or perennial herbs; leaves alternate, 2- to 3-pinnately dissected, lobes linear or filiform; flowers usually terminal, solitary, actinomorphic; sepals 5(-8); petals 5-20, conspicuous; stamens numerous; carpels superior, many, free; style short, persistent, indurate in fruit; achenes short-beaked. 26 species, Europe, Mediterranean region, Asia.

1. *Adonis dentata* Delile, Descr. Egypte, Hist. Nat. 287, t. 53 (1814) subsp. *dentata*

Annual herb 10-25 cm; stems erect, branched; leaves 2- to 3-pinnatisect, with filiform segments; flowers 1-1.5 cm diam.; sepals glabrous; petals, about twice as long as the

sepals, yellow or orange-red; stamens violet; achenes 2(-3) mm, globular-rhomboid, wrinkled, with a dorsal crest, toothed.

M, D, S; sandy deserts. North Africa, Sinai, Palestine, Arabia, extending to Cyprus, Turkey and Iran.

4. *Nigella* L.

Annual herbs; leaves alternate, pinnatisect; flowers bisexual, solitary, actinomorphic, pink, blue, white or yellow; calyx of 5 sepals, often petaloid; corolla of 5(-8) petals with a bent claw and 1- to 2-lipped nectariferous limb; stamens many; carpels 2-10, more or less fused; fruit partly fused follicles; styles accrescent, persistent; seeds angular or discoid. 20 species, Europe, Mediterranean region, Asia.

1. Sepals more or less equalling the petals (nectaries) 1. *N. deserti*
+ Sepals longer than the petals (nectaries) 2
2. Stems and leaves hairy; fruit ovoid-oblong, the carpels connate almost to apex 3. *N. sativa*
+ Stems and leaves glabrous or scabrid, not hairy; fruit obconical, the carpels connate for $\frac{2}{3}$ their length 2. *N. arvensis* subsp. *taubertii*

1. *Nigella deserti* Boiss., Ann. Sci. Nat. Bot., ser. 2, 16: 359 (1841).
Syns. *Nigella assyriaca* (Boiss.) Boiss., Fl. Orient. 1: 67 (1867).
Nigella arvensis L. var. *grabica* (Boiss.) Zohary, Fl. Palaest. 1: 193 (1966).

Annual herb 10-30 cm, erect or decumbent; stems simple or branched; lower leaves petiolate, dissected into linear segments; flowers 1 cm diam., long-pedicellate, bluish or white; sepals more or less equalling the petals, persistent; petals 0.8-1.1 cm, the lobes of the lower petal lip straight; anthers with very short appendages; carpels smooth, divergent.

S (Rafah); coastal and sandy soils. Sinai, Palestine.

2. *Nigella arvensis* L., Sp. Pl., ed. 1, 534 (1753) subsp. *taubertii* (Brand) Maire, Fl. Afr. Nord 11: 40 (1964).
Syn. *Nigella taubertii* Brand, Helios 12: 192 (1895).

Annual herb 10-40 cm, glabrous, glaucous; stems simple or branched, smooth or scabrid, furrowed; lower leaves petiolate, stem leaves sessile, all pinnatisect with narrow linear segments; flowers solitary, terminal, 1-1.8 cm diam., pink, blue or white; sepals 0.6-1 cm, broadly ovate, glabrous, persistent; petals 5-8 mm, shorter than the sepals; follicles 3-6, connate for $\frac{2}{3}$ their length into an obconical capsule, smooth or verruculose, with 3 prominent ribs and a 1 cm beak; seeds 1.5 x 1 mm, 2-angled, papillate.

M; coastal plains. Europe, North Africa, Southwest Asia.

3. *Nigella sativa* L., Sp. Pl., ed. 1, 534 (1753).

Annual herb 20-40 cm, hairy; stems branched, ascending, furrowed; lower leaves

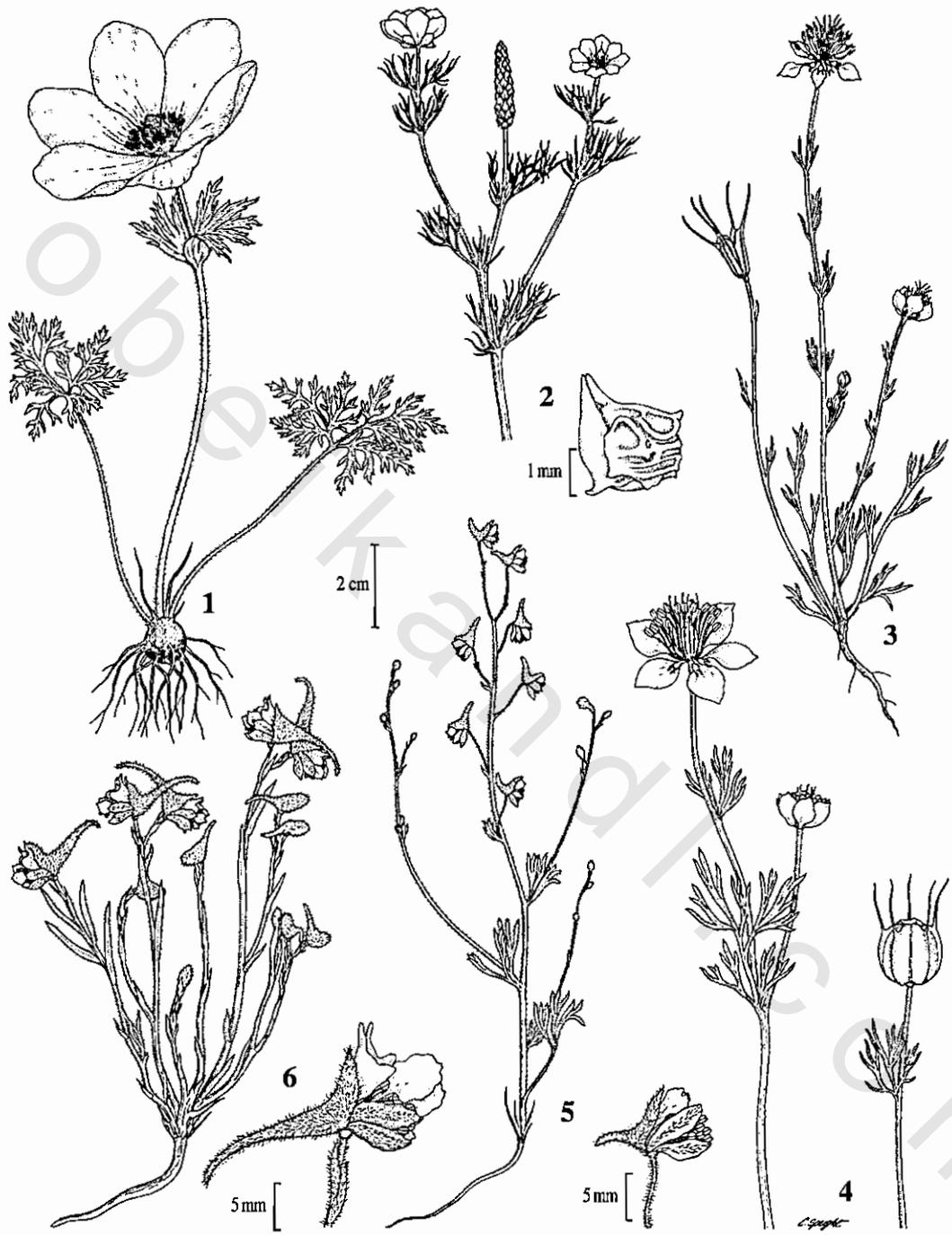


Plate 28. RANUNCULACEAE: *Anemone coronaria* 1, habit. *Adonis dentata* 2, flowering and fruiting branch, and achene. *Nigella arvensis* 3, habit. *Nigella sativa* 4, flowering and fruiting branches. *Consolida flava* 5, habit and flower. *Delphinium ambiguum* 6, habit and flower. All drawings to the same scale except enlarged parts (scale given).

petiolate, pinnately dissected into narrowly linear-lanceolate segments; stem leaves sessile; flowers solitary, terminal, 2 cm diam., white or bluish; sepals 1-1.5 cm, glabrous; petals 8, shorter than the sepals, 2-lipped, the lobes of upper and lower lip acuminate; stamens 0.8-1 cm; anthers yellow; follicles 4-8, ovoid-oblong, united almost to apex, tuberculate, the beak 1 cm; seeds 3-angled, minutely papillate, black.

N, M; escape from cultivation. West Asia to India; naturalized in North Africa and Europe.

5. *Delphinium* L.

Annual or perennial herbs, roots simple or tuberous; leaves alternate, palmately lobed or divided; flowers bisexual, conspicuous, in racemes or panicles, zygomorphic; perianth segments 5, the upper prolonged into a conical or cylindrical hollow spur; honey-leaves 4, free, nectariferous, with spurs inserted into the spur of the uppermost perianth-segment, and with the limb exerted; the 2 lateral with a wide limb and a narrow claw; stamens 8, spirally arranged; follicles 3(-5), free; seeds in 2 rows, mostly black. About 320 species, north temperate regions.

1. Entire plant glabrous, except the appressed-pubescent peduncles; spur 1.2 cm, sparsely hairy; capsule glabrous; stems erect, branching above 1. *D. bovei*
- + Entire plant appressed-pubescent; spur 1.6-2 cm, densely appressed-pubescent; capsule appressed-puberulent; stems ascending, richly branched especially from the base 2. *D. ambiguum*

1. *Delphinium bovei* Decne., Ann. Sci. Nat. Bot., ser. 2, 4: 356 (1835).

Annual herb 20-40 cm; entire plant glabrous, except the appressed-pubescent peduncles; stems erect, branching above; lower leaves oblong-spathulate, trifid; cauline leaves linear-lanceolate, acute; flowers in lax racemes; limb of lateral honey-leaves 2-3 times shorter than the claw; spur 1.2 cm, sparingly hairy; follicles glabrous.

S; sandy wadis. Sinai, Palestine.

2. *Delphinium ambiguum* L., Sp. Pl., ed. 2, 749 (1762).

Syns. *Delphinium nanum* DC., Syst. Nat. 1: 349 (1817).

Delphinium obcordatum DC., Syst. Nat. 1: 350 (1817).

Delphinium peregrinum, sensu Täckh., Stud. Fl. Egypt, ed. 2, 143 (1974).

Delphinium halteratum, sensu Qaiser in Jafri & El-Gadi (eds.), Fl. Libya 108: 8 (1984).

Annual herb 10-20 cm; entire plant appressed-pubescent; stems richly branched especially from the base; inflorescence 2- to 12-flowered, lax; pedicels and outside of the perianth-segments appressed-pubescent; flowers bluish-violet; spur 1.6-2 cm; limb of lateral honey-leaves equalling the claw; follicles 0.6-1 cm, densely appressed-puberulent, often divaricate.

M; coastal sandy soil. Portugal, Spain, Morocco, Algeria, Libya, Egypt.

6. *Consolida* (DC.) S. F. Gray

Like *Delphinium* but always annual, the 2 upper honey-leaves connate into a nectary, with a single spur, the lateral honey-leaves absent; stamens 5, spirally arranged; fruit a single many-seeded follicle. 43 species, Mediterranean region to Central Asia.

1. *Consolida flava* (DC.) Schrödinger, Ann. K. K. Naturhist. Hofmus. 27: 43 (1913).

Syns. *Delphinium flavum* DC., Syst. Nat. 1: 346 (1817).

Delphinium deserti Boiss., Fl. Orient. 1: 346 (1867).

Consolida deserti (Boiss.) Munz, J. Arnold Arbor. 48: 51 (1967).

Annual herb 10-25 cm, appressed-pubescent, glandular above; stems erect or ascending; lower leaves 2-6 cm, long-petiolate, palmately 3-lobed; lobes linear-lanceolate, pubescent; upper leaves small, sessile; uppermost linear, bract-like; flowers in 1-to few-flowered racemes, 0.7-1 cm including the spur; pedicels glandular-pubescent; sepals 5 mm; corolla yellow with purple spots, 3-lobed, the lateral lobes longer than the middle denticulate to be; spur equalling the petal, bent upwards; follicle 1-1.5 cm, oblong-linear, glandular-hairy, with a short beak; seeds many, minute, angular.

M, S; sandy and stony ground. Egypt, Palestine, Syria, Lebanon.

BERBERIDACEAE (incl. Leonticaceae)

15 genera, 680 species, mainly north temperate trees, shrubs and perennial herbs. *Leontice* is the only genus in Egypt.

1. *Leontice* L.

Perennial herbs; stems tuberous, subterranean; leaves 2- or 3-ternate, mostly cauline; flowers in axillary and terminal bracteate racemes; perianth-segments 6, petaloid, conspicuous, yellow; honey-leaves 6, small; stamens 6; fruit 1- to 4-seeded; pericarp membranous, dehiscing irregularly by decay. 3 species, Southeast Europe to East Asia.

1. *Leontice leontopetalum* L., Sp. Pl., ed. 1, 312 (1753) subsp. *leontopetalum*

Perennial herb, 20-50 cm; aerial stem erect, hollow, glabrous; subterranean tuber 5-8 cm diam., subglobose; leaves 2- to 3-ternate; leaflets 2-5 cm, ovate, obovate or subcordate; flowers yellow, in richly branched panicles; pedicels erect, elongating in fruit; perianth 8 mm, petaloid; honey-leaves (nectary scales) orbicular; capsule 2-2.5 cm, subglobose, 1-seeded.

M, S; sandy soil, weed of cultivation. Southeast Europe, East Mediterranean region, West Asia to Iran.

MENISPERMACEAE

72 genera, 450 species, mainly tropical and warm regions, usually dioecious lianes and shrubs. *Cocculus* is the only genus in Egypt.

1. **Cocculus DC.**, nom. conserv.

Woody climbers or shrubs, dioecious; leaves simple; flowers solitary, axillary; sepals 6, in 2 whorls, inner larger; petals 6; staminate flowers with 6-9 free, stamens, the anthers 4-lobed; pistillate flowers with 6 or no staminodes, carpels 3 or 6; style undivided; fruit a drupe, compressed; seeds horseshoe-shaped. 8 species, tropical and warm regions, excluding South America and Australia.

1. **Cocculus pendulus** (J. R. & G. Forst.) Diels in Engl., Pflanzenr. 46: 237 (1910).
Syns. *Epibaterium pendulum* J. R. & G. Forst., Char. Gen. Pl. 108, ed. 4 (1776).
Cocculus leoeba (Delile) DC., Syst. Nat. 1: 529 (1817).

Woody much-branched climber, glaucous, puberulent; branches elongate, twining; leaves 1-3.5 x 0.5-1.5 cm, subsessile, leathery, lanceolate-oblong or ovate-oblong, entire or rarely lobed, mucronate, glabrous; flowers small, the staminate short-pedicellate in few-flowered cymes, the pistillate on pedicels 5-8 mm, solitary or in pairs; drupe 5 mm, spherical.

N (Aswan Nile islands), D, GE, S; climber on trees, on cliffs or prostrate. Paletropical.

NYMPHAEACEAE

6 genera, 60 species, cosmopolitan aquatic herbs with rhizomes or tubers. *Nymphaea* is the only genus in Egypt.

1. **Nymphaea L.**, nom. conserv.

Perennial aquatic rhizomatous herbs; leaves broadly elliptic-ovate to orbicular, with a deep basal sinus; flowers solitary, bisexual, actinomorphic; perianth-segments numerous, free, the outer 4-6 sepaloid, the remainder petaloid; stamens numerous, the outer petaloid; carpels 8 or more; ovary semi-inferior; ovules 1 to numerous; fruit a rather dry berry. About 50 species, cosmopolitan.

1. Leaf margin dentate
+ Leaf margin entire

1. **N. lotus**
2. **N. caerulea**

1. **Nymphaea lotus** L., Sp. Pl., ed. 1, 511 (1753).

Perennial herb; rhizome stout, with stolon-like branches; leaves 15-40 cm, acutely spinose-dentate, prominently veined on the lower surface; flowers 15-22 cm diam., the sepals veined with white; petals white above, with a purplish tint beneath; stamens with broad white filaments; stigma concave with 20-35 rays.

N, M; canals. Romania, Egypt, tropical Africa and Asia.

2. **Nymphaea caerulea** Savigny, Décade Pl. Egypt. 1: 71 (1798).
Syn. *Nymphaea stellata* Willd., Sp. Pl., ed. 4, 2: 1153 (1799).

Perennial herb, with a thick rhizome; leaves 20-35 cm diam., orbicular or ovate-orbicular, entire, green above, purplish near the margin; flowers 8-16 cm diam.; stalk to 1

m; sepals slightly longer than the petals, lanceolate, acuminate; petals pale blue, linear-oblong to lanceolate; stamens about 60; anthers with appendages to 5 mm; stigma with 10-30 rays; fruit subglobular; seeds ellipsoid-globular, smooth.

N, M, O; ponds and canals. Tropical Africa, Palestine, Yemen.

CERATOPHYLLACEAE

Description as for *Ceratophyllum*., the only genus in the family.

1. *Ceratophyllum* L.

Aquatic monoecious herbs, free floating, perennating by buds, stems branched; leaves exstipulate, in whorls of 3-10, filiform, once or more dichotomously branched, margins often spinose-dentate; flowers axillary, subsessile; male 1(-4), female 1 per node; male and female often at different nodes; perianth lobes 9- to 12(-15) united at the base, some joined in pairs to over halfway; male flowers with about 30 stamens in several whorls, filaments 0 or short; female flowers with superior ovary; ovule 1; staminodes 0; fruit an achene, ovoid or ellipsoid, slightly flattened, sometimes with a marginal rim or spiny wing, a pair of basal spines often present; surface smooth, spiny or warty; style rather persistent, forming a distinct terete apical spine; embryo straight, endosperm absent. 3 species, cosmopolitan.

1. Leaves branched twice, rarely once or 3 times; spiny teeth on leaf margin often many, prominent; lateral flattening of fruit slight, the surface almost smooth 1. **C. demersum**
+ Leaves, at least the majority, branched 3-4 times; spiny teeth on leaf margin few, small, inconspicuous; fruit with distinct irregularly crenate to spinulose marginal wing, the surface with abundant often elongated warty papillae 2. **C. muricatum**

1. *Ceratophyllum demersum* L., Sp. Pl., ed. 1, 992 (1753).

Aquatic perennial herb; stems to 1.5 m; leaves bright or olive green, 7-10 per whorl, 0.8-4 cm, rather stiff; upper leaves forked once or twice into many, prominent, linear, flattened, spinose-denticulate segments 0.2-0.8 mm thick; lower leaves similar or 3-4 times dichotomous; male flowers 1-3 at a node; stamens often more than 20; female flowers solitary; achene (3-)4-5.5(-7) x 2-3.5 mm, ovoid, with or without 2 basal spines; terminal spine (0.15-)0.35-1.2 cm; lateral flattening of fruit slight, surface almost smooth.

N, M, De (along Suez Canal); Nile, irrigation canals, shallow or deep water, swamps, lakes, tolerant of brackish water. Cosmopolitan.

2. ***Ceratophyllum muricatum*** Cham., Linnaea 4: 504 (1829). Type: Egypt, Damietta, June 1821, Sieber s. n., iso K! G.
Syn. *Ceratophyllum submersum* L. subsp. *muricatum* (Cham.) Wilmot-Dear, Kew Bull. 40: 266 (1985).

Aquatic perennial herb; stems 20-80 cm; leaves 2-4 cm, soft, at least the majority branched 3-4 times; spiny teeth on leaf margin few, small, inconspicuous; achene 3-5 x 2.5-3 mm, obovoid, ellipsoid or ovoid to almost triangular, with distinct, irregularly



Plate 29. BERBERIDACEAE: *Leontice leontopetalum* 1, flowering and fruiting branch. MENISPERMACEAE: *Cocculus pendulus* 2, fruiting branch and leaf variation. CERATOPHYLLACEAE: *Ceratophyllum demersum* 3, leafy branch; leaf and fruit (up right). *Ceratophyllum muricatum* 4, leafy branch; leaf and fruit (down left). NYMPHAEACEAE: *Nymphaea lotus* 5, leaf and flower. *Nymphaea caerulea* 6, leaf and flower. ARISTOLOCHACEAE: *Aristolochia bracteolata* 7, flowering branch; fruit and l.s. in the fruit (up r.ght). *Aristolochia maurorum* 8, flowering branch; fruit (down left). Drawings to different scales.

crenate to spinulose marginal wing; basal spines (0.5-)2-6 mm, the terminal spine (1-)4-9 mm; surface with abundant, often elongate, warty papillae.

N; canals, slow-flowing or stagnant water. Ukraine, Southeast Russia, Egypt, Senegal, Ghana, Chad, Sudan, ?Mozambique, South Africa, India, Pacific Islands.

ARISTOLOCHIACEAE

12 genera, 475 species in tropical and warm regions especially America; aromatic lianes, shrubs or rhizomatous herbs. *Aristolochia* is the only genus in Egypt.

1. *Aristolochia* L.

Perennial rhizomatous herbs or shrubs, the stems frequently twining or climbing; leaves alternate, entire; flowers axillary, pedicellate, variously coloured; perianth zygomorphic, lower part of tube (utricle) swollen around the style, the upper part cylindrical, ending with the limb; stamens mostly 6; anthers almost sessile, adnate to the stylar column; ovary inferior, (4-)6-celled, with many ovules; stylar column of (4-)6 or more styles and an equal number of stigmas; capsule usually dehiscent into 6 valves; seeds many, in 1 row, compressed. 120 species, warm and tropical regions, especially America.

1. Leaves broadly ovate-triangular, with a cordate base 1. *A. bracteolata*
+ Leaves ovate-oblong to lanceolate-triangular, with a hastate-auriculate base 2. *A. maurorum*
and a deep sinus

1. *Aristolochia bracteolata* Lam., Encycl. 1: 258 (1783).

Syns. *Aristolochia sempervirens*, sensu Forssk., Fl. Aegypt.-Arab. 156 (1775), non L., Sp. Pl., ed. 1, 961 (1753).

Aristolochia bracteata Retz., Obs. Bot. 5: 29 (1788).

Aristolochia kotschyi A. Rich., Tent. Fl. Abyss. 2: 237 (1850).

Aristolochia abyssinica Klotzsch, Monatsb. Akad. Berl. 1859: 589 (1859).

Perennial sprawling herb, glabrous; stems to 80 cm; leaves 1.5-6 x 2-6 cm, broadly ovate-triangular, the tip rounded, with a cordate base; petiole 1-3 cm; bract minute; perianth-tube 1.5-2 cm, yellowish-green suffused with brown, the limb 5-8 mm diam., purple or maroon, the tube swelling at the base to 5 mm diam.; capsule 2 x 1-1.25 cm, broadly cylindrical.

GE; wadi beds. Tropical Africa, Arabia, Pakistan, India.

2. *Aristolochia maurorum* L., Sp. Pl., ed. 2, 1363 (1763).

Perennial herb 20-40 cm, puberulent; stems erect, branched; leaves 2-5 x 0.5-1.5(-2.5) cm, ovate-oblong to lanceolate-triangular, with a hastate-auriculate base and a deep sinus, tip acute; bracts small, leafy; pedicels as long as the flowers; flowers 4-5 cm, solitary; perianth rusty-red, with yellow spots; tube incurved, dilating towards the apex; limb ovate-oblong, cordate-auriculate at the base; capsule 5 cm, oblong-obovoid.

S (Rafah); sandy plains. East Mediterranean region, West Asia.

NOTE: Some plants with broad leaves are known as *A. maurorum* var. *latifolia* Boiss., but intermediate variants are known.

GUTTIFERAE

45 genera, 1370 species, tropical and north temperate regions; trees, shrubs, woody climbers and herbs. *Hypericum* is the only genus in Egypt.

1. *Hypericum* L.

Herbs, shrubs or trees; leaves opposite, simple, often glandular with translucent or glandular dots; stipules absent; flowers bisexual, actinomorphic, solitary or in terminal cymes or panicles; sepals 5, free, imbricate; petals 5, free, contorted in bud; stamens numerous, in bundles; ovary superior, 1- to 5-locular; ovules numerous; styles 3 or 5, free or fused; fruit a many-seeded 3- or 5-valved capsule. About 370 species, temperate and tropical mountainous regions of the Old World, some naturalized in North America.

1. Plant glabrous
+ Plant pubescent

1. *H. triquetrifolium*
2

2. Leaves 0.3-1.2 x 0.3-0.8 cm
+ Leaves 1.5-5 x 0.8-1.5 cm

2. *H. sinaicum*
3. *H. lanuginosum*

1. *Hypericum triquetrifolium* Turra, Farset. Nov. Gen. 12 (1765).
Syn. *Hypericum crispum* L., Man. 106 (1767).

Perennial herb 15-30 cm, glabrous; stems decussately branched from the base; leaves 0.3-1.2 cm, sessile, lanceolate; margins with black dots, undulate; base cordate, the tip acute; flowers 1.5 cm diam., in terminal small cymes; sepals 1.5-2 mm, ovate-oblong; petals yellow, 6-8 mm, linear-oblong, eglandular; stamens in 3 bundles; capsule 3-locular; seeds pitted.

S (Rafah); sandy soil. East Mediterranean region, West Asia.

NOTE: Plant poisonous to livestock.

2. *Hypericum sinaicum* Hochst. & Steud. ex Boiss., Fl. Orient. 1: 808 (1867).

Perennial herb 10-25 cm, with woody base; stems branched, ascending; leaves 0.3-1.2 x 0.3-0.8 cm, white-tomentose, sessile, ovate to elliptic, with scattered black gland-dots; flowers 1-1.5 cm diam., in few-flowered terminal cymes; sepals 3-4 x 1-1.25 mm, acute, with black glandular dots, the margins with stalked black glands; petals 6-8 x 3.5 mm, yellow, persistent; stamens in 3 bundles; styles 3, free; capsule 5 x 3 mm, ovoid, 3-valved.

S; mountainous sheltered moist crevices. Sinai, Northwest Saudi Arabia.

3. *Hypericum lanuginosum* Lam., Encycl. 4: 171 (1797).

Perennial herb 15-50 cm, tomentose-canescens; stems few, arising from the base; leaves

1.5-5 x 0.8-1.5 cm, ovate-oblong to cordate, the base amplexicaul, with black glands close to the margin; flowers 1.5-2 cm diam., in paniculate terminal cymes; bracts with stipitate glands; sepals 2.5 mm, ovate, dentate, with black glands; corolla 6-8 mm, slightly glandular at the margins; stamens in 3 bundles, with a black gland at the apex of connective; capsule 5 mm, ovoid; seeds reticulate.

S; rock crevices. East Mediterranean region, Sinai.

PAPAVERACEAE

Annual and perennial herbs (our species), rarely shrubs and trees, often with latex or coloured sap; leaves alternate, sometimes in rosettes, lobed or divided, exstipulate; flowers usually large, bisexual and solitary; sepals 2 or 3, free, caducous; petals 4-6, rarely more or 0, free, usually crumpled in bud; stamens numerous and spirally arranged, free; ovary superior of 2 or more connate carpels, 1- to 2-celled, with parietal placenta, often forming false septa; ovules few or many; style short or 0; stigmas equalling the number of carpels; fruit a capsule, dehiscent by valves or pores, many-seeded; seeds with mealy or oily endosperm, embryo minute. 23 genera, 230 species, mainly north temperate regions.

- | | |
|--|--------------------|
| 1. Fruit a capsule, opening by pores below the stigmatic head | 1. Papaver |
| + Fruit a capsule, opening by valves | 2 |
| 2. Capsule oblong, 1.5-2 cm diam., armed with prickles | 2. Argemone |
| + Capsule linear, 2-5 mm diam., glabrous or hairy | 3 |
| 3. Capsule 2.5-7.5 cm, 3-valved; stigma globose, 3- to 4-lobed | 3. Roemeria |
| + Capsule 10-25 cm, 2-valved; stigma 2-horned | 4. Glaucium |

1. **Papaver** L.

Annual or perennial herbs with latex; sepals 2 or 3, usually caducous; petals 4 or 6, usually entire, often bright red, crumpled in bud, caducous; stigmas 4-6(-18), sessile over the placentae; capsule clavate to globose, opening by pores (our species) or valves below the stigmatic disc; seeds reniform. About 80 species, temperate regions of northern hemisphere.

- | | |
|---|--------------------------|
| 1. Capsule bristly | 2 |
| + Capsule glabrous | 3 |
| 2. Capsule 0.6-1.2 cm diam., ovoid-globose, densely covered with curved bristles | 1. P. hybridum |
| + Capsule 3-5 mm diam., oblong-cylindrical, with a few erect bristles | 2. P. argemone |
| 3. Sinuses between the stigma lobes extending almost to the centre of the disc; upper leaves linear-lanceolate, not dissected | 3. P. macrostomum |
| + Stigma lobes and leaves not as above | 4 |

4. Plant glabrous; upper leaves clasping 4. **decaisnei**
 + Plant variably hairy; upper leaves not clasping 5
5. Stigmatic disc flat; lower leaves long-petiolate, the upper short-petioled 5. **P. humile**
 + Stigmatic disc convex; lower leaves short-petiolate, the upper sessile or subsessile 6
6. Peduncles with spreading hairs; capsule subglobose to obovoid-oblong,
 less than twice as long as broad; stigmatic disc wider than the capsule,
 with 8-15(-18) rays 6. **P. rhoeas**
 + Peduncles with appressed hairs; capsule narrowly obovoid-oblong,
 more than twice as long as broad; stigmatic disc not wider than
 the capsule, with 5-9 rays 7. **P. dubium** subsp. **dubium**

1. **Papaver hybridum** L., Sp. Pl., ed. 1, 506 (1753).
 Syns. *Papaver hispidum* Lam., Fl. Fr. 3: 174 (1779).
Papaver siculum Guss., Fl. Sicul. Syn. 2: 6 (1844).
Papaver apulum Ten. var. *gracillimum* Fedde, Pflanzr. 40: 332 (1909).

Annual herb 10-40 cm; stems erect or ascending, hispid-setose; leaves 1- to 3-pinnatifid; pedicels appressed-setose; flower buds patent-setose; petals 1.8-2.5 cm, pink with basal black spot, anthers blue; capsule 0.8-1.5 x 0.6-1.2 cm, ovoid-globose, densely covered with curved bristles; stigmatic disc narrower than the capsule, with 4-8 prominent rays.

M, S; weed of cultivation, sandy soils. Atlantic Islands, Europe, North Africa, Sinai, Asia eastwards to Mongolia.

2. **Papaver argemone** L., Sp. Pl., ed. 1, 506 (1753).

Annual herb 10-30 cm, appressed-setulose; stems simple or branched, erect or ascending; leaves 1- to 2-pinnatisect, the segments oblong, acute; pedicels long, appressed-setulose; flower buds 0.5-1 cm, oblong-ovoid; sepals bristly; petals 1-2 cm, scarlet with a dark base; anthers bluish; capsule 1-2.5 x 0.3-0.5 cm, oblong-cylindrical, with a few erect bristles; stigmatic disc narrower than the capsule, with 4-6 rays.

M, S; weed of cultivation, sandy soils. Mediterranean region, Europe, Southwest Asia.

3. **Papaver macrostomum** Boiss. & A. Huet in Boiss., Fl. Orient. 1: 115 (1867).
 Syn. *Papaver divergens* Fedde & Bornm. in Engl., Pflanzenr. 40: 337 (1909).

Annual herb 10-30 cm; stems erect, branched; lower leaves pinnatisect, the segments oblong-lanceolate; upper leaves linear-lanceolate, often all leaves not dissected; peduncles appressed-setose; flowers 4-5 cm diam.; petals broader than long, purple or crimson, with or without a spot at the base; capsule 1-1.5 cm, elliptic-oblong; stigmatic disc flat, with 5-10 rays, the sinuses between the stigma lobes extending almost to the centre of the disc.

S (Rafah); sandy soil. Sinai, Syria, Iran, extending to South Russia and Caucasia.

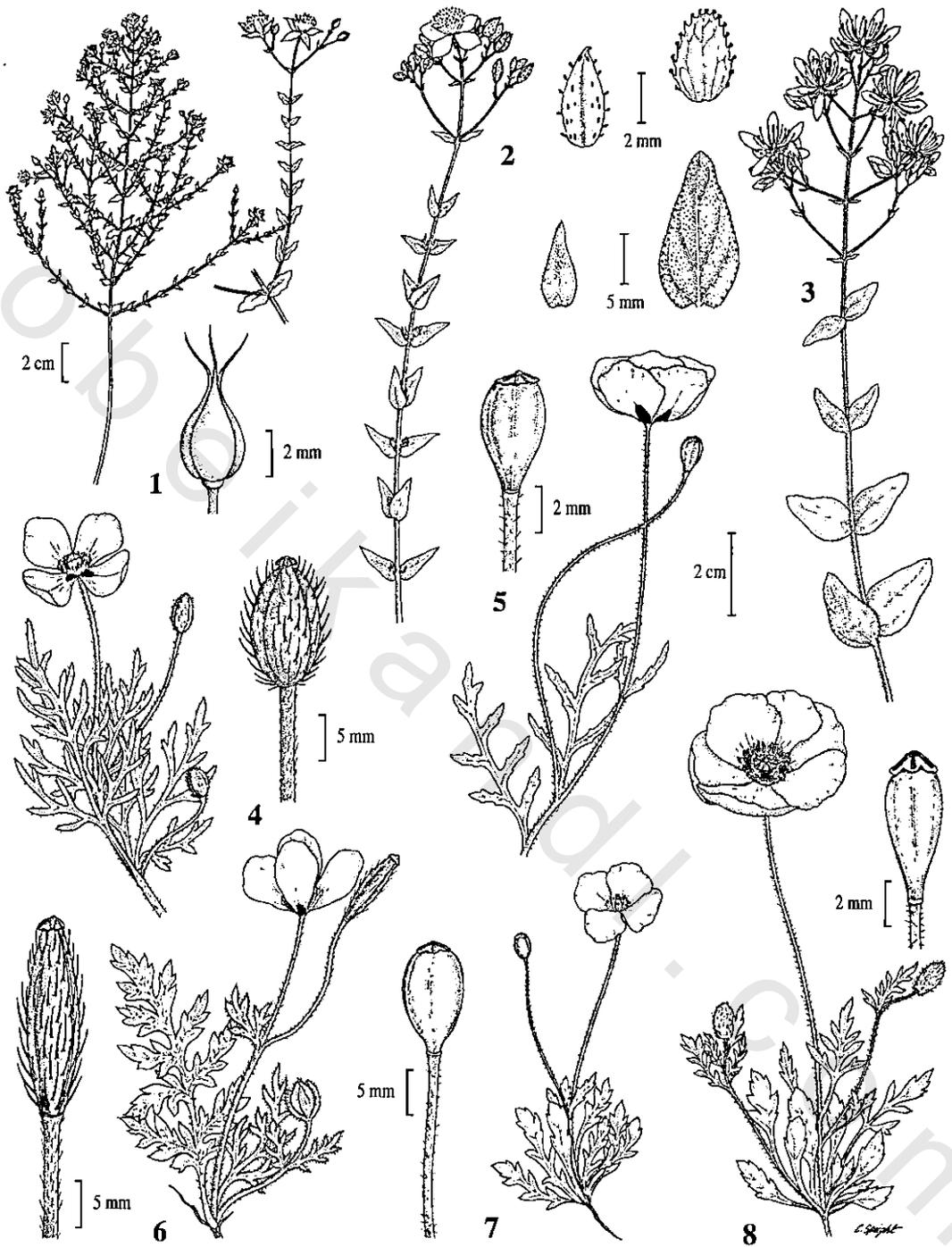


Plate 30. GUTTIFERAE: *Hypericum triquetrifolium* 1, flowering branches and fruit. *Hypericum sinaicum* 2, flowering branch; calyx lobe (up right); leaf (down right). *Hypericum lanuginosum* 3, flowering branch; calyx lobe (up left); leaf (down left). **PAPAVERACEAE:** *Papaver hybridum* 4, flowering branch; fruit (right). *Papaver humile* 5, flowering branch; fruit (up left). *Papaver argemone* 6, flowering branch; fruit (left). *Papaver decaisnei* 7, habit; fruit (left). *Papaver rhoeas* 8, habit; fruit (up right). All drawings to the same scale except enlarged parts (scale given).

4. **Papaver decaisnei** Hochst. & Steud. ex Elkan, Tent. Monogr. Papav. 26 (1839).

Annual herb 10-50 cm, glabrous, glaucous; stems erect, branched; leaves pinnatifid to pinnatisect, with entire or toothed margins, the upper leaves clasping; flowers 2 cm diam., on long peduncles; petals red to purple; capsule 1.5-1.8 x 0.6-0.8 cm, ribbed, tapered at the base, glabrous; stigmatic disc flat.

De, S; stony and sandy wadis. Egypt, Palestine, Arabia, Southwest Asia to Afghanistan and Pakistan.

5. **Papaver humile** Fedde, Bull. Herb. Boiss., ser. 2, 5: 446 (1905).

Annual herb 10-40 cm; stems erect or decumbent, branched mainly at the base; lower leaves long-petiolate, pinnatisect; the lobes triangular to linear, dentate, often at right angles to the leaf axis; upper leaves short-petiolate, with narrow divaricate lobes; pedicels appressed or spreading hairy; flower buds 1.2-1.4 cm, ovoid-oblong; flowers 3-4 cm diam.; petals scarlet; capsule 0.8-1.4 x 0.5-0.7 cm, obovoid; stigmatic disc flat, slightly broader than the capsule; stigmatic rays 6-12(-15), overlapping.

M, S; sandy coasts. East Mediterranean region, Sinai.

6. **Papaver rhoeas** L., Sp. Pl., ed. 1, 507 (1753).

Annual herb 20-50 cm, stems erect, branching, usually hispid; leaves to 12 cm, 1- to 2-pinnatisect, the lower leaves short-petiolate, the upper sessile; segments coarsely dentate, terminal usually longer than lateral, hispid especially along the veins; peduncles with spreading hairs; petals 2.5-4 cm, red with a dark blotch at the base; capsule 1-2 x 0.7-1.2 cm, subglobose to obovoid-oblong, less than twice as long as broad, rounded at the base, glabrous; stigmatic disc wider than the capsule; stigmatic rays 8-15(-18).

N, M, D, S; barley fields, orchards, roadsides. North Africa, Europe, Asia.

7. **Papaver dubium** L., Sp. Pl., ed. 1, 1196 (1753) subsp. **dubium**

Annual herb 20-50 cm, hispid to glabrescent; stems simple or with few branches from the base; basal leaves 2-pinnatisect, the cauline pinnatifid with linear-lanceolate lobes; pedicels to 15 cm, appressed-hairy; flower buds 1.5-2 cm, ovoid-orbicular, hispid; flowers 3-5 cm diam.; petals red, pink or scarlet with a basal black blotch, suborbicular-obovate; capsule 1.5-2 x 0.4-0.8 cm; narrowly obovoid-oblong, more than twice as long as broad; stigmatic disc not wider than the capsule; stigmatic rays 5-9; seeds reniform, bluish-black.

M, S; weed of cultivation. North Africa, Europe, Asia.

2. **Argemone** L.

Annual or short-lived perennial herbs, armed with sharp prickles; latex white or yellow; leaves sinuate to pinnatifid, glaucous, with conspicuous white veins, the margins spiny, the base amplexicaul; flowers solitary, showy; sepals 2-3, spine-tipped, petals 4-6, yellow; stamens numerous; ovary 1-locular; stigma sessile, stellate; capsule splitting at apex into 3-6 valves, many-seeded. 23 species, North and South America, West Indies, Hawaii.

1. *Argemone mexicana* L., Sp. Pl., ed. 1, 508 (1753).

Annual herb 20-80 cm, with yellow latex; stems erect, branched; leaves 5-10 x 2.5-5 cm; rather fleshy, oblong-elliptic, pinnatifid; the margins and veins on the lower surface armed with sharp prickles; flowers axillary, sessile; petals 2-3.5 x 2-2.5 cm, yellow, obovate; capsule 3-4 x 1.5-2 cm, oblong, armed with prickles, the lid covered by the stigmatic disc.

N; Nile banks, waste ground, edges of cultivation. Pan-tropical weed, naturalized from Central America.

3. *Roemeria* Medik.

Annual herbs with foetid yellow latex; leaves 2- to 3-pinnatisect into narrow segments; flowers solitary; sepals 2, petals 4, red or violet; stamens numerous; ovary 1-locular; stigma globose, 3-4 lobed; fruit a linear-cylindrical capsule, 3- to 4-valved, 1-locular, many-seeded, the valves dehiscent from apex to base. 3 species, Mediterranean region to Afghanistan.

1. *Roemeria hybrida* (L.) DC., Syst. Nat. 2: 92 (1821).

Syns. *Chelidonium hybridum* L., Sp. Pl., ed. 1, 506 (1753).

Roemeria tenuifolia Pamp., Nuovo Giorn. Bot. Ital., ser. 2, 26: 211 (1919).

Annual herb 10-25 cm, pubescent; stems unbranched or few, erect or ascending, branched; leaves sparingly hairy to glabrescent, 1- to 3-pinnatisect; lobes 0.5-2 cm, linear-oblong, bristly tipped; margins serrate; radical leaves long-petiolate, the upper sessile; flower buds 1-1.2 cm, oblong, sparingly hairy; sepals 1 cm; petals 1-2 cm, violet-blue with a dark spot at the base; stamens with black filaments; capsule 2.5-7.5 x 0.2-0.3 cm, 3-valved, narrowly cylindrical, glabrescent to densely covered with spreading setae; seeds 1 mm, reniform, reticulate.

Two subspecies occur in Egypt:

subsp. *hybrida*

Capsule 5-7.5 cm; leaves 2- to 3-pinnatisect, the ultimate segments 1-2 x 0.15-0.3 cm.

M, S; cultivated ground, desert wadis and plains. Europe, North Africa, Southwest Asia.

subsp. *dodecandra* (Forssk.) Maire in Jahand. & Maire, Cat. Pl. Maroc 257 (1932).

Syns. *Chelidonium dodecandrum* Forssk., Fl. Aegypt.-Arab. 100 (1775).

Roemeria orientalis Boiss., Ann. Sci. Nat. Bot., ser. 2, 16: 374 (1841).

Roemeria dodecandra (Forssk.) Stapf, Denkschr. Kaiserl. Akad. Wiss. Math.-Naturwiss. Kl. 51: 295 (1885).

Capsule 2.5-4.5 cm; leaves 1- to 2-pinnatisect, the segments shorter and broader than in subsp. *hybrida*.

M, De, S; desert wadis, sandy plains. North Africa, West Asia to Pakistan.

4. *Glaucium* Mill.

Annual or perennial herbs, glaucous, with yellow juice; leaves large, the radical petiolate, pinnatifid or lobed, the cauline clasping; flowers showy, solitary, axillary or terminal, long-pedicellate, yellow, red or orange; sepals 2, caducous; petals 4, caducous; stamens numerous, free; ovary elongate, 2-valved, 2-horned at the apex; seeds numerous. 23 species, Europe, Mediterranean region, Southwest and Central Asia, some naturalized in North America.

1. Flowers yellow 2
+ Flowers red or orange-red 3
2. Lower leaves 3-10 cm, short-petiolate; capsule 8-15 cm; petals yellow 4. *G. arabicum*
+ Lower leaves 15-35 cm, long-petiolate; capsule 12-25 cm; petals bright yellow 3. *G. flavum*
3. Annual, upper leaves longer than pedicels 1. *G. corniculatum* subsp. *corniculatum*
+ Perennial, upper leaves much shorter than pedicels 2. *G. grandiflorum*

1. *Glaucium corniculatum* (L.) Rudolph, Fl. Jen. 13 (1781) subsp. *corniculatum*
Syns. *Chelidonium corniculatum* L., Sp. Pl., ed. 1, 506 (1753).
Glaucium phoeniceum Crantz, Stirp. Austr. Fasc. 2: 133 (1763).
Glaucium rubrum Sm., Fl. Graec. Prodr. 1: 357 (1809).
Glaucium tricolor Besser, Enum. Pl. 69 (1821).

Annual herb 20-50 cm, papillose-hairy; stems erect or ascending, branched; leaves 1- to 2-pinnatifid; lobes narrowly-oblong, rather spaced, coarsely dentate; lower leaves 10-25 cm, petiolate; upper leaves longer than pedicels, clasping; flower buds 1.5-3 cm; sepals papillose-hairy; petals 1.5-3 cm, light scarlet or orange-red with a blackish spot at the base; capsule 10-20 cm, appressed or patent-hairy; stigma broader than the capsule, with ascending horns.

N (Cairo region), M, S; moist waste ground. Bulgaria, Romania, Caucasia, Mediterranean region, Sinai, Arabia, North Iraq, Iran.

2. *Glaucium grandiflorum* Boiss. & A. Huet in Boiss, Diagn. Pl. Orient., ser. 2, 5: 15 (1856).
Syn. *Glaucium judaicum* Bornm., Beih. Bot. Centralbl. 29(2): 12 (1912).

Perennial herb 25-50 cm, glaucous; stems branching; lower leaves 10-15 cm, petiolate, pinnatisect segments spaced, obovate-oblong, irregularly dentate; intermediate leaves clasping, the upper leaves much shorter than pedicels; flower buds 1.5-4 cm, oblong to spindle-shaped, attenuate at the apex; sepals oblong, hairy; petals red to dark orange, with a violet spot at the base; capsule 10-18 cm, densely to loosely covered with appressed hairs.

M, S; desert wadis and sandy plains. East Mediterranean region, Sinai.

3. *Glaucium flavum* Cranz, Stirp. Austr. Fasc. 2: 133 (1763).
Syns. *Glaucium luteum* Scop., Fl. Carniol., ed. 2, 1: 369 (1771).



Plate 31. PAPAVERACEAE: *Argemone mexicana* 1, flowering and fruiting branch. *Roemeria hybrida* 2, habit. *Glaucium corniculatum* 3, flowering branch, fruit and basal leaf. *Glaucium grandiflorum* 4, flowering branch and fruit. *Glaucium flavum* 5, flowering and fruiting branch. *Glaucium arabicum* 6, flowering branch, basal leaf and fruit. All drawings to the same scale.

Glaucium fulvum Sm., Exotic Bot. 1: 11 (1805).

Short-lived perennial herb, 30-50 cm, papillose-hairy to glabrescent, glaucous; stems erect or ascending, branched; leaves rather succulent; lower leaves 15-35 cm, long-petiolate, pinnatifid; intermediate and upper leaves sessile, the base clasping; flowers 5-7 cm diam., bright yellow; capsule 12-25 cm, densely tuberculate, sometimes glabrous at maturity; stigma broader than the capsule.

S; moist coastal sandy soil. Europe, North Africa, East Mediterranean region, West Asia.

4. *Glaucium arabicum* Fresen., Mus. Senckenb. 1: 174 (1834).

Perennial herb 10-30 cm, glaucous, pilose; stems simple or branched; leaves densely hairy; lower leaves 3-10 cm, short-petiolate, pinnatifid, the lobes obovate-oblong, dentate, the terminal segments truncate; intermediate and upper leaves 2-4 cm, clasping; pedicels much longer than the upper leaves; flower buds 1.5-2 cm; sepals papillose-hairy; petals 1.5-2.5 cm, yellow; capsule 8-15 cm, straight, sparingly hairy to glabrous.

M, S; desert plains and wadis. Egypt, Palestine, Iraq.

FUMARIACEAE (incl. Hypecoaceae)

Annual or perennial herbs, often with swollen underground parts; leaves alternate to subopposite, usually dissected, exstipulate; flowers usually in racemes, irregular or \pm regular; calyx of 2 free sepals, bract-like, caducous; corolla of 4 petals, 1 or 2 outer with basal spur or pouch, inner 2 \pm connate over the stigmas; stamens 2 or 4, nectaries often at the base of stamens; ovary superior, of 2 fused carpels, 1-locular, with 2-numerous ovules on parietal placentas; fruit 1-seeded indehiscent nutlet or capsule often with replum, dehiscent longitudinally, breaking into 1-seeded segments; seeds arillate; endosperm oily, abundant. 17 genera, 530 species, north temperate, few tropical African mountains and South Africa.

1. Flowers irregular; stamens 2
+ Flowers \pm regular; stamens 4

1. *Fumaria*
2. *Hypecoum*

1. *Fumaria* L.

Annual glabrous herbs; stems erect, diffuse or climbing; leaves alternate, 2-3-pinnatisect; flowers white, pink or purplish, in bracteate racemes in the axils of upper leaves; petals 4, in 2 whorls; upper petal spurred at the base, the 2 lateral petals fused at their tips; stamens 2; fruit 1-seeded, indehiscent nutlet. 50 species, Europe, Mediterranean region to Central Asia, Himalaya, highlands of tropical East Africa.

1. Flowers 1-1.6 cm
+ Flowers 3-9 mm

2
4

2. Fruit distinctly keeled at the margins
+ Fruit not keeled

7. *F. gaillardotii*
3

3. Mature dry fruits smooth, the fruiting pedicel arcuate-recurved

6. *F. capreolata*

- + Mature dry fruits rugose, the fruiting pedicel erect 8. *F. judaica*
4. Corolla 7-9 mm, bract shorter than the fruiting pedicel, apex of fruit truncate or slightly emarginate 5. *F. officinalis* subsp. *officinalis*
- + Corolla 3-7 mm, bract longer than the fruiting pedicel; apex of fruit not truncate or emarginate 5
5. Sepals broader than the corolla and half its length 6
- + Sepals narrower than the corolla and 1/5 its length 7
6. Flowers 6-7 mm; corolla pink with blackish-red tip 1. *F. densiflora*
- + Flowers 3-4.5 mm; corolla deep pink 2. *F. bracteosa*
7. Fruit 2 x 2 mm, globose, keeled, obtuse or apiculate at the apex 3. *F. parviflora*
- + Fruit 3 x 3 mm, obcordate, not keeled, retuse at the apex 4. *F. microstachys*

1. *Fumaria densiflora* DC., Cat. Pl. Hort. Monsp. 113 (1813).
 Syns. *Fumaria micrantha* Lag., Gen. Sp. Pl. 21 (1816).
Fumaria obtusisepala Pugsley, J. Linn. Soc. Bot. 50: 550 (1937).
Fumaria densiflora DC. subsp. *micrantha* (Lag.) Maire & Weiller in
 Maire, Fl. Afr. Nord 12: 102 (1965).

Annual herb 10-25 cm; stems erect or spreading; leaves 2-6 cm, 3- to 4 pinnatisect; lobes linear, canaliculate; raceme 15-to 30-flowered; bracts longer than the fruiting pedicels; sepals 2.5-3.5 mm, orbicular-elliptical, broader than the corolla; corolla 6-7 mm, pink; wings of upper petal and tip of inner blackish-red; fruit 2-2.5 mm, globose, keeled, rugose at maturity, the apex rounded.

N, O, M, S; weed of cultivation. Mediterranean region, Europe, West Asia.

2. *Fumaria bracteosa* Pomel, Nouv. Mat. Fl. Atl. 239 (1874).
 Syns. *Fumaria parlatoreana* (Boiss.) Bornm., Verh. K. K. Zool.-Bot. Ges. Wien 48: 549 (1898).
Fumaria emarginata Braun-Blanq., Bull. Soc. Hist. Nat. Afr. Nord 13:13 (1922).
Fumaria densiflora DC. subsp. *bracteolosa* (Pomel) Murb., Acta Univ. Lund, ser. 2, 18(3): 40 (1922).

Annual herb 10-30 cm; stems diffuse, branched mainly at the base; leaves 2-6 cm, 2- to 3-pinnatisect, glaucous, the segments finely linear-setaceous; racemes dense, 15- to 35-flowered; bracts longer than the erect fruiting pedicels; sepals 1.5-2.5 mm, broader than the corolla; corolla 3-4.5 mm, deep pink; fruit 2-2.5 mm, globose, strongly keeled, rugose at maturity, the apex emarginate.

M, S; cultivated and waste ground. North Africa, Sinai, Cyprus, Lebanon, Syria, Palestine, Iraq.

3. *Fumaria parviflora* Lam., Encycl. 2: 567 (1788).
 Syns. *Fumaria leucantha* Viv., Fl. Cors. Prodr. 12 (1824).
Fumaria glauca Jord., Mém. Acad. Roy. Sci. Lyon, Sect. Sci, ser. 2, 1: 219 (1852).

Fumaria minima Pugsley, J. Linn. Soc., Bot. 50: 552 (1937).

Annual herb 5-30 cm; stems diffuse or suberect, richly branched; leaves 1.5-4 cm, 2- to 3-pinnatisect, segments very narrow-linear, channelled; petiole 0.5-2 cm, raceme 7- to 15(-20)- flowered; bracts longer than the fruiting pedicel; sepals 0.5-0.8 x 0.5-0.8 mm, narrower than the corolla; corolla 4-5 mm, white, occasionally flushed pink; fruit 1.6-2.2 x 1.8-2.5 mm, subglobose, distinctly keeled, acute.

N, M, De, S; weed of cultivation, waste ground. Atlantic Islands, Europe, Mediterranean region, West Asia to Afghanistan.

4. *Fumaria microstachys* Hausskn., Flora (Regensburg) 56: 552 (1873).

Annual herb, leaves 2- to 3-pinnatisect, the leaf segments linear; racemes few-flowered, lax; flowers 5-6 mm, pink; sepals long-acuminate; fruit 3 x 3 mm, obcordate, retuse at the apex, not keeled.

M; weed of cultivation. Endemic.

5. *Fumaria officinalis* L., Sp. Pl., ed. 1, 700 (1753) subsp. *officinalis*

Annual herb 10-25 cm; stems erect or diffuse, richly branched; leaves 5-8 cm, the ultimate segments unequal, narrowly linear, acute; racemes dense, many-flowered; bracts 1-2.5 mm, purple-tinged, shorter than the fruiting pedicels; sepals 2.5-3 x 1.5-2 mm; corolla 7-9 mm, purplish-pink, tip blackish-red; fruit 2 x 2.5-3 mm, apex truncate or slightly emarginate, rugose when dry.

M; weed of cultivation. Atlantic Islands, Europe, Mediterranean region, West Asia to Iran.

6. *Fumaria capreolata* L., Sp. Pl., ed. 1, 701 (1753).

Syns. *Fumaria speciosa* Jord., Cat. Graines Jard. Grenoble 1849: 15 (1849).

Fumaria pallidiflora Jord., Arch. Fl. France Allemagne 305 (1854).

Fumaria platycalyx Pomel, Nouv. Mat. Fl. Atl. 239 (1874).

Annual herb 10-30 cm; stems much branched at the base; leaves 5-8 cm, 2-pinnatisect, petiolate; racemes 15- to 25-flowered, fruiting pedicels arcuate-recurved; corolla 1-1.4 cm, creamy-white to pinkish, blackish-red at the tip; mature fruit 2.5 mm, globose, smooth, pitted at the apex.

M, S; stony ground. Europe, Mediterranean region, Sinai.

7. *Fumaria gaillardotii* Boiss., Fl. Orient. 1: 139 (1867).

Annual herb 15-40 cm; stems diffuse or scrambling, sparingly branching; leaves 4-10 cm, petiole of basal leaves 2-5 cm, upper leaves sessile or subsessile; ultimate leaf segments to 4 mm diam., oblong, obtuse; raceme 10- to 20-flowered; sepals 2-4 x 2 mm, broadly ovate, acute, white, membranous, margins lacinate; corolla 1-1.2(-1.4) cm, pale purplish pink; fruiting pedicels short, thick, suberect; fruit compressed-globose, 2.5-3.5 mm diam., distinctly keeled at the margins, verruculose, minutely apiculate, with shallow obscure apical pits.

M, S; sheltered cultivated ground, under the shrubs or trees. Southeast Europe, East Mediterranean region, Sinai.

8. **Fumaria judaica** Boiss., *Diagn. Pl. Orient.*, ser. 2, 8: 15 (1849) subsp. **judaica**

Annual herb 20-50 cm; stems sparingly branched near the base; leaves 5-10 cm, 2-pinnatisect; ultimate leaf lobes to 1.5 mm diam.; broadly lanceolate, acute; petiole 2-6 cm, channelled above; raceme 8- to 20-flowered; bracts 2-2.5 mm, shorter than the fruiting pedicel; sepals 1-2 mm; corolla 1 cm, white or pink-tinged; fruiting pedicels 2.5-3 mm, erect; fruit 2.5-3 mm diam., compressed-globose, rugose; the apex obtuse, with apical pits.

N, M; waste ground and cultivated land. Egypt, Palestine, Cyprus, southeastern Europe.

2. **Hypecoum** L.

Annual herbs, glabrous; basal leaves 2- to 3-pinnate, the ultimate leaflets narrow; sepals 2, free; petals 4, at least the inner pair 3-lobed; stamens 4; stigmas 2, style short; capsule a striate lomentum, usually breaking into 1-seeded portions; seeds rugose. 20 species, Mediterranean region to Central Asia and North China.

- | | |
|---|--|
| 1. Fruit pendulous, on a deflexed pedicel | 1. H. pendulum |
| + Fruit erect | 2 |
| 2. Outer petals entire, not lobed | 3. H. littorale |
| + Outer petals 3-lobed | 3 |
| 3. Central lobe of inner petals entire | 7. H. aegyptiacum |
| + Central lobe of inner petals fringed or ciliate | 4 |
| 4. Two of the filaments of stamens winged on both sides, the two others winged on one side only | 4. H. dimidiatum |
| + All filaments winged on both sides | 5 |
| 5. Flowers small, to 1 cm diam. | 2. H. procumbens subsp. procumbens |
| + Flowers larger, more than 1 cm diam. | 6 |
| 6. Outer petal clawed, the lateral lobes subequal, slightly smaller than the middle lobe | 5. H. aequilobum |
| + Outer petal hardly clawed, the lateral lobes equalling or larger than the middle lobe | 6. H. imberbe |

1. **Hypecoum pendulum** L., *Sp. Pl.*, ed. 1, 124 (1753).

Syns. *Hypecoum parviflorum* Kar. & Kir., *Bull. Soc. Imp. Nat. Moscou* 15: 141 (1842).

Hypecoum tetragonum Bertol., *Misc. Bot.* 1: 12 (1842-1863).

Annual herb 5-40 cm, greyish-green to glaucous, smelling of curry on drying; leaves 2- to 3-pinnatisect, ultimate lobes linear; inflorescence 1- to 12-flowered; flowers 0.6-1 cm, sepals 2-3.5 x 1-2.5 mm, acute, caducous; outer petals 5-8 x 2.5-5 mm, pale yellow,

rhombic; inner petal with black spots, lateral lobes $\frac{1}{2}$ the length of lamina of central lobe; central lobe 1-2.5 x 1-2.5 mm, broadly elliptical; filaments sometimes with black spots; fruit 2-3 mm diam., pendulous, on a deflexed pedicel, straight, not thickened at septa.

M, De, S; desert wadis, sandy soils. Central Europe, Mediterranean region, West Asia.

2. **Hypocoum procumbens** L., Sp. Pl., ed. 1, 124 (1753) subsp. **procumbens**

Syn. *Hypocoum ponticum* Velen, Sitzungsber. Königl. Böhm. Ges. Wiss. Prag, Math.-Naturwiss. Cl. 1893(37): 6 (1893).

Annual herb 10-40 cm, green or glaucous; leaves 2-3-pinnatisect; ultimate lobes linear-lanceolate, with 1 lateral tooth; inflorescence 1- to 10-flowered; flowers to 1 cm diam., sepals 2-7 x 1-2.2 mm; petals lemon-yellow to yellowish-orange; outer petals 0.4-1.2 x 1.1 cm, rhombic to 3-lobed; inner petals without black spots; fruit slightly arcuate, 1-3.5 mm diam. at the widest septa; seeds dark brown.

M; coastal sandy soils. Mediterranean region, West Asia.

3. **Hypocoum littorale** Wulfen in Jacq., Collectanea 2: 205 (1789).

Syns. *Hypocoum geslinii* Coss. & Kralik, Bull. Soc. Bot. Fr. 4: 52 (1857).

Hypocoum deuteroparviflorum Fedde, Bull. Herb. Boiss., ser. 2, 5: 166 (1905).

Annual herb 5-25 cm, glaucous; leaves 2- to 3-pinnatisect, the ultimate lobes linear, acute; inflorescence 5- to 15-flowered; sepals 3-4 x 1-1.5 mm, persistent; petals yellow, the outer petals 6-8.5 x 2-4.5 mm, rhombic, entire, not lobed; inner petals without black spots, the lateral lobes $\frac{1}{2}$ as long as the lamina of the central lobe, the central lobe 1.2 x 1.5 mm; filaments linear, without black spots; fruit 1-2 mm diam., erect, compressed, slightly arcuate, not thickened at septa; seeds dark brown.

M, S; sandy shores and plains. Southern Portugal and Spain, North Africa, Sinai, Palestine, Iraq.

4. **Hypocoum dimidiatum** Delile in Laborde, Voy. Arabie Pétrée 84 (1830-1833).

Annual herb 5-40 cm, green or glaucous; leaves 2- to 3-pinnatisect, the ultimate lobes with 3-fid apex; inflorescence (1-)5- to 20-flowered; sepals 3-5 x 1.5-2.5 mm; the apex sometimes 2- or 3-fid; petals lemon yellow, the outer petals 0.7-1.1 x 0.65-1.3 cm, 3-lobed, the inner petals with black spots; lateral lobes 5.5-8.5 x 1-2.8 mm, linear; fimbriate lobe 3-5.5 x 1.7-3.4 mm; 2 of the filaments of stamens winged on both sides, the 2 others winged on one side only; fruit 1.5-4 mm diam. at the broadest septa.

S; stony wadis. Sinai, Palestine, Lebanon, Syria, Turkey.

5. **Hypocoum aequilobum** Viv., Fl. Libyc. Spec. 7 (1824).

Annual erect herb 10-35 cm, glaucous; leaves 2- to 3-pinnatisect, the ultimate lobes linear, acute; flowers yellow, the outer petals 1-1.2 cm, 3-lobed with a conspicuous claw; lateral lobes subequal, slightly smaller than the middle lobe; inner petal 9 mm, clawed,

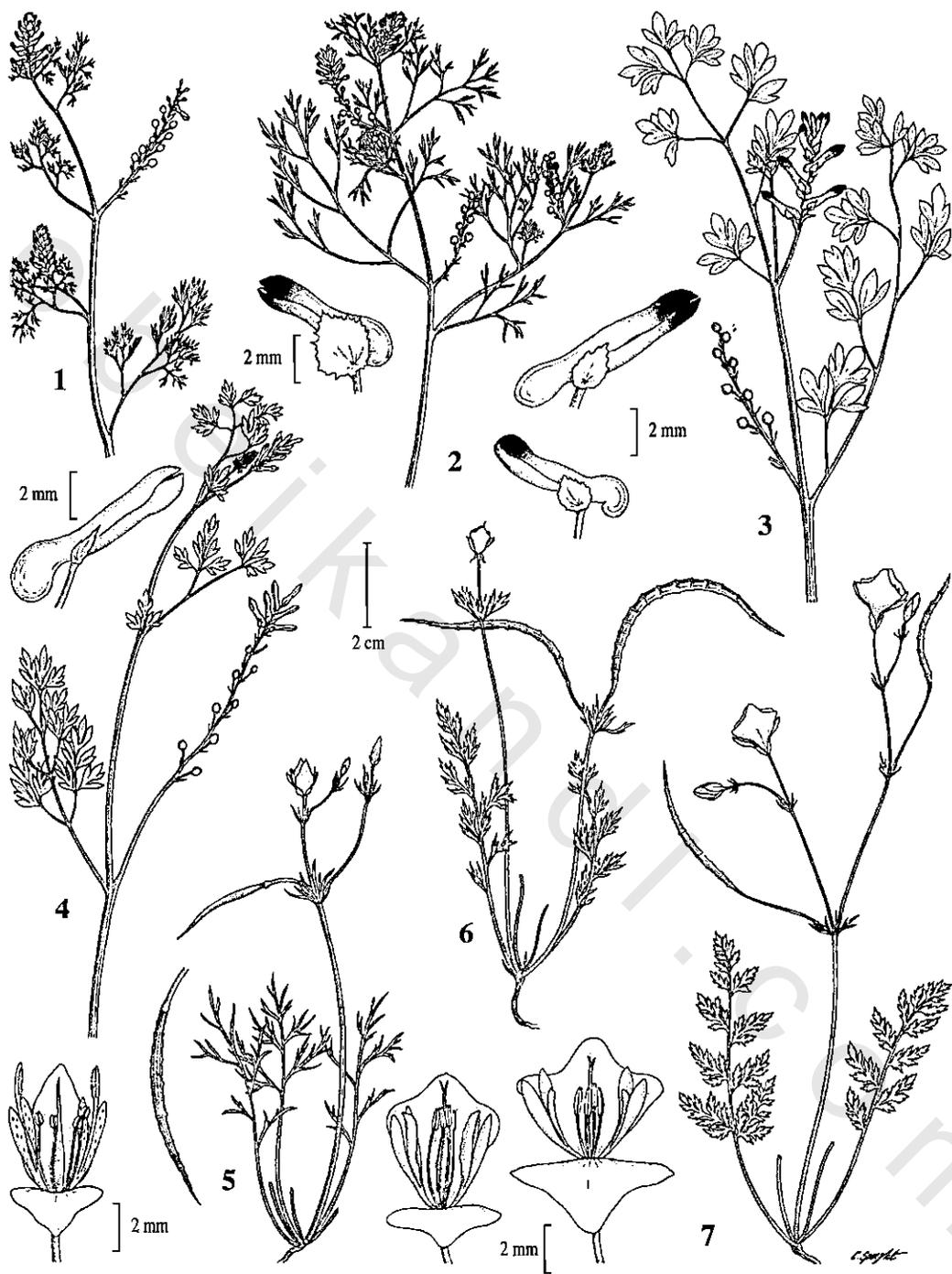


Plate 32. FUMARIACEAE: *Fumaria densiflora* 1, flowering and fruiting branch; flower (right). *Fumaria parviflora* 2, flowering branch; flower (down right). *Fumaria gaillardotii* 3, flowering and fruiting branch; flower (up left). *Fumaria judaica* 4, flowering and fruiting branch; flower (up left). *Hypecoum pendulum* 5, flowering and fruiting branch; flower and fruit (left). *Hypecoum procumbens* 6, habit; flower (down left). *Hypecoum aegyptiacum* 7, habit; flower (left). All drawings to the same scale except enlarged parts (scale given).

with subequal 3 linear-oblong lobes; the middle lobes with revolute-fimbriate margins; filaments of stamens dilated at the base; fruit 1.5 mm diam., slightly arcuate, erect; style persistent.

M, S; sandy soil. Egypt, Libya.

6. **Hypecoum imberbe** Sm., Fl. Graec. Prodr. 1: 107 (1806).

Syns. *Hypecoum grandiflorum* Benth., Cat. Pl. Pyrénées 91 (1826).

Hypecoum glaucescens Guss., Pl. Rar. 79 (1826).

Annual herb 5-30 cm, green or glaucous; leaves 2- to 3-pinnatisect, the ultimate lobes linear; inflorescence 5- to 15-flowered; sepals 2.5-6 x 1.5-3 mm, entire; petals orange-yellow; the outer petals 0.65-1.3 x 1.3 cm, distinctly 3-lobed, hardly clawed; lateral lobes equalling or larger than the middle lobe; inner petals with black spots; filaments of median stamens narrowly triangular, without black spots; fruit 2-3.5 mm diam. at the widest septa.

S (Rafah), N (Faiyum); sandy soil. Mediterranean region, Sinai.

7. **Hypecoum aegyptiacum** (Forssk.) Asch. & Schweinf., Mém. Inst. Egypt. 2: 37

(1887).

Syn. *Mnemosilla aegyptiaca* Forssk., Fl. Aegypt.-Arab. 122 (1775).

Annual herb 10-25 cm; leaves 2- to 3-pinnatisect, the ultimate lobes lanceolate, mucronate; inflorescence 3- to 15-flowered; flowers 0.8-1.5 cm diam., calyx 4-5 mm; apex 2-mucronate; outer petals 3-lobed, middle lobe as long as or slightly longer than the lateral ones; inner petals violet at the base, 3-partite, the central lobe entire; filaments of stamens narrowly winged; fruit 1.5-2 mm diam. at the broadest septa, straight or slightly arcuate.

N, M, S; sandy soil. Egypt, Palestine.

CAPPARACEAE (incl. Cleomaceae)

Herbs, shrubs or trees, sometimes woody climbers; leaves alternate, rarely opposite, simple or digitate; stipules present; flowers bisexual (our species), rarely unisexual, actinomorphic or zygomorphic, in racemes or clusters, sometimes solitary; sepals 4, free or connate; petals 4, sometimes 0, usually free; stamens 4 to many, often borne on an elongate androphore; ovary superior, sessile or borne on an elongate gynophore, 1 or several-celled by false septa; ovules numerous, rarely few, on parietal placenta; fruit a berry, capsule or nutlet; seeds reniform; endosperm absent. 39 genera, 650 species, especially in warm arid regions, few temperate.

1. Annual or perennial herbs 2
+ Shrubs or trees 4

2. Fruit a 1-seeded winged nutlet 5. **Dipterygium**
+ Fruit not as above 3

3. Androphore absent; stamens 4-numerous, free 6. **Cleome**

- + Androphore present; stamens c. 10, inserted on the androphore
 - 4. Leaves with spiny stipules
 - + Leaves exstipulate
 - 5. Fruit globose or ovoid, hard, indehiscent
 - + Fruit cylindrical or torulose, pulpy
 - 6. Stamens 4-5, inserted on the androphore
 - + Stamens 6-numerous, free, androphore absent
7. **Gynandropsis**
1. **Capparis**
5
3. **Boscia**
6
2. **Cadaba**
4. **Maerua**

1. **Capparis** L.

Shrubs, trees or woody climbers, usually with stipular spines and simple alternate leaves; flowers solitary, racemose, corymbose or umbellate, axillary or terminal, conspicuous; sepals 4; petals 4; stamens numerous; gynophore elongate or short; ovary 2- to 8-carpellate, 1-locular, the ovules numerous; stigma sessile; fruit a fleshy berry, indehiscent or separating into 3-4 valves; seeds numerous. 250 species, warm regions.

- 1. Leafless shrub or small tree, leaves when present linear-oblong to linear, soon deciduous; flowers red
 - + Leafy shrubs, leaves mostly broadly ovate; flowers white
 - 2. Posterior sepal 4 cm, much larger than the others; leaves fleshy, ovate-oblong
 - + Sepals 1-2 cm, subequal; leaves sometimes fleshy, ovate-orbicular, elliptical or orbicular
1. **C. decidua**
2
2. **C. sinaica**
3. **C. spinosa**

1. **Capparis decidua** (Forssk.) Edgew., Proc. Linn. Soc. Bot. 6: 184 (1862).
 Syns. *Sodada decidua* Forssk., Fl. Aegypt.-Arab. 81 (1775).
Capparis aphylla Roth, Nov. Pl. Sp. 238 (1821).
Capparis sodada R. Br. in Denham *et al.*, Narr. Travels Africa 225 (1826),
 nom. illeg.

Shrub or small tree to 4 m; stems usually leafless; leaves few, 1-2 cm, appearing on young twigs, linear-oblong to linear, spiny-tipped, soon deciduous; stipular spines short recurved; flowers in axillary clusters of 2-5, borne on short branches; pedicels 0.5-1.5 cm; sepals 0.5-1 cm, unequal, the posterior large and deeply concave; petals red, 0.8-1.2 cm, unequal, the 2 posterior partly enclosed within the posterior sepal; stamens 8-20; gynophore 1-1.5 cm; fruit 0.6-1 cm diam., subglobular, apiculate, yellow or red; pubescent, long-stipitate; seeds few to many.

N, O, D, R, GE, S; desert wadis, sandy and alluvial plains. Tropical East and North Africa, Sinai, Palestine, Arabia, Iran, Pakistan, Northwest India.

2. **Capparis sinaica** Veill. in Duh., Traité Arbr. Arbust., ed. 2, 1: 144 (1801).
 Syns. *Capparis cartilaginea* Decne., Ann. Sci. Nat. Bot., ser. 2, 3: 273 (1835).
Capparis galeata Fresen., Mus. Senkenb. 2: 111 (1837).
Capparis spinosa L. subsp. *cartilaginea* (Decne.) Maire & Weiller in
 Maire, Fl. Afr. Nord 12: 120 (1965).

Shrub 1-2.5 m; stems many, intricately branched; leaves 2.5-4.5 x 1-3.5 cm, long-petiolate, thick, ovate-oblong, with a spiny tip; stipular spines short, recurved; flower buds 1.5 x 2 cm; flowers 7-8 cm diam., solitary, axillary, zygomorphic, white; sepals unequal; the posterior 4 cm, largest, with a deep cavity; petals unequal, the anterior pair free, the posterior coherent; ovary borne on a long gynophore; fruit 6-8 cm, pyriform berry, on a stipe 2.5-4 cm; seeds numerous, reniform.

De, R, GE, S; cliffs, stony wadis. East and Southwest Africa, Southwest Asia to India.

3. *Capparis spinosa* L., Sp. Pl., ed. 1, 503 (1753).

Shrub 30-80 cm, stems trailing or ascending; leaves 1-4.5 x 0.5-4 cm, mostly ovate-orbicular; flowers solitary on pedicels 1.5-5 cm; sepals 1-2 cm, subequal; petals 1-2.5 x 0.5-1.5 cm, subequal, white, obovate; stamens 2-3.5 cm, numerous; gynophore 2-4 cm; fruit 3-6 cm, pyriform; seeds numerous.

Four varieties occur in Egypt:

var. *spinosa*

Syns. *Capparis aegyptia* Lam., Encycl. 1: 605 (1785).

Capparis spinosa L. var. *aegyptia* (Lam.) Boiss., Fl. Orient. 1: 420 (1867).

Plant glabrous; stipules often spinose; filaments of stamens pink; fruit 2.5-5.5 x 2.5-4 cm.

O, D, S; cliffs, rocky slopes, desert wadis.

var. *canescens* Coss., Notes Pl. Nouv., Fasc. 2: 28 (1849).

Syns. *Capparis ovata* Desf., Fl. Atlant. 1: 404 (1798).

Capparis sicula Duh., Traité Arbr., ed. 2, 1: 159 (1801).

Capparis leucophylla DC., Prodr. 1: 246 (1824).

Capparis ovata var. *palaestina* Zohary, Bull. Res. Council Israel D, 8: 56 (1960).

Capparis ovata Desf. var. *canescens* (Coss.) Heywood, Feddes Repert. 69: 56 (1964).

Plant greyish-green, canescent; stipules often spinose; filaments of stamens white; fruit 2.5-3 x 1.5-2 cm.

O, De, S; stony desert wadis and plains.

var. *inermis* Turra, Fl. Ital. Prodr. 65 (1730).

Syns. *Capparis orientalis* Duh., Traité Arbr., ed. 2, 1: 142 (1801).

Capparis rupestris Sibth. & Sm., Fl. Graec. Prodr. 1: 355 (1809).

Capparis spinosa L. var. *rupestris* (Sibth. & Sm.) Viv., Fl. Libyc. Spec. 26 (1824).

Capparis spinosa L. subsp. *orientalis* (Duh.) Jafri in Ali & Jafri, Fl. Libya 12: 3 (1977).

Leaves large, 3-4.5 cm wide, orbicular, thick; stipules up to 2 mm, setaceous, inconspicuous; flowers large, 4-5.5 cm diam.

M; maritime cliffs.

var. **deserti** Zohary, Bull. Res. Council Israel D, 8: 54 (1960).

Syns. *Capparis deserti* (Zohary) Täckh. & Boulos, Publ. Cairo Univ. Herb. 5: 14 (1974).

Leaves small, 1-1.5 cm wide, orbicular, glabrous, spine-tipped; stipular spines patent, yellow; stems prostrate.

Dw (North of Siwa Oasis); alluvial desert plains.

Area of the species: Mediterranean region, West and Central Asia to India.

2. *Cadaba* Forssk.

Trees or shrubs; leaves simple, alternate or clustered; flowers zygomorphic, in terminal corymbs or racemes, sometimes solitary; sepals 4, free; petals 4 or 0, clawed; nectarial appendage tubular, the upper part sometimes petaloid; stamens 4-5, androphore present; ovary 1- to 2-locular, gynophore present; ovules numerous; fruit fleshy, cylindrical, tardily dehiscent. 30 species, Old World tropics especially Africa.

1. Leaves glandular-hairy; fruits glandular
+ Leaves glabrous or farinose; fruits not glandular

2. *C. glandulosa*
2

2. Petals present; leaves farinose, elliptic or oblong-ovate, to 1.2 cm wide
+ Petals absent; leaves glabrous, dark green, broadly ovate to orbicular,
to 5 cm wide

3. *C. farinosa*
1. *C. rotundifolia*

1. *Cadaba rotundifolia* Forssk., Fl. Aegypt.-Arab. 68 (1775).

Shrub to 2.5 m; stems drooping; leaves 2-5 x 1.5-4.5 cm, broadly ovate to orbicular, glabrous, the tip retuse or rounded; flowers in terminal corymbs; sepals 6-8 x 3-4 mm; petals 0; stamens 4-5 connate at the base of the gynophore; nectarial appendage 2 cm, tubular, petaloid above, yellow; fruit 1.5-5 x 0.2-0.8 cm, eglandular.

R, GE; rocky slopes, coastal plains. Somalia, Djibouti, Ethiopia, Kenya, Sudan, Southeast Egypt, Arabia, Socotra.

2. *Cadaba glandulosa* Forssk., Fl. Aegypt.-Arab. 68 (1775).

Shrub to 1.5 m; young stems densely glandular-hairy; leaves 0.5-2 x 0.5-2 cm, greyish-green, broadly elliptic to orbicular, covered with long-stalked glandular hairs; flowers few in corymbs; sepals 8 x 5 mm; petals 0; stamens 5, attached at the base of the gynophore; nectarial appendage 1.5 cm, tubular, petaloid above, yellow; fruit 1-1.2 x 0.5 cm, densely covered with stalked glands.

R, GE; sandy plains and rocky slopes. Southeast Egypt, Sudan, Ethiopia, Somalia, Mali Tanzania, Kenya, Uganda.

3. **Cadaba farinosa** Forssk., Fl. Aegypt.-Arab. 68 (1775).

Shrub or small tree, sometimes climbing on other trees; leaves 0.5-2.5 x 0.3-1.2 cm, farinose, elliptic or oblong-ovate, with rounded tips; flowers whitish-green to greenish yellow, solitary or in few-flowered racemes; sepals 1 x 0.3-0.4 cm; petals 1-1.5 cm, linear-elliptic, clawed; stamens 4-5; androgynophore 5-8 mm; nectarial appendage 5 mm, tubular, shortly toothed at the tip; fruit 2.5-5 x 0.3-0.5 cm, farinose.

D, R, GE; sandy plains, rocky slopes. Tropical Africa, Egypt, Arabia, Pakistan, India.

3. **Boscia** Lam., nom. conserv.

Small trees or shrubs; leaves alternate or clustered; flowers scented, actinomorphic, small, in terminal or axillary corymbose racemes; sepals 4, free; petals 0; stamens 4-9, free, on a short androphore; gynophore present; style short, stigma capitate; fruit globose, hard, indehiscent. 37 species, especially tropical and southern Africa.

1. Leaves 2-4 cm wide
+ Leaves 0.8-1.6 cm wide

1. **B. senegalensis**
2. **B. angustifolia**

1. **Boscia senegalensis** Poir. in Lam., Tab. Encycl. 2: 517 (1819).

Syn. *Boscia octandra* Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 14: 62 (1884).

Shrub or small tree; leaves 4-12 x 2-4 cm, elliptic to ovate-elliptic, coriaceous, with 5-6 lateral nerves raised on both surfaces and prominently looped, distinctly reticulate, glabrous to finely pubescent; racemes short, crowded, corymbose; flowers 3-5 mm; filaments long-exserted; fruit 1-1.2 cm diam., globose, warty, minutely tomentose.

GE; stony ground. Mauritania, Senegal, Nigeria, Chad, Ethiopia, eastern Sudan, Southeast Egypt.

NOTE: The fruit is edible.

2. **Boscia angustifolia** A. Rich. in Guillemin & Perr., Fl. Seneg. Tent. 1: 26, t. 6 (1831).

Tree to 6 m, with a rounded crown; trunk smooth; young branches pubescent; leaves 2.5-6 x 0.8-1.6 cm, dark green, glabrous, narrowly oblong-elliptic to obovate, the apex retuse or rounded; petiole 1-5 mm; flowers in terminal or axillary clusters on pedicels 3-8 mm; sepals 4 x 1-1.5 mm; stamens 5-9; gynophore present; fruit 1 cm diam., ovoid, verrucose, green.

GE; stony ground. Southeast Egypt, southern Arabia, Sudan, Ethiopia, Chad, Nigeria, Senegal.

4. **Maerua** Forssk.

Shrubs, trees or woody climbers; leaves alternate or clustered, simple (our species) or 3-foliolate; flowers actinomorphic, in terminal racemes or panicles, or clustered in leaf axils; sepals 3-4, free; petals (3-)4 or 3, subequal; stamens 6-numerous, free, on the androphore; gynophore present; stigma capitate; fruits globose to ellipsoidal or



Plate 33. CAPPARACEAE: *Capparis decidua* 1, flowering and fruiting branch; 2, fruits. *Capparis sinaica* 3, flowering branch; 4, leaf variation; 5, fruit. *Cadaba rotundifolia* 6, flowering branch; 7, fruit. *Cadaba glandulosa* 8, flowering branch; 9, fruit. *Cadaba farinosa* 10, flowering branch; 11, fruit. *Boscia senegalensis* 12, fruiting branch. *Boscia angustifolia* 13, flowering branch; 14, fruit. *Maerua oblongifolia* 15, flowering branch; 16, fruit. *Maerua crassifolia* 17, flowering branch; 18, fruit. All drawings to the same scale except enlarged parts (scale given).

cylindrical, often torulose, indehiscent. 50 species, especially tropical and southern Africa to India.

1. Climbing shrubs; petals present; fruit irregularly globose;
leaves 4.5-7 cm

1. **M. oblongifolia**

+ Tree or shrub; petals absent; fruit cylindrical, torulose; leaves
1-2.5 cm

2. **M. crassifolia**

1. **Maerua oblongifolia** (Forssk.) A. Rich., Tent. Fl. Abyss. 1: 32, t. 6 (1847).

Syns. *Capparis oblongifolia* Forssk., Fl. Aegypt.-Arab. 99 (1775).

Capparis mithridatica Forssk., Fl. Aegypt.-Arab. 99 (1775).

Niebuhria oblongifolia (Forssk.) DC., Prodr. 1: 244 (1824).

Maerua virgata Gilg, Bot. Jahrb. 33: 226 (1903).

Maerua scobelensis Chiov., Nuov. Giorn. Bot. Ital., n. s., 34: 841 (1927).

Climbing shrub to 3 m, glabrous; branches elongate, slender; leaves 4.5-7 x 0.5-1.5 cm, narrowly-oblong, the base rounded, the tip acute or obtuse; petiole 0.5-1 cm; flowers fragrant, in axillary or terminal corymbose racemes; sepals 0.8-1 cm, green with white margins; petals whitish or yellowish-green; gynophore 1.5-2 cm; fruit unevenly globular, usually 4-seeded, red at maturity.

GE; stony ground. Tropical Africa, southern Arabia.

2. **Maerua crassifolia** Forssk., Fl. Aegypt.-Arab. CXIII, 104 (1775).

Syns. *Maerua uniflora* Vahl, Symb. Bot. 1: 36 (1790).

Maerua arabica J. F. Gmel., Syst. Nat. 827 (1791).

Tree or shrub 2-6 m; crown umbrella-shaped; branches often spinescent; leaves 1-2.5 x 0.5-1.2 cm, simple, solitary on the new shoots, in clusters on short spur-twigs on older branches, obovate to elliptic, obtuse to retuse at the tip, rarely acute, glabrous or finely pubescent; petiole 1-4 mm; flowers in clusters arising from the spur-twigs; sepals 4-7 mm, greenish-yellow; petals 0; gynophore 1-2 cm; fruit 2-5 x 0.5 cm, cylindrical, torulose, pale green at maturity.

O, D, R, GE, S; sandy plains, stony wadis and slopes. North and tropical Africa, Sinai, Palestine, Arabia, Iran, Pakistan.

5. **Dipterygium** Decne.

Perennial herbs; leaves simple, small, short-petiolate; flowers small, in lax racemes, actinomorphic; sepals 4, free, shortly clawed; stamens 6, equal; androphore absent, gynophore short; fruit a 1-seeded winged nutlet. 1 species, Egypt, East Africa, Arabia to Pakistan.

1. **Dipterygium glaucum** Decne., Ann. Sci. Nat. Bot., sér. 2, 4: 67 (1835).

Perennial herb or subshrub 30-60 cm, glabrous or glandular; stems much branching, slender; leaves 0.3-2 x 0.1-0.5 cm, oblong-linear to ovate, acute to obtuse; flowers on short slender pedicels; sepals 0.5-2 mm; petals 3-4 x 1-2 mm, pale yellow, sometimes pink-tinged; stigma capitate; style short; fruit 3.3-4.5 x 2-3.5 mm, elliptic, muricate.

D, R, GE; sandy and gravelly deserts. Egypt, Sudan, Ethiopia, Somalia, Djibouti, Arabia, Iran, Pakistan.

6. *Cleome* L.

Annual or perennial herbs or low shrubs; leaves simple or digitately compound, alternate; flowers usually zygomorphic, in racemes; sepals 4, free or fused at the base; petals 4, equal or unequal, sessile or clawed; stamens 4-numerous, free; androphore absent; staminodes present or absent; gynophore present or absent; fruit a capsule, dehiscent by 2 valves. 150 species, tropical and warm regions.

- | | |
|---|---------------------------|
| 1. Leaves simple (rarely some 3-foliolate in <i>C. arabica</i>) | 2 |
| + Leaves mostly 3-5-foliolate | 5 |
| 2. Stamens 10-14; fruiting pedicel rounded or coiled; leaves 1-nerved | 2. <i>C. chrysantha</i> |
| + Stamens 4-6; fruiting pedicel almost straight; leaves 3-nerved | 3 |
| 3. Annual, not aromatic; fruit 0.5-1.5 mm diam. | 3. <i>C. scaposa</i> |
| + Perennials, aromatic dwarf shrubs; fruit 2-5 mm diam. | 4 |
| 4. Leaves 0.5-1.5 cm, orbicular or broadly-ovate, usually broader than long; petals appendiculate, dimorphic, 2 broad and 2 narrow, greenish-yellow; stamens 4; fruit erect; seeds glabrous | 1. <i>C. droserifolia</i> |
| + Leaves 1-4.5 cm, ovate; petals not appendiculate, not dimorphic, reddish-brown; stamens 6; fruit pendulous; seeds lanate at maturity | 4. <i>C. arabica</i> |
| 5. Fruit 0.5-1.2 cm | 5. <i>C. brachycarpa</i> |
| + Fruit 2-12 cm | 6 |
| 6. Fruit 9-13 cm, leaflets linear or narrowly-elliptic | 7. <i>C. paradoxa</i> |
| + Fruit 2-9 cm; leaflets obovate, ovate-elliptic or elliptic | 7 |
| 7. Stamens 10-20 | 9. <i>C. viscosa</i> |
| + Stamens 6-8 | 8 |
| 8. Fruit 5.5-9 x 0.1-0.4 cm; seeds glabrous | 6. <i>C. hanburyana</i> |
| + Fruit 3-4.5 x 0.5-1 cm; seeds densely lanate at maturity | 8. <i>C. amblyocarpa</i> |

1. *Cleome droserifolia* (Forssk.) Delile, Descr. Egypte, Hist. Nat. 250 (1814).
Syn. *Roridula droserifolia* Forssk., Fl. Aegypt.-Arab. LXII, 35 (1775).

Low aromatic shrub, 25-60 cm, cushion-like, yellowish-green, glandular-viscid; stems intricately branched; leaves 0.5-1.5 x 0.5-1.5 cm, orbicular or broadly-ovate, usually broader than long, 3-nerved, thick-textured, densely glandular-hairy; petiole 1-2 cm; flowers 1-1.2 cm, in the axils of upper leaves, forming a lax few-flowered raceme; bracts not differentiated from leaves; pedicels 1-1.5 cm; sepals 4-8 x 1-2 mm, dimorphic, lanceolate; petals 0.8-1 x 0.2-0.3 cm, greenish-yellow, appendiculate, dimorphic, 2 broad and 2 narrow; stamens 4; fruit 1-2 x 0.3-0.4 cm, erect; seeds 0.5-1 mm, smooth, glabrous.

O (Uweinat), D, R, GE, S; stony and sandy wadis and plains. Libya, Egypt, Palestine, Syria, Arabia.

2. **Cleome chrysantha** Decne., Ann. Sci. Nat. Bot., ser. 2, 3: 274 (1835).

Perennial, woody at the base, 20-50 cm, glandular-hairy; leaves 0.5-2 x 0.4-1 cm, simple, ovate, 1-nerved, villous and glandular-hairy; petiole 0.2-1.2 cm; flowers in the axils of leaf-like bracts in long lax racemes; pedicels 0.5-1.5 cm, becoming rounded or coiled and thickened in fruit; sepals 2-8 x 1-2 mm; petals 4-8 x 1.5-3 mm, obovate, yellow; stamens 10-14; fruit 6-8 x 2-3 mm, compressed; seeds 1 mm, reticulate, glabrous.

O (Uweinat), D, R, GE, S; rocky and sandy desert wadis and plains. Libya, Egypt, Sudan, Ethiopia, Saudi Arabia, Iran.

3. **Cleome scaposa** DC., Prodr. 1: 239 (1824).

Syn. *Cleome papillosa* T. Anderson, J. Proc. Linn. Soc. Bot. 5, Suppl. 1: 3 (1860), nom. illeg.

Annual herb 10-25 cm, villous and glandular-hairy above; leaves 1-2.5 x 0.5-1.8 cm, simple, broadly ovate to orbicular; margins glandular-hairy; petiole 0.5-3 mm; flowers 4-5 mm diam., actinomorphic, in few-flowered lax racemes, white or pinkish, turning pale yellow; fruiting pedicels 1.2 cm; sepals 1.5-2 mm; petals 3-4 x 1.5-2 mm; stamens 6; fruit 2-3.5 x 0.05-0.15 cm, narrowly-linear, usually spreading and curved; seeds 0.5 mm, minutely granulate, glabrous.

R, GE; sandy and rocky soils. Tropical and North Africa, Arabia, Pakistan.

4. **Cleome arabica** L., Cent. Pl. 1: 20 (1775).

Syn. *Cleome trinervia* Fresen., Mus. Senkenb. 1: 177 (1834).

Perennial aromatic herb, 15-40 cm, with a woody base, glandular; leaves 1-4.5 x 0.5-1.5 cm, simple, ovate, rarely 3-foliolate; petiole 0.5-2.5 cm; pedicels 0.5-1.5 cm; flowers zygomorphic, in few-flowered lax racemes; sepals 2 mm; petals 0.5-1 cm, reddish-brown, not appendiculate, not dimorphic, stamens 6; fruit 1.5-4.5 x 0.3-0.5 cm, pendulous; seeds 1.5 mm, lanate at maturity.

De, R, S; rocky wadis and sandy plains. Egypt, Palestine, Arabia, southern Iran.

5. **Cleome brachycarpa** DC., Prodr. 1: 240 (1824).

Annual or short-lived perennial herb, 10-40 cm, stipitate-glandular; leaves 3- to 5-foliolate, the leaflets 0.5-1.5 x 0.2-0.8 cm, elliptic, glandular; petiole 0.3-3 cm; pedicels 0.5-1.5 cm; flowers few on lax racemes; bracts leaf-like; sepals 1-3 x 1-1.5 mm, acute; petals 3-8 x 1.5 mm, yellow, elliptic, not appendiculate; stamens 6; fruit 0.5-1.2 x 0.1-0.4 cm, oblong, spreading; seeds 0.5-1 mm, finely reticulate, glabrous.

R, GE, S; stony wadis and sandy plains. Tropical and Northeast Africa, Sinai, Arabia to Northwest India.

6. **Cleome hanburyana** Penz., Atti. Congr. Bot. Genova 330 (1893).

Syns. *Cleome areysiana* Defflers, Bull. Soc. Bot. France 42: 297 (1895).

Cleome deflersii Blatter, Flora Arabica. Rec. Bot. Surv. India 8: 38 (1919-1936).

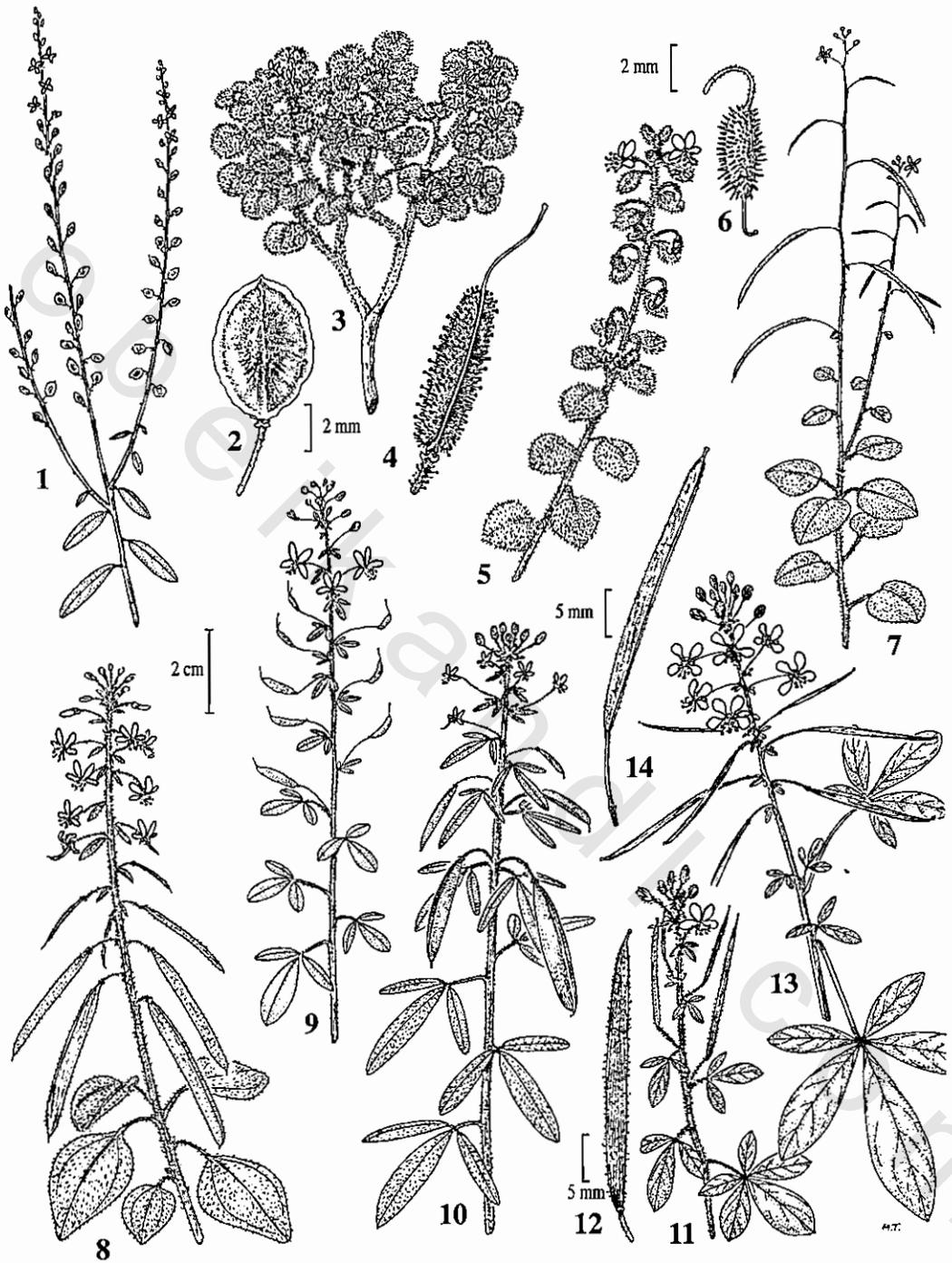


Plate 34. CAPPARACEAE: flowering and fruiting branches of: *Dipterygium glaucum* 1; 2, fruit. *Cleome droserifolia* 3; 4, fruit. *Cleome chrysantha* 5; 6, fruit. *Cleome scaposa* 7. *Cleome arabica* 8. *Cleome brachycarpa* 9. *Cleome amblyocarpa* 10. *Cleome viscosa* 11; 12, fruit. *Gynandropsis gynandra* 13; 14, fruit. All drawings to the same scale except enlarged parts (scale given).

Annual or short-lived perennial herb, 15-40 cm, densely glandular-villous and stipitate-glandular; leaves 5-foliolate; leaflets 0.5-2 x 0.3-0.5 cm, obovate, densely glandular-hairy; petiole 1.5-6 cm; flowers bracteate, on a many-flowered raceme; lower bracts 3-foliolate, the upper simple and small; pedicels 1-1.5 cm; sepals 3-7 x 1.5-3 mm, densely glandular; petals 1.5-2.5 x 0.3-0.6 cm, white and purple with a yellow spot; stamens 6-8; gynophore 1.5-2.5 cm; fruit 5.5-9 x 0.1-0.4 cm; seeds 1.5 mm, glabrous.

GE; stony wadis. Tropical Northeast Africa, from South Egypt to Northeast Kenya, Arabia.

7. **Cleome paradoxa** R. Br. ex DC., Prodr. 1: 241 (1824).

Annual or short-lived erect perennial, 0.4-2 m, sometimes woody at the base, glabrous or slightly glandular above; leaves 5-foliolate; leaflets 1.5-6 x 0.1-0.6 cm, linear to narrowly-elliptic, glabrous; petiole 2-10 cm; flowers bracteate, on a many-flowered raceme; bracts 0.5-1.5 x 0.05-0.1 cm; fruiting pedicels 1-3 cm; sepals dimorphic, 0.5-1.5 x 0.2-0.5 cm, lanceolate or triangular-ovate, glandular; petals dimorphic, the large almost twice the size of the small, 1.5-3 x 0.5-1.5 cm, elliptic, yellow, sometimes with reddish veins; stamens 6; gynophore 1-2.5 cm; fruit 9-13 x 0.3-0.6 cm, linear; seeds 1.5 mm, reticulate, densely hairy at maturity.

De, GE; stony wadis, slopes and waste ground. Southeast Egypt, Sudan, Ethiopia, Arabia.

8. **Cleome amblyocarpa** Barratte & Murb., Acta Univ. Lund, ser. 2, 1(4): 25 (1905).

Syns. *Cleome africana* Botsch., Nov. Sist. Vyss. Rast. 1: 130 (1964).

Cleome arabica, acut. nor. L., Cent. Pl. 1: 120 (1755).

Annual foetid herb, 15-80 cm; stems erect, much-branched, scabrid; leaves 3-foliolate, rarely simple; leaflets 0.5-3.5 x 0.3-1.2 cm, elliptic, scabrid; flowers in lax racemes, bracteate; bracts leaf-like, progressively smaller above; pedicels 0.5-1 cm; sepals 2 mm, ovate; petals 3-4 x 1-2 mm, narrowly-oblong to obovate, pale yellow; stamens 6; fruit 3-4.5 x 0.5-1 cm, shortly stipitate, oblong, pendulous; seeds 2 mm, densely lanate at maturity.

M, D, R, GE, S; sandy coastal dunes, waste ground, desert wadis and plains. North and East Africa, Sinai, Palestine, Arabia, Iraq, Iran.

9. **Cleome viscosa** L., Sp. Pl., ed. 1, 672 (1753).

Annual or short-lived perennial, erect, 20-60 cm, densely glandular-hairy, foetid; leaves 3-5-foliolate; leaflets 1-4 x 0.5-2 cm, ovate-elliptic; petiole 0.5-6 cm; flowers bracteate on few-flowered racemes; bracts trifoliate; pedicels 1-3 cm; sepals 3-6 mm; petals 0.5-1 x 0.1-0.3 cm, elliptic, yellow, fading to white, not appendiculate; stamens 10-20; fruit 5-8 x 0.3-0.5 cm, linear, straight, nerved; seeds 1-1.5 mm, ridged, glabrous.

De; stony ground. Pan tropical weed.

7. **Gynandropsis** DC., nom. conserv.

Like *Cleome* but differs by the presence of androphore, usually with 10 stamens inserted

on it, and a long gynophore. 2 species, tropical and subtropical regions.

1. **Gynandropsis gynandra** (L.) Briq., Ann. Conserv. Jard. Bot. Genève 17: 382 (1914).
 Syns. *Cleome gynandra* L., Sp. Pl., ed. 1, 671 (1753).
Cleome pentaphylla L., Sp. Pl., ed. 2, 938 (1763).

Annual herb, 30-80 cm; stems branching from the base; sparsely villous and glandular-hairy; leaves 3- to 5-foliolate, the leaflets 2-8 x 1-4 cm, obovate; petiole 2-10 cm; flowers in many-flowered long racemes, bracteate; bracts 3-foliolate, becoming simple and small above; pedicels 1.5-2.5 cm; sepals 2-4 mm, ovate, acute; petals 3-6 mm, white or mauve; stamens 6, borne on an androphore 1-2 cm; fruit 3-10 x 0.3-0.5 cm, borne on a 0.5-1.5 cm gynophore, linear; seeds 1 mm, reticulate, glabrous.

N, M; weed of cultivation. Pan-tropical weed.

CRUCIFERAE

Annual or perennial herbs or small shrubs; leaves alternate, exstipulate; flowers bisexual actinomorphic, hypogynous; inflorescence a raceme, usually ebracteate; sepals 4, free, in 2 decussate pairs; petals 4, free, clawed, alternate with the sepals; stamens usually 6, rarely 4 or 2, tetradynamous; filaments linear, sometimes winged or with tooth-like appendages; honey glands around the base of the filaments of various sizes, shapes and arrangements; ovary of 2 carpels, with 2 parietal placentas, usually 2-locular through the formation of a membranous false septum by the union of outgrowths of the placentas; ovules (1-)2-many; style simple, elongate, short or 0; stigma capitate or 2-lobed; fruit a siliqua (at least 3 times as long as broad) or a silicula (less than 3 times as long as broad), sometimes indehiscent and breaking into 1-seeded portions, or indehiscent; seeds in 1 or 2 rows in each cell, winged or not, endosperm 0, embryo folded. 365 genera, 3250 species, cosmopolitan, especially temperate, particularly Mediterranean region to Central Asia and western North America.

Key to genera partly after El-Hadidi, El-Naggar & Hedge. *Taeckholmia* 11: 63-77 (1991).

- | | |
|---|---------------------------|
| 1. Fruit a siliqua | 2 |
| + Fruit a silicula | 33 |
| 2. Plant glabrous or with simple hairs | 3 |
| + Plant with branched hairs at least on some parts | 21 |
| 3. Petals with distinct dark veins | 4 |
| + Petals without distinct dark veins | 6 |
| 4. Inflorescence bracteate | 39. Enarthrocarpus |
| + Inflorescence ebracteate | 5 |
| 5. Fruit 2-3.5 cm, dehiscent; beak 0.5-1 cm | 33. Eruca |
| + Fruit 3-5.5 cm, indehiscent, breaking into 1-seeded segments; beak 1.5-2.5 cm | 40. Raphanus |

6. Fruit of 2 jointed segments	7
+ Fruit of 1 segment	8
7. Lower leaves 1-pinnate; lower segment of fruit with lateral projections; plants of sea coasts	37. Cakile
+ Lower leaves 2- to 3-pinnate; lower segment of fruit without lateral projections; plants of desert wadis and plains or edges of cultivation	34. Erucaria
8. Petals pink or violet	9
+ Petals white or yellow	11
9. Perennials with woody base or dwarf shrubs; upper cauline leaves clasping	45. Moricandia
+ Annuals; upper cauline leaves never clasping	10
10. Plant glabrous; leaves pinnatisect, the lobes terete	46. Pseuderucaria
+ Plant glabrescent, hairy or hispid; leaves entire, or lobed to lyrate	29. Diplotaxis
11. Seeds in 2 parallel rows in each locule	12
+ Seeds in 1 row in each locule	15
12. Plant entirely glabrous	13
+ Plant with an indumentum at least on some parts	14
13. Petals white; fruit 1.5-2 cm	9. Nasturtium
+ Petals yellow; fruit 0.4-1.4 cm	10. Rorippa
14. Leaves simple, entire or lobed; fruit flattened	29. Diplotaxis
+ Leaves pinnatifid; fruit terete	4. Nasturtiopsis
15. Upper cauline leaves clasping	16
+ Upper cauline leaves petiolate	17
16. Upper and lower leaves simple, entire	44. Conringia
+ Upper leaves simple, entire; lower lyrate with 2-5 lateral lobes	30. Brassica rapa
17. Fruit beakless	18
+ Fruit beaked	19
18. Leaves with 3-5 filiform segments; petals white; fruit compressed	20. Leptaleum
+ Leaves simple, lobed, lyrate or pinnatifid; petals yellow; fruit terete	1. Sisymbrium
19. Valves of fruit distinctly 3- to 7-veined	32. Sinapis
+ Valves of fruit with 1-3 prominent veins	20
20. Fruit 4-angled; seeds obovoid	31. Erucastrum
+ Fruit not 4-angled; seeds spherical	30. Brassica
21. Indumentum of appressed medifixed (T-shaped) hairs	22
+ Indumentum of forked, dendroid or stellate hairs	24

22. Fruit with apical horns 19. **Notoceras**
+ Fruit without apical horns 23
23. Petals yellow; fruit slightly angled; seeds wingless 8. **Erysimum**
+ Petals greenish-brown, white to mauve, brownish-yellow, pink or pale yellow, fading purple; fruit not angled; seeds broadly winged 22. **Farsetia**
24. Leaves finely dissected, the segments to 1 mm broad 25
+ Leaves not as above 26
25. Fruiting pedicel 1-2 mm; fruit and fruiting pedicel densely stellate-hairy 3. **Robeschia**
+ Fruiting pedicel 5-8 mm; fruit and fruiting pedicel glabrous or with a sparse indumentum of stellate hairs 2. **Descurainia**
26. Cauline leaves clasping; fruit glabrous 27
+ Cauline leaves sessile or petiolate; fruit hairy 28
27. Petals yellow or mauve 7. **Arabidopsis**
+ Petals white 11. **Arabis**
28. Fruit with prominent horns at the apex 18. **Matthiola**
+ Fruit without horns at the apex 29
29. Stigma 2-lobed; fruit 0.8-2.5 cm 16. **Morettia**
+ Stigma with decurrent or shallow lobes, or the stigmatic head small and narrower than the pod 30
30. Subshrubs, basal stems woody; flowers 2.5-3 cm, sweet scented 17. **Diceratella**
+ Annuals or short-lived perennial herbs; flowers 0.25-2.5 cm, not sweet scented 31
31. Fruit curved or strongly torulose at maturity 6. **Neotorularia**
+ Fruit straight at maturity 32
32. Leaves oblong or obovate, toothed, pinnatifid or lyrate, rarely entire, seeds wingless 5. **Malcolmia**
+ Leaves linear to oblong, entire; seeds narrowly-winged 15. **Eremobium**
33. Fruit much compressed 34
+ Fruit not compressed or inconspicuously compressed 44
34. Plant glabrous or with simple hairs 35
+ Plant with branched hairs, at least on some parts 50
35. Fruit compressed with septum parallel to the valves 36
+ Fruit compressed with septum at right angles to the valves 37
36. Fruiting pedicel 1-2.5 mm, capillary, spreading or deflexed; fruit 1-1.4 x 0.5-0.8 cm, shortly stipitate; seeds broadly winged 43. **Savignya**
+ Plant not as above 25. **Ricotia**

37. Petals pink or purple; fruit with winged valved; the beak spine-like	38
+ Petals white or yellow; fruit not as above	39
38. Winged valves entire	42. <i>Schouwia</i>
+ Winged valves dentate	47. <i>Aethionema</i>
39. Petals white	40
+ Petals yellow	42
40. Plant prostrate to ascending; inflorescence axillary; fruit indehiscent	49. <i>Coronopus</i>
+ Plant ascending to erect, inflorescence terminal; fruit dehiscent	41
41. Locule 1-seeded	48. <i>Lepidium</i>
+ Locule many-seeded	53. <i>Hymenolobus</i>
42. Fruit 1-seeded	12. <i>Isatis</i>
+ Fruit 2- or more-seeded	43
43. Fruit of 2 orbicular valves	50. <i>Biscutella</i>
+ Fruit cordate, or not as above	48. <i>Lepidium</i>
44. Spiny shrub; petals lilac or violet	38. <i>Zilla</i>
+ Plant herbaceous, not spiny; petals yellow	45
45. Leaves pinnatisect; petals with dark venation; upper part of the fruit spoon-shaped, seedless	41. <i>Carrichtera</i>
+ Leaves simple, lobed, pinnatifid or pinnatisect; petals without dark venation; upper part of the fruit not as above	46
46. Fruit 1-segmented	47
+ Fruit 2-segmented	48
47. Fruit indehiscent, subglobose, densely tuberculate	13. <i>Ochthodium</i>
+ Fruit dehiscent, oblong-ellipsoid, smooth	10. <i>Rorippa</i>
48. Fruit with a flattened beak, longer than the silicula	14. <i>Schimpera</i>
+ Fruit not as above	49
49. Lower segment of the fruit narrowly cylindrical, the upper segment globose, both segments persistent	35. <i>Rapistrum</i>
+ Lower segment of the fruit distinctly 4- to 6-angled, persistent; upper caducous	36. <i>Didesmus</i>
50. Hairs appressed, medifixed	51
+ Hairs dendroid or forked	52
51. Petals to 1.5-2 cm; fruit 0.8-4.5(-5) cm	22. <i>Farsetia</i>
+ Petals 2-4 mm; fruit 2-6 mm	27. <i>Lobularia</i>
52. Upper cauline leaves clasping	53
+ Upper cauline leaves not clasping	55

- | | |
|--|---------------------------------|
| 53. Petals white; fruit triangular-obcordate | 52. Capsella |
| + Petals yellow; fruit not as above | 54 |
| 54. Fruit indehiscent; style short, jointed with the fruit | 23. Neslia |
| + Fruit dehiscent; style long, not jointed with the fruit | 51. Camelina |
| 55. Fruit appressed to the stem; valves with 2 auricles at the apex | 21. Anastatica |
| + Fruit not appressed to the stem; the septum parallel to the valves | 56 |
| 56. Fruit 1.5-2.5 cm | 24. Fibigia |
| + Fruit 2-6 mm | 57 |
| 57. Fruit glabrous, margins with scattered tubercles | 26. Alyssum homalocarpus |
| + Fruit with simple, hooked or stellate hairs | 58 |
| 58. Fruit with simple or hooked hairs | 28. Clypeola |
| + Fruit with stellate hairs | 26. Alyssum |

1. **Sisymbrium L.**

Annual or perennial herbs, glabrous or with unbranched hairs; leaves entire to pinnate; sepals not saccate at the base; petals yellow, rarely white, entire; fruit a siliqua; valves usually 3-veined; style distinct or indistinct; stigma 2-lobed; seeds small, usually less than 2.5 mm. 90 species, Europe, Asia, Mediterranean region, South Africa, North America, Andes.

- | | |
|---|---------------------------|
| 1. Flowers in bracteate racemes | 2 |
| + Flowers in ebracteate racemes (rarely the lowest 1-3 flowers bracteate) | 3 |
| 2. Petals 1.5-2.5 mm; style distinctly thinner than the siliqua | 2. S. polyceratium |
| + Petals 2.5-3.5 mm; style almost as thick as the siliqua | 3. S. runcinatum |
| 3. Fruit 8-12(-15) cm | 6. S. orientale |
| + Fruit 2.5-8 cm | 4 |
| 4. Petals 1-1.5 cm | 5. S. septulatum |
| + Petals 1.5-4 mm | 5 |
| 5. Fruiting pedicel 1.5-3.5(-5.5) mm, almost as thick as the fruit; petals 1.25-2.5 mm;
fruit 2.5-4 cm | 1. S. erysimoides |
| + Fruiting pedicel 0.3-1.5 cm, much thinner than the fruit; petals 3-4 mm;
fruit 3.5-6.5 cm | 4. S. irio |

1. **Sisymbrium erysimoides** Desf., Fl. Atlant. 2: 84 (1798).

Annual herb 10-60 cm, glabrous or shortly pubescent; radical leaves to 12 cm, lyrate-pinnatisect, irregularly dentate; cauline leaves lyrate-pinnatifid, short-petioled; pedicels 1-2 mm in flower, to 5.5 mm in fruit and as thick as the fruit; petals 1.25-2.5 mm; racemes elongate in fruit; siliqua 2.5-4 cm, torulose, attenuate into a style; style to 1 mm; seeds 0.8-1.2 mm, orange-yellow.

De, R, GE, S; shaded and sheltered wadi sides or stony crevices. Mediterranean region, Africa, Southwest Asia.

2. **Sisymbrium polyceratium** L., Sp. Pl., ed. 1, 658 (1753).

Annual, glabrous, foetid, 30-60 cm; lower leaves sinuate-pinnatifid, lobes triangular; inflorescence bracteate to the apex; flowers usually in fascicles; fruiting pedicels 0.5-1 mm; petals 1.5-2.5 mm, equalling or slightly longer than the sepals; siliqua 1.5-2.5 x 0.08-0.12 cm, torulose; style distinctly thinner than the siliqua; seeds 0.8-1 mm.

S (El-Qantara); sandy waste ground. Europe, Mediterranean region, Sinai.

3. **Sisymbrium runcinatum** Lag. ex DC., Syst. Nat. 2: 478 (1821).

Like *S. polyceratium* but the lower cauline leaves subentire to sinuate-pinnatifid, the lobes oblong; flowers usually solitary: petals 2.5-3.5 mm; siliqua 1-3.5 x 0.1-0.2 cm; style 1-2 mm, almost as broad as the siliqua.

De; sandy wadis. Southwest Europe, North Africa, Palestine, Caucasus, Iran.

4. **Sisymbrium irio** L., Sp. Pl., ed. 1, 659 (1753).

Annual herb 10-50 cm, glabrous or with long curved hairs; lower leaves 3-15 cm, sinuate-pinnatifid, the terminal lobe larger than the laterals; cauline leaves lobed or entire, short-petiolate; inflorescence condensed, the young fruits overtopping the flowers and buds; pedicels 3-6 mm in flower, to 1.5 cm in fruit, much narrower than the fruit; petals 3-4 mm, pale yellow; fruiting racemes elongated; fruit 3.5-6.5 cm, torulose; style 0.6-1.2 mm; seeds 0.8-1.1 mm.

N, M, De, R, GE, S; weed of cultivation and waste ground. Europe, Mediterranean region, Southwest Asia; introduced and naturalized in temperate regions.

5. **Sisymbrium septulatum** DC., Syst. Nat. 2: 471 (1821).

Annual erect herb, 20-50 cm, glabrous or sparsely villous; basal leaves 5-20 x 1.5-5 cm, pinnatisect-runcinate upper leaves with linear lobes; petals 1-1.5 cm, yellow; flowers overtopping the young fruits; pedicels 3-5 mm in fruit, as broad as the siliqua; fruit 2-8 x 0.1-0.25 cm, glabrous; style short; stigma 2-lobed.

S; stony and sandy deserts. Sinai, Arabia to Central Asia.

6. **Sisymbrium orientale** L., Cent. Pl. 2: 24, no. 173 (1756).

Annual erect robust herb, 50-75 cm, pubescent to villous; basal leaves lyrate-pinnatifid, soon withering; lower cauline leaves to 12 x 5 cm, pinnatisect, terminal lobe linear to narrowly-lanceolate; upper leaves entire or few-lobed; petals 0.5-1 cm, yellow; pedicels 3-5 mm in fruit, as thick as the siliqua; fruit 8-12(-15) cm, glabrescent; style short; seeds oblong, orange-brown.

S; waste ground, weed of cultivation. Europe, North Africa, Southwest Asia.

2. *Descurainia* Webb & Berthel., nom. conserv.

Annual or biennial herbs, hairs simple and branched; leaves 2-3-pinnatisect, with linear segments; sepals not saccate; petals pale yellow, smaller than sepals; fruit a siliqua, valves with a distinct median vein; style very short; stigma bicapitate; seeds small, not mucilaginous when moistened. About 40 species, temperate and cool northern hemisphere.

1. *Descurainia sophia* (L.) Webb ex Prantl in Engl. & Prantl, Natürl. Pflanzenfam. 3(2): 192 (1891).

Syns. *Sisymbrium sophia* L., Sp. Pl., ed. 1, 659 (1753).

Sisymbrium persicum Spreng., Novi Provent. 39 (1819).

Annual herb 20-80 cm, sparsely hairy below, glabrous above; cauline leaves with linear or oblong lobes; sepals 2-3 mm; stamens usually exceeding the sepals; siliqua 2-4.5 x 0.05-0.1 cm, erect; fruiting pedicels 5-8 mm, spreading; fruit and fruiting pedicel glabrous or with a sparse indumentum of stellate hairs; valves reticulate; seeds 1 mm, ovoid, in 1 row per locule.

M; weed of cultivation, and disturbed ground. Europe, Mediterranean region, Asia.

3. *Robeschia* Hochst. ex O. E. Schulz

Small herb, flowers cream-coloured; leaves and fruits like in *Descurainia*, but pedicels short, much thickened. 1 species, Sinai to Afghanistan.

1. *Robeschia schimperi* (Boiss.) O. E. Schulz in Engl. & Prantl, Pflanzenz. 86 (IV, 105): 360 (1924).

Syns. *Sisymbrium schimperi* Boiss., Ann. Sci. Nat., ser. 2, 17: 76 (1842).

Arabidopsis schimperi (Boiss.) N. Busch, Fl. Cauc. Crit. 3, 4: 457 (1909).

Annual herb 5-10 cm, pubescent; leaves 2-pinnatisect; lobes short, oblong, obtuse; flowers cream, rarely pink or purple, in 3- to 20-flowered racemes; siliqua slightly curved, densely stellate-hairy; style short; valves 1-nerved; pedicel 1-2 mm in fruit, much thickened, densely stellate-hairy.

S; stony wadis. Sinai to Afghanistan.

4. *Nasturtiopsis* Boiss.

Annual pubescent herbs; leaves radical, dentate or pinnately dissected; racemes corymbose, ebracteate; flowers small, yellow; sepals equal; petals clawed; stamens free, dilated at the base; stigma capitate, emarginate or 2-lobed; fruit an oblong to linear, many-seeded, 2-valved siliqua; seeds in 2 rows. 2 species, North Africa to Arabia.

1. *Nasturtiopsis coronopifolia* (Desf.) Boiss., Fl. Orient. 1: 237 (1867) subsp. **arabica** (Boiss.) Greuter & Burdet, Willdenowia 13: 94 (1983).

Syns. *Nasturtiopsis arabica* Boiss., Fl. Orient. 1: 237 (1867).

Nasturtiopsis coronopifolia (Desf.) Boiss. var. *arabica* (Boiss.) O. E. Schulz, Pflanzenz. 86 (IV, 105): 254 (1924).

Annual pubescent herb, 10-25 cm; radical leaves almost in a rosette, petiolate, pinnatifid,

the lobes oblong-linear; cauline leaves sessile, small; flowers in compact racemes, elongating in fruit; pedicels 0.5-1.2 cm in fruit, filiform, spreading; sepals 2 mm, pubescent; petals 3.5-6 mm, short-clawed; siliqua 1.2-1.8 x 0.1-0.2 cm, terete torulose, style short; stigma capitate; seeds in 2 rows per locule.

M, S; sandy and stony soils. Egypt, Palestine.

5. *Malcolmia* R. Br., nom. conserv.

Annual, subglabrous to pubescent herbs; leaves toothed or pinnatifid; sepals erect, the inner usually saccate at the base; petals pink to violet, rarely white, long-clawed; fruit a siliqua; valves 3-veined; style absent or indehiscent; stigma deeply 2-lobed or retuse; seeds in 1 row per locule. About 35 species, Mediterranean region to Afghanistan.

- | | |
|---|------------------------|
| 1. Siliqua 2-3.5 cm | 2 |
| + Siliqua 4-8(-12) cm | 3 |
| 2. Flowers 3-5 mm; plant tomentose-canescens with stellate hairs | 2. <i>M. nana</i> |
| + Flowers 0.7-1.2 cm, plant green | 1. <i>M. pygmaea</i> |
| 3. Petals 0.6-1.2 cm; siliqua 4-6 x 0.15 cm, not beaked, square in section, densely-hispid; fruiting pedicels 0.5-2 mm | 3. <i>M. africana</i> |
| + Petals 1.5-2.5 cm; siliqua 6-10(-14) x 0.2-0.3 cm, tapering into a 1-1.5 cm beak, glabrous or scabrid; fruiting pedicels 0.3-1 cm | 4. <i>M. crenulata</i> |

1. *Malcolmia pygmaea* (DC.) Boiss., Fl. Orient. 1: 222 (1867).

Syns. *Hesperis pygmaea* DC., Syst. Nat. 2: 455 (1821).

Maresia pygmaea (DC.) O. E. Schulz in Engl. & Prantl, Pflanzenr. 86 (IV, 105): 210 (1924).

Erect annual herb, 5-20 cm, green, minutely hairy or glabrous above; stems almost leafless; leaves 0.3-2 x 0.2 cm, in a rosette, petiolate; pinnatifid to lyrate, the lobes sinuate; flowers 0.7-1.2 cm, few, in racemes; pedicels longer than the calyx; sepals 3-3.5 mm, erect, 2 sepals saccate; petals 0.7-1.2 cm, lilac with a white claw; siliqua 2-3.5 x 0.1 cm, linear, straight or slightly curved, glabrescent; seeds ovoid, brownish.

M, De, S; sandy soils. Egypt, Palestine, Syria, Arabia, Iran.

2. *Malcolmia nana* (DC.) Boiss., Fl. Orient. 1: 222 (1867).

Syns. *Sisymbrium nanum* DC., Syst. Nat. 2: 486 (1821).

Malcolmia confusa Boiss., Fl. Orient. 1: 221 (1867).

Maresia nana (DC.) Batt. in Batt. & Trab., Fl. Algérie 1: 68 (1888).

Annual herb 10-25 cm, tomentose-canescens with stellate hairs; stems erect or prostrate; leaves 0.8-1 x 0.2-0.3 cm, subsessile, oblong-linear, entire or dentate; flowers 3-5 mm, white or pink, in dense corymbose racemes; pedicels 3-5 mm; calyx 2 mm; fruit 2-2.5 x 0.1 cm, on erect thickened pedicels, terete, tomentose to glabrescent; style short; stigma capitate, truncate or 2-lobed; valves 1-nerved; seeds ellipsoid, brown.

M, S; coastal sand. Mediterranean region, Sinai.

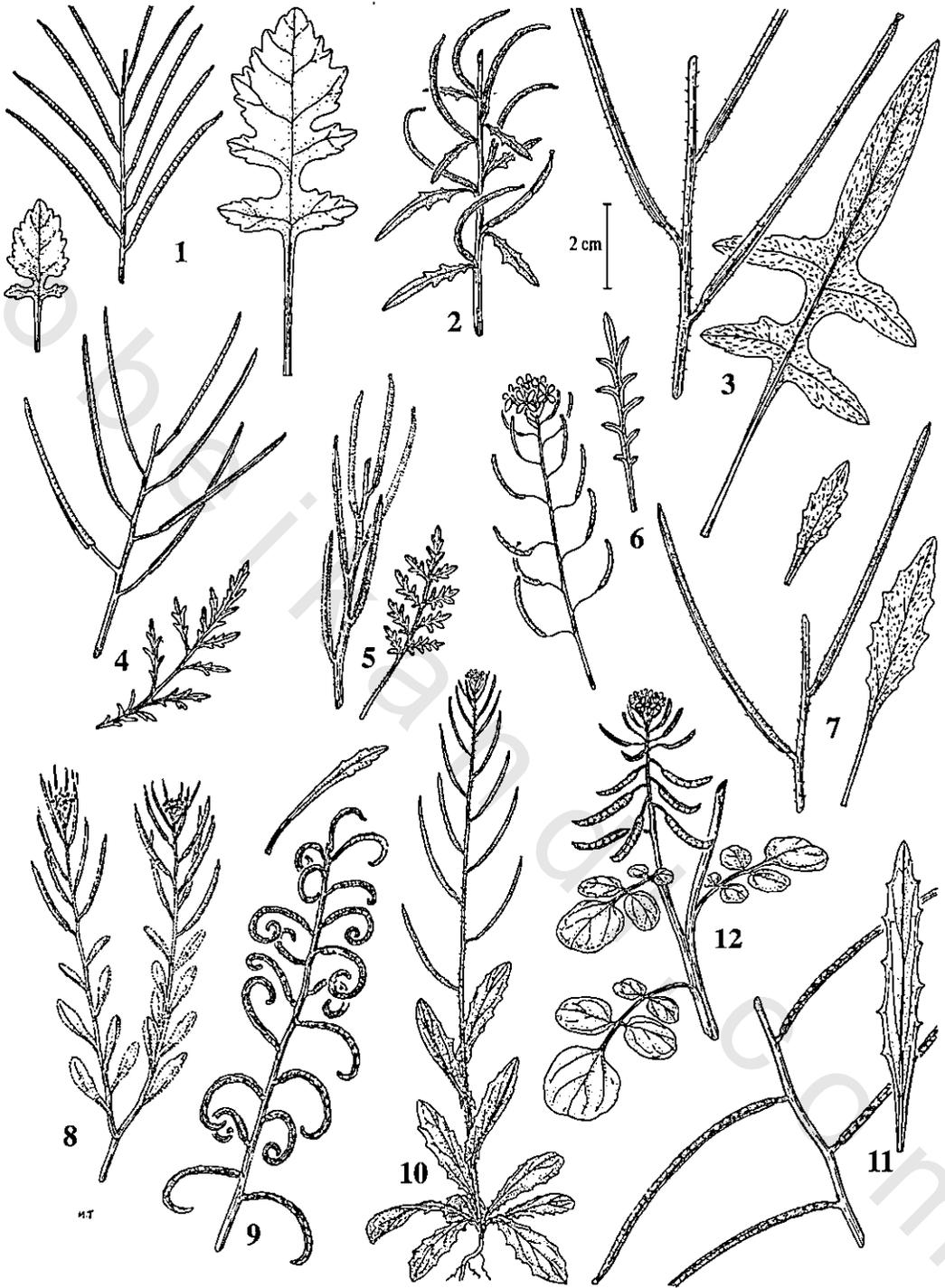


Plate 35. CRUCIFERAE: *Sisymbrium erysimoides* 1, fruiting branch and leaves. *Sisymbrium runcinatum* 2, fruiting branch. *Sisymbrium orientale* 3, fruiting branch and basal leaf. *Descurainia sophia* 4, fruiting branch and basal leaf. *Robeschia schimperii* 5, fruiting branch and basal leaf. *Nasturiopsis coronopifolia* 6, flowering and fruiting branch, and basal leaf. *Malcolmia africana* 7, fruiting branch and leaves. *Malcolmia nana* 8, flowering and fruiting branch. *Neotorularia torulosa* 9, fruiting branch and leaf. *Arabidopsis pumila* 10, habit. *Erysimum repandum* 11, fruiting branch and basal leaf. *Nasturtium officinale* 12, flowering and fruiting branch. All drawings to the same scale.

3. **Malcolmia africana** (L.) R. Br. in W. T. Aiton, Hort. Kew., ed. 2, 4: 121 (1812).
 Syns. *Hesperis africana* L., Sp. Pl., ed. 1, 663 (1753).
Malcolmia calycina Sennen, Diagn. Pl. Espagne Maroc 178 (1936).
Strigosella africana (L.) Botsch., Bot. Zhurn. 57: 1038 (1972).

Annual herb 10-30 cm, pubescent with stellate or forked hairs; stems much-branched; leaves 1.5-5(-7) x 0.5-1.5(-3) cm, oblong or oblong-obovate, dentate, petiolate; flowers few in racemes; petals 0.6-1.2 cm, white, pale lilac or purple, long-clawed; pedicels 0.5-2 cm in fruit, siliqua 4-6 x 0.15 cm, square in section, densely hispid; stigma 0.5-0.15 mm.

S; stony wadis. Mediterranean region, Sinai, Arabia to India and northern China.

4. **Malcolmia crenulata** (DC.) Boiss., Fl. Orient. 1: 229 (1867).
 Syns. *Hesperis crenulata* DC., Syst. Nat. 2: 456 (1821).
Maresia crenulata (DC.) Dvorák, Feddes Repert. 83: 272 (1972).

Annual herb 10-20 cm; stems branched from the base; leaves 2-5 x 0.5-2.5 cm, the radical petiolate, obovate, the cauline sessile, oblong-lanceolate, slightly auriculate; flowers few, in racemes; sepals 1-1.8 cm, the 2 inner saccate; petals 1.5-2.5 cm, lilac, pink or white; siliqua 6-10(-14) x 0.2-0.3 cm, tapering into a 1-1.5 cm beak; glabrous or scabrid; pedicels 0.3-1 cm in fruit; seeds brown.

S; stony deserts. East Mediterranean region to Iran.

6. **Neotorularia** Hedge & Léonard
 Syn. *Torularia* O. E. Schulz

Annual herbs; hairs bifid and unbranched; leaves simple or pinnatifid; inner sepals not saccate; petals white, lilac or violet; filaments of stamens unappendaged; style distinct; stigma capitate or retuse; fruit a linear dehiscent siliqua, straight or contorted. 12 species, Europe, Mediterranean region, Asia.

1. Petals white; radical leaves 3-10 cm, fruit strongly curved or contorted at maturity, fruiting pedicel 1 mm 1. **N. torulosa**
 + Petals dark pink; radical leaves 1-2 cm; fruit straight or slightly curved; fruiting pedicel 2.5-3.5 mm 2. **N. aculeolata**

1. **Neotorularia torulosa** (Desf.) Hedge & J. Léonard, Bull. Jard. Bot. Nat. Belg. 56: 395 (1986).
 Syns. *Sisymbrium torulosum* Desf., Fl. Atlant. 2: 84, t. 159 (1798).
Malcolmia torulosa (Desf.) Boiss., Fl. Orient. 1: 225 (1867).
Torularia torulosa (Desf.) O. E. Schulz in Engl. & Prantl, Pflanzenr. 84 (IV, 105): 214 (1924).

Annual herb 5-25 cm; stems erect, ascending or prostrate, branching at the base; radical leaves 3-10 cm, oblong-linear, remotely dentate to almost entire, petiolate; cauline leaves sessile, small; sepals subequal; petals 2-4 mm; twice as long as the sepals, truncate, white; fruit 2-5 cm, rigid, straight, curved or strongly torulose at maturity; stigma capitate; seeds oblong-ovoid.

Two varieties occur in Egypt:

var. **torulosa**

Fruit and upper part of the plant hispid.

M, De, S; sandy deserts.

var. **scorpiuroides** (Boiss.) Hedge & J. Léonard, Bull. Jard. Bot. Nat. Belg. 56: 395 (1986).

Syns. *Sisymbrium scorpiuroides* Boiss., Ann. Sci. Nat. Bot., ser. 2, 17: 62 (1842).

Malcolmia torulosa (Desf.) Boiss. var. *leiocarpa* Boiss., Fl. Orient. 1: 225 (1867).

Fruit and upper part of the plant glabrous.

M, De, S; sandy deserts.

Area of the species: North Africa, East Mediterranean region, Sinai, Crimea, Arabia to Northwest India.

2. **Neotorularia aculeolata** (Boiss.) Hedge & J. Léonard, Bull. Jard. Bot. Nat. Belg. 56: 393 (1986).

Syns. *Sisymbrium aculeolatum* Boiss., Ann. Sci. Nat. Bot., ser 2, 17: 75 (1842).

Malcolmia aculeolata (Boiss.) Boiss., Fl. Orient. 1: 226 (1867).

Torularia aculeolata (Boiss.) O. E. Schulz in Engl. & Prantl, Pflanzenr. 86 (IV, 105): 312 (1924), non Bonnemaïson (1828).

Annual herb 3-8 cm, glabrous, except the white-hispid fruits; stems usually simple, rarely branched from the base; basal leaves 1-2 cm, obovate, dentate, petiolate, glabrous; the cauline leaves linear, entire; sepals 1.5-2 mm, unequal; petals 2.5-3.5 mm, dark pink; pedicels 2.5-3.5 mm in fruit; fruit 2.5-4.5 cm, white-hispid, straight or slightly curved; stigma truncate-bilobed.

S; rock crevices, hillsides. Sinai, Iran, Afghanistan, Baluchistan.

7. **Arabidopsis** (DC.) Heynh.

Annual or perennial herbs; glabrous or with unbranched or branched hairs; leaves entire or pinnatifid; sepals not saccate at the base; petals white, mauve, pale purple or yellow; fruit a siliqua; valves 1-veined; style short; stigma subcapitate; seeds less than 1 mm. About 18 species, North temperate, Afroalpine.

1. Flowers yellow; fruiting pedicel 2-5 mm, thick; siliqua 1.5-3.5 cm, stellate-hairy

1. **A. pumila**

+ Flowers mauve; fruiting pedicel 0.8-1 cm, thin; siliqua 4-6 cm, glabrous

2. **A. kneuckeri**

1. **Arabidopsis pumila** (Stephan ex Willd.) Busch in Kuhn., Busch & Fomin, Fl. Cauc. Crit. 3, 4: 457 (1909).

Syn. *Sisymbrium pumilum* Stephan ex Willd., Sp. Pl., ed. 4, 3(1): 507 (1800).

Annual herb 10-50 cm, with 2-fid or multifid hairs; stems simple or branching from near

the base; basal leaves 2-5 cm, almost in a rosette, dentate or pinnatifid, petiolate; cauline leaves linear, denticulate, amplexicaul at the base; racemes much elongating in fruit; petals 2-3 mm, yellow; pedicels 2-5 mm in fruit, ascending; siliqua 1.5-3.5 x 0.1 cm, stellate-hairy.

S; sheltered wadi sides and crevices. Eastern Europe, East Mediterranean region, Sinai, West and Central Asia.

2. **Arabidopsis kneuckeri** (Bornm.) O. E. Schulz in Engl. & Prantl, Pflanzenr. 86 (IV, 105): 277 (1924).

Syn. *Sisymbrium kneuckeri* Bornm., Allg. Bot. Z. Syst. 9: 45 (1903).

Annual herb, 10-25 cm; hairs simple or branched; basal leaves 1-3 cm, few in a rosette, spatulate, obscurely dentate, petiolate; cauline leaves small, linear-lanceolate, entire sessile; racemes much elongating in fruit; petals 2-3 mm, mauve; pedicels 0.8-1 cm in fruit, thin; siliqua 4-6 x 0.05 cm, glabrous, spreading.

S; sheltered crevices and hill sides. Sinai, Baluchistan, Afghanistan.

8. **Erysimum** L.

Annual or perennial herbs, with branched hairs; sepals erect, the inner saccate; petals yellow, rarely purple, long-clawed; fruit a siliqua; valves 1-veined; style distinct, not exceeding $\frac{1}{3}$ the length of the siliqua; stigma slightly 2-lobed; seeds in 1-2 rows per locule. About 200 species, Mediterranean region, Europe.

1. **Erysimum repandum** L., Demonstr. Pl. 17 (1753).

Syn. *Erysimum rigidum* DC., Syst. Nat. 2: 505 (1821).

Annual herb 10-40 cm; hairs 2- or 3-fid; stems erect, simple or branching, angular; basal leaves 2-8 x 0.3-1 cm, linear to linear-oblong, entire or sinuate-dentate; pedicels 3-6 mm in fruit; racemes elongating in fruit; sepals 3-5 mm, densely hairy; petals 6-9 mm, yellow; siliqua 3.5-8 x 0.15-0.2 cm, slightly angled; style 2-5 mm, hairy; seeds wingless.

M; calcareous ridges. Europe, Mediterranean region, West and Central Asia, Northwest India.

9. **Nasturtium** R. Br., nom. conserv.

Perennial herbs, glabrous or with few unbranched hairs; leaves pinnate; petals white, rarely purplish; fruit a siliqua; valves with weak median vein; style short; stigma capitate, slightly 2-lobed; seeds in 1 or 2 rows per locule. 6 species, Mediterranean region to Central Asia, mountains of tropical East Africa, North America.

1. **Nasturtium officinale** R. Br. in W. T. Aiton, Hort. Kew., ed. 2, 4: 110 (1812).

Syns. *Nasturtium fontanum* Asch., Brandenb. 1: 32 (1860), nom. illeg.

Rorippa nasturtium-aquaticum (L.) Hayek, Sched. Fl. Striac. Exs. No 170 (1905).

Perennial herb, glabrous; stems to 1 m, prostrate to ascending, hollow, sometimes

floating; leaves 5-12 cm, with 2-8 pairs of leaflets, petiolate; upper leaves shortly auriculate; leaflets elliptic to suborbicular, entire, the terminal lobe large; petals 4-6 mm, white; siliqua 1.5-2 x 0.2 cm; seeds in 2 rows, reticulate, with 25-40 polygonal areoles on each face.

N, M, S; mountain springs and canals. Macaronesia, Europe, North Africa, West and Central Asia to India.

10. *Rorippa* Scop.

Annual or perennial herbs, glabrous or with unbranched hairs; leaves simple or pinnately lobed; sepals non-saccate; petals yellow; fruit a siliqua or silicula; valves with a weak median vein or veinless; style short; stigma flat or 2-lobed; seeds in 1 or 2 rows per locule. 80 species, subcosmopolitan.

1. Leaves narrowly linear-lanceolate, entire
+ Leaves pinnatisect

3. *R. integrifolia*
2

2. Fruit siliqua, 1-1.6 x 0.2 cm
+ Fruit silicula, 4-8 x 2-3 mm

1. *R. indica*
2. *R. palustris*

1. ***Rorippa indica*** (L.) Hiern, Cat. Afr. Pl. 1: (xxvi) Add. & Corr. (1896).

Syns. *Sisymbrium indicum* L., Mant. 93 (1767).

Nasturtium indicum (L.) DC., Syst. Nat. 2: 199 (1821).

Clandestinaria indica (L.) Spach, Hist. Nat. Vég. Phan. 6: 429 (1838).

Nasturtium niloticum Boiss., Diagn. Pl. Orient., ser. 1, 8: 19 (1849).

Annual or short-lived perennial, 20-50 cm, glabrous, except the young branches and leaves with unbranched hairs; stems erect or ascending, branching; basal leaves 4-10 cm, dentate to pinnatisect; cauline smaller, pinnatisect; sepals 1.5-2 mm; petals 3-4 mm, yellow; siliqua 1-1.4 x 0.2 cm; style 1 mm; seeds 0.5 mm, in 2 rows per locule.

N; weed of cultivation. Egypt, India, Burma.

2. ***Rorippa palustris*** (L.) Besser, Enum. Pl. Volhyn. 27 (1822).

Syns. *Sisymbrium amphibium* L. var. *palustre* L., Sp. Pl., ed. 1, 657 (1753).

Nasturtium palustre (L.) DC., Syst. Nat. 2: 191 (1821).

Rorippa islandica, sensu Täckh., Stud. Fl. Egypt, ed. 2, 176 (1974).

Annual or short-lived perennial 20-80 cm, glabrous; stems erect or ascending, richly branched; leaves lyrate, pinnatisect to pinnatifid, auriculate, the lobes serrate; flowers in richly branched racemes; petals 1.5-2.5 mm, almost equalling the sepals, yellow; silicula 4-8 x 2-3 mm, oblong-ellipsoid; style 0.5-1 mm, seeds in 2 rows per locule.

N, M; canal banks and moist ground. Subcosmopolitan.

3. ***Rorippa integrifolia*** Boulos, Candollea 19: 210 (1964).

Annual erect herb 10-15 cm; leaves narrowly linear-lanceolate, entire, slightly hairy; flowers pedicellate; petals pale yellow; silicula 4 x 2 mm, oblong-ellipsoid, slightly curved, glabrous; pedicels in fruit longer than the siliqua, hairy; seeds in 2 rows.

S (Maghara); sandy soils. Endemic.

11. *Arabis* L.

Annual or perennial herbs; hairs simple, irregularly branching or stellate, rarely glabrous; leaves simple; inner sepals slightly saccate at the base; petals white, pink or purple; fruit a siliqua; valves flat, sometimes with a median vein; style distinct; stigma capitate or emarginate; seeds usually winged, in 1 row per locule. 180 species, north temperate, African mountains.

1. Perennial; siliqua torulose
+ Annuals; siliqua not torulose

2. *A. alpina* subsp. *caucasica*
2

2. Petals 2-2.5 mm, white; siliqua 1-nerved, hairy
+ Petals 4.5-6 mm, violet; siliqua many-nerved, glabrous

1. *A. nova* var. *sinaica*
3. *A. verna*

1. *Arabis nova* Vill., Prosp. Hist. Pl. Dauphiné 39 (1779) var. *sinaica* (Boiss.) Täckh., Publ. Cairo Univ. Herb. 5: 36 (1974).

Syns. *Arabis auriculata* Lam., Encycl. 1: 219 (1783).

Arabis sinaica Boiss., Diagn. Pl. Orient., ser. 1, 8: 21 (1849).

Arabis cadmea Boiss., Diagn. Pl. Orient., ser. 1, 8: 21 (1849).

Arabis auriculata Lam. var. *sinaica* (Boiss.) Boiss., Fl. Orient. 1: 169 (1867).

Delicate annual herb 5-15 cm, altogether covered with irregularly-branched dendritic hairs; stems usually simple; leaves 0.5-2 x 0.3-0.8 cm, ovate-elliptic, simple, auriculate, entire or slightly serrate; racemes ebracteate; pedicels longer than the calyx; calyx 1.5 mm; petals 2-2.5 mm, white; siliqua 2-3 x 0.1 cm, 1-nerved, hairy.

S; sheltered crevices. Sinai, Oman (Jabal Harim). The species, usually biennial, is otherwise endemic to the Alps and mountains of South Europe.

NOTE: The type is from Arabia petraea. Sinai, Mart. 1846, E. Boissier (K!).

2. *Arabis alpina* L., Sp. Pl., ed. 1, 664 (1753) subsp. *caucasica* (Willd.) Briq., Prodr. Fl. Corse 2(1): 48 (1913).

Syns. *Arabis caucasica* Willd., Enum. Pl. Hort. Berol. Suppl. 45 (1814).

Arabis albida Jacq. f., Ecl. Pl. Rar 1: 105 (1815), nom. illeg.

Arabis viscosa DC., Syst. Nat. 2: 216 (1821).

Perennial herb 10-25 cm, canescent or tomentose; stems procumbent, branched near the base; basal leaves 1-6 x 0.4-2 cm, oblong-obovate, petiolate, the margins entire or toothed; cauline leaves smaller, clasping, auriculate; flowers in short racemes; sepals 5-7 mm; petals 1-1.3 cm, white; siliqua 3.5-6 x 0.2 cm, linear, compressed, torulose; seeds 1-1.25 mm, narrowly-winged.

N (Luxor); waste land. Mediterranean region, West Asia, subalpine regions.

3. *Arabis verna* (L.) R. Br. in W. T. Aiton, Hort. Kew., ed. 2, 4: 105 (1812).

Syn. *Hesperis verna* L., Sp. Pl., ed. 1, 664 (1753).

Annual herb 5-20 cm, with irregularly-branched dendritic hairs; stems erect, usually unbranched; leaves 1-5 cm, mostly basal, obovate, serrate, obtuse; racemes few-flowered, ebracteate; fruiting pedicels 2.5-4 mm; sepals 2-2.5 mm; petals 4.5-6 mm, violet; siliqua 2.5-5 x 0.1-0.2 cm, borne on the thickened pedicel, compressed, erect, many-nerved, glabrous; seeds in 1 row per locule.

S; sheltered wadi sides and crevices. Mediterranean region, West Asia.

12. *Isatis* L.

Annual or perennial herbs; basal leaves petiolate, entire; cauline leaves sessile, auriculate; racemes corymbose-paniculate, ebracteate, elongating in fruit; sepals equal; petals yellow, clawed; stigma 2-lobed; style very short; fruit indehiscent, 1-seeded, compressed, pendulous, the valves winged; 30 species, Mediterranean region to Central Asia.

1. Fruit 1.2-2.5 x 0.3-0.5 cm, linear-oblong; fruiting pedicel 1-1.2 cm 1. *I. lusitanica*
+ Fruit 0.5-1 x 0.2-0.6 cm, elliptic; fruiting pedicel 3-6 mm 2. *I. microcarpa*

1. *Isatis lusitanica* L., Sp. Pl., ed. 1, 670 (1753).

Syns. *Isatis aegyptiaca* L., Sp. Pl., ed. 1, 671 (1753).

Isatis aleppica Scop., Delic. Fl. Fauna Insubr. 2: 31, t. 16 (1786).

Annual herb 10-60 cm, glabrous or slightly hairy; stems erect, branched; basal leaves 5-12 x 1-4 cm; spatulate-obovate, entire or dentate; cauline leaves auriculate; racemes paniculate, many-flowered; flowers 4-7 mm, yellow; pedicels 1-1.2 cm in fruit, deflexed, filiform; fruit 1.2-2.5 x 0.3-0.5 cm, linear-oblong, winged, the apex truncate or retuse, hairy along the margins.

M, S; waste ground. North Africa, Southwest Asia, extending to Karpathos Island (Greece).

2. *Isatis microcarpa* J. Gay ex Boiss., Ann. Sci. Nat. Bot., ser. 2, 17: 201 (1842).

Annual herb 10-40 cm, glabrous, glaucous; stems erect, branched; radical leaves 3-6 x 0.6-1.8 cm, oblong-obovate, petiolate, entire or slightly dentate; cauline leaves sessile, triangular-lanceolate, auriculate; racemes paniculate, elongating in fruit; flowers 2.5-3.5 mm, yellow, pedicels 3-6 mm in fruit; deflexed; fruit 0.5-1 x 0.2-0.6 cm, elliptic, pubescent or glabrous.

M, De, S; desert wadis and rocky ridges. Egypt, Palestine.

13. *Ochthodium* DC.

Annual herbs; leaves 2-pinnatifid or lyrate; inflorescence paniculate; pedicels slender, flowers yellow; sepals almost equal at base; petals short-clawed; stamens free; fruit an indehiscent silicula, 2-celled, subglobular, 2-valved with thick septum; style short; stigma 2-lobed; 1 seed in each cell. 1 species, East Mediterranean region.

1. *Ochthodium aegyptiacum* (L.) DC., Syst. Nat. 2: 423 (1821).

Syn. *Bunias aegyptiaca* L., Syst. Nat., ed. 12, 2: 23 (1767).

Annual herb 20-60 cm, slightly hirsute; stems erect to ascending, branched; radical leaves 5-15 x 1-2.5 cm, lanceolate, lyrate or 2-pinnatifid, the cauline leaves smaller; flowers in paniculate inflorescences, elongating in fruit; sepals 2 mm, spreading; petals 3-3.25 mm; fruiting pedicels 3.5-7 mm; fruit 4 x 3 mm, subglobose, densely tuberculate; style short, pyramidal.

M; waste ground. East Mediterranean region.

14. *Schimpera* Hochst. & Steud. ex Endl.

Annual herbs, with simple hairs; leaves 1- to 2-pinnatifid or simple, dentate; sepals not saccate; petals yellow; filaments unappendaged; fruit indehiscent silicula, tuberculate with a flattened beak; 1-seeded. 1 species, East Mediterranean region to southern Iran.

1. *Schimpera arabica* Hochst. & Steud. ex Endl., Pl. Arab. Exsicc. No. 144 (1836).

Syn. *Schimpera persica* Boiss., Diagn. Pl. Orient., ser. 1, 1(6): 18 (1845).

Annual herb 10-50 cm; stems erect, much branched, slightly pubescent; basal leaves 5-22 x 0.5-5.5 cm, oblong to lanceolate, dentate to 1-2-pinnatifid, short-petiolate; upper cauline smaller, linear-oblong, sagittate-auriculate, entire or obscurely dentate; sepals 2 mm; petals 3 mm, yellow; pedicels 1-2 mm in fruit; erect; silicula 5-8 mm, including the beak; beak flattened, longer than the silicula.

De, S; sandy wadis and plains. East Mediterranean region to southern Iran.

15. *Eremobium* Boiss.

Annual or short-lived perennial herbs with appressed stellate hairs; leaves simple, entire; inner sepals saccate; petals white to lilac; stamens unappendaged; stigma 2-lobed; fruit a linear siliqua, dehiscent, torulose, hairy; seeds in 1 row per locule, ellipsoid-globular, compressed, marginate or winged. 3 species, North Africa to Arabia, Iran, Pakistan.

1. *Eremobium aegyptiacum* (Spreng.) Asch. & Schweinf. ex Boiss., Fl. Orient. Suppl. 30 (1888).

Syn. *Malcolmia aegyptiaca* Spreng., Syst. Veg. 2: 898 (1825).

Annual or short-lived perennial herb, 10-40 cm, canescent with appressed stellate hairs; stems prostrate to ascending; leaves 1.2-3.5 x 0.2-0.5 cm, linear to oblong, entire, obtuse; flowers in compact or elongate racemes; pedicels 3-8 mm; sepals 3-5 mm; petals 5-8 mm, lilac; siliqua 1.5-3.5 x 0.1-0.2 cm, linear, terete or slightly compressed, torulose, pubescent, tapering into a short style; seeds ellipsoid, narrowly-winged.

Two varieties occur in Egypt:

var. *aegyptiacum*

Syns. *Malcolmia pyramidum* C. Presl, Abh. Königl. Böhm. Ges. Wiss., ser. 5, 3: 439 (1845).

Eremobium pyramidum (C. Presl) Botsch., Novosti Sist. Vyss. Rast. 1: 359 (1964).

Eremobium aegyptiacum var. *pyramidum* (C. Presl) Täckh. & Boulos,

Publ. Cairo Univ. Herb. 5: 36 (1974).

Annual or short-lived perennial; flowers in compact racemes; petals 4-6 mm, almost equalling the sepals; fruit 2.5-3.5 x 0.8-0.1 cm, slightly compressed, usually more than 8-seeded.

N, O, M, D, R, S; sandy wadis and desert plains, edges of cultivation.

var. **lineare** (Delile) Zohary, Fl. Palaest. 1: 267 (1966).

Syns. *Matthiola linearis* Delile in Laborde & Linant, Voy. Arabie Pétrée 85 (1830).

Eremobium lineare (Delile) Asch. & Schweinf. ex Boiss., Fl. Orient. Suppl. 30 (1888).

Eremobium diffusum (Decne.) Botsch., Novosti Sist. Vyss. Rast. 1: 359 (1964).

Annual; flowers in lax racemes; petals 5-8 mm, much longer than sepals; fruit 1.5-2.5 x 0.15-0.175 cm, compressed, usually less than 8-seeded.

S; sandy soil.

Area of species: Sinai, Palestine, Arabia, Iraq, Iran, Pakistan.

16. **Morettia** DC.

Annual or perennial herbs, densely stellate-hairy; leaves simple, entire or dentate; sepals not saccate; petals white, pink or yellow; filaments of stamens not appendaged; stigma 2-lobed; the lobes decurrent; fruit a silique; style persistent. 4 species, North Africa to Arabia.

1. Silique 2-3.5 mm wide at the base; sepals 5-6 mm, plant yellowish-green

3. **M. philaeana**

+ Silique 1-2 mm wide at the base; sepals 3.5-5 mm; plant grey-canescens

2

2. Leaves petiolate, entire; fruit strongly curved, not appressed to the stem

2. **M. parviflora**

+ Leaves almost sessile, often dentate; fruit straight or slightly curved, appressed to the stem

1. **M. canescens**

1. **Morettia canescens** Boiss., Diagn. Pl. Orient., ser. 1, 2(8): 17 (1849).

Perennial herb, grey-canescens, appressed stellate-hairy; stems 20-50 cm, much branched, prostrate; leaves 1-1.5 cm, almost sessile, oblong-ovate to elliptic, entire or often dentate, acute, the margins revolute; sepals 3.5-4.5 mm; petals 5-9 mm, white or pink; silique 0.8-1.5 x 0.1-0.2 cm, straight or slightly curved, appressed to the stem, torulose; stigma with 2 divergent lobes, on a slender style.

De, S; stony wadis. North Africa, Sinai, Palestine, Saudi Arabia.

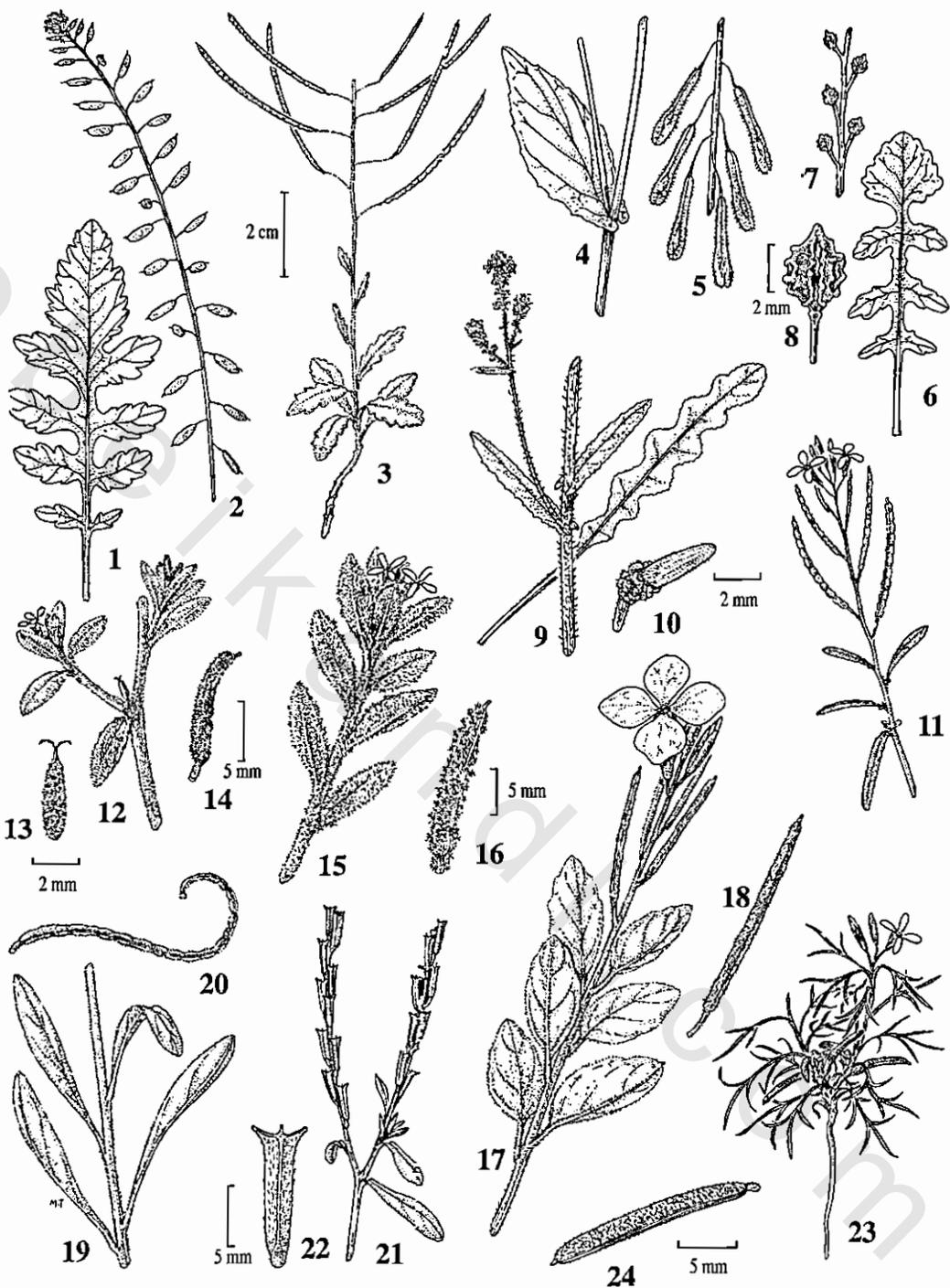


Plate 36. CRUCIFERAE: *Rorippa palustris* 1, leaf; 2, flowering and fruiting branch. *Arabis alpina* 3, habit. *Isatis lusitanica* 4, leafy branch; 5, fruits. *Ochthodium aegyptiacum* 6, leaf; 7, fruiting branch; 8, fruit. *Schimpera arabica* 9, flowering branch and basal leaf; 10, fruit. *Eremobium aegyptiacum* 11, flowering and fruiting branch. *Morettia canescens* 12, flowering and fruiting branch; 13, immature fruit; 14, mature fruit. *Morettia philaeana* 15, flowering branch; 16, fruit. *Diceratella elliptica* 17, flowering and fruiting branch; 18, mature fruit. *Matthiola arabica* 19, leafy branch; 20, fruit. *Notoceras bicorne* 21, fruiting branch; 22, fruit. *Leptaleum filifolium* 23, habit; 24, fruit. All drawings to the same scale except enlarged parts (scale given).

2. **Morettia parviflora** Boiss., Ann. Sci. Nat. Bot., ser. 2, 17: 60 (1842).

Perennial herb, white-tomentose with stellate hairs; stems 20-30 cm, prostrate or ascending; leaves 1-2.5 cm, petiolate, ovate-elliptic, acute, entire; sepals 2.5-3 mm; petals 4-5 mm, white; fruit 1-2 x 0.1-0.2 cm, strongly curved, not appressed to the stem, stellate-hairy, tapering towards the apex.

S; stony and sandy wadis. Sinai, Palestine, Arabia.

3. **Morettia philaeana** (Delile) DC., Syst. Nat. 2: 427 (1821).

Syns. *Sinapis philaeana* Delile, Descr. Egypte, Hist. Nat. 243, t. 33, f. 3 (1814).

Morettia asperrima Boiss., Ann. Sci. Nat. Bot., sér. 2, 17: 60 (1842).

Perennial, yellowish-green, tomentose, with scabrous brittle stellate hairs that are readily detached and adhering to fingers; stems 20-80 cm, ascending or prostrate, often forming thick mats of several layers on mud flats; leaves 1-3.5 cm, short-petiolate, oblong-elliptic; sepals 5-6 mm; petals 5-9 mm; siliqua 1.2-2.5 x 0.2-0.35 cm, torulose, appressed to the stem, tetragonous, straight or slightly curved; stigma lobes divergent on a thick style.

N, O, D, R, GE, S; stony and sandy wadis and plains, muddy and moist ground especially by the Nile banks in Upper Nubia. North and East Africa, from Sudan to Somalia, Sinai, Arabia.

17. **Diceratella** Boiss.

Subshrubs, densely covered with branched and stellate hairs; leaves entire; inner sepals not saccate; petals white or lilac; filaments of stamens unappendaged; stigma bifid, conical; fruit a siliqua, tardily dehiscent, with a small stigmatic head, horns absent; seeds in 1 row, with transverse septa separating them. 7 species, tropical Northeast Africa, Arabia, Iran.

1. **Diceratella elliptica** (DC.) Jonsell, Bot. Notiser 132: 526 (1979).

Syns. *Matthiola elliptica* DC., Syst. Nat. 2: 167 (1821).

Pirazzia elliptica (DC.) Chiov., Nuov. Giorn. Bot. Ital., n. s., 26: 147 (1919).

Subshrub 50-75 cm, grey-canescens; basal stems woody, the young branches herbaceous; leaves 1-4 x 1-2 cm, ovate to elliptic, mostly entire, rarely obscurely dentate; petiole 1-2 cm; flowers in racemes, fragrant, sepals 1.5 cm; petals 2.5-3 cm; siliqua 5-7 x 0.15 cm, terete, torulose, stellate-hairy; stigmatic head narrower than the siliqua; horns absent.

GE; rocky slopes. Southeast Egypt, Sudan, Djibouti, Somalia.

18. **Matthiola** R. Br., nom. conserv.

Annual or perennial herbs, with branched hairs and sometimes stipitate glands; leaves simple or pinnatifid, entire or dentate; inner sepals saccate; petals white, yellow, or purple; inner filaments winged towards the base; stigma decurrent; fruit a siliqua, usually with 2 stigmatic horns on ripe fruits, seeds in 1 row per locule. 55 species, Macaronesia, western Europe, Mediterranean region.

1. Perennials with woody base; siliqua with a stigmatic head, not horned 2
 + Annuals; siliqua with two horned appendages 3
2. Plant 0.4-0.8(-1) m; stems stout, leafy; leaves 2.5-8(-10) x 0.3-1.2 cm;
 inflorescence richly branched, paniculate 1. *M. arabica*
 + Plant 15-40 cm; stems slender, almost leafless; leaves 3-5 x 0.1-0.3 cm;
 inflorescence racemose, unbranched 2. *M. fruticulosa*
3. Petals 0.6-0.8(-1.2) cm; sepals 5-6 mm 3. *M. parviflora*
 + Petals 1.5-2(-3) cm; sepals 0.7-1.1 cm 4. *M. longipetala*

1. ***Matthiola arabica*** Boiss., Ann. Sci. Nat. Bot., sér. 2, 17: 49 (1842).
 Syn. *Matthiola arabica* Velen. in Sitzungsber., Königl. Böhm. Ges. Wiss. Prag
 11: 12 (1911).

Perennial herb 0.4-0.8(-1) m, woody at the base, canescent, densely covered with irregularly branched denticulate hairs and often with stipitate glands; stems erect, stout, yellowish-grey or greyish-white, leafy, much branched from the base; leaves 2.5-8(-10) x 0.3-1.2 cm, linear-lanceolate, entire, canescent, the lower petiolate, the cauline sessile; flowers short-pedicellate, in richly branched paniculate inflorescences; sepals 0.8-1.1 cm, with scarious margins; petals 1.6-2.2 cm, purplish; fruiting pedicels 1-2 mm in fruit, thickened; siliqua 5-7 x 0.15 cm, torulose, spreading or twisted; stigma ovoid, slightly broader than the fruit; horns absent.

S; stony wadis. Sinai, Palestine, Saudi Arabia.

Type: Sinai, 26.5.1835, W. Schimper 314, isotype K! No authentic specimens were seen from Palestine or Saudi Arabia.

2. ***Matthiola fruticulosa*** (L.) Maire in Jahand. & Maire, Cat. Pl. Maroc 2: 311 (1932).
 Syns. *Cheiranthus fruticulosus* L., Sp. Pl., ed. 1, 662 (1753).
Cheiranthus tristis L., Syst. Nat., ed. 10, 1134 (1759).
Cheiranthus coronopifolius Sm., Fl. Graec. Prodr. 2: 25 (1813).
Matthiola stenopetala Pomel, Nouv. Mat. Fl. Atlant. 372 (1875).

Perennial herb 15-40 cm, woody at the base, appressed white-pubescent; stems branched from the base, almost leafless; leaves 3-5 x 0.1-0.3 cm, all basal, linear to narrowly oblanceolate, entire or shallowly toothed; pedicels 1-2 mm, thickened in fruit; inflorescence racemose, not branching; sepals 6-8 mm, pubescent; petals 1.5-2 cm, bluish-purple; siliqua 6-8 x 0.15 cm, terete, slightly torulose, straight or curved upwards, spreading; stigmatic head 1.5 mm, subglobose, not horned.

M, Dw; sandy soils. North Africa, South Europe, Cyprus, Lebanon, Turkey.

3. ***Matthiola parviflora*** (Schousb.) R. Br. in W. T. Aiton, Hort. Kew., ed. 2, 4: 121
 (1812).
 Syn. *Cheiranthus parviflorus* Schousb. in Koenig., Danske Vidensk.-Selsk. Skr.
 1: 195 (1800).

Annual herb 10-20 cm, with appressed, branched soft white hairs; stems erect, branched at the base; leaves 4-6 x 0.5-1.5 cm, oblanceolate, pinnatifid or dentate, the lower leaves

long-petiolate, the upper sessile; racemes short; flowers short-pedicellate or sessile; sepals 4-6 mm; petals 0.6-0.8(-1.2) cm, purple; siliqua 4.5-6 cm, erect or spreading; stigmatic horns 4-5 mm, straight, acute.

O (Wadi Natrun); waste ground. Canary Islands, Southwest Europe, North Africa.

4. **Matthiola longipetala** (Vent.) DC., Syst. Nat. 2: 174 (1821).

Syns. *Cheiranthus longipetalus* Vent., Descr. Pl. Jard. Cels., t. 93 (1803).

Matthiola oxyceras DC., Syst. Nat. 2: 173 (1821).

Annual herb 10-40 cm, pubescent, stipitate-glandular or eglandular; stems branched from the base, almost leafless; leaves 2-8 cm, crowded at the base, linear, linear-lanceolate to oblong-lanceolate, dentate or pinnatifid, canescent; flowers sessile or short-pedicellate; sepals 0.7-1.1 cm; petals 1.5-2(-3) cm; the margins usually undulate; limb pink or purple, the claw yellow or purple; siliqua 3-10 x 0.1-0.25 cm, erect or spreading, sometimes recurved; stigmatic horns (0-)0.3-1.2 cm, straight or curved.

Four subspecies occur in Egypt:

subsp. **longipetala**

Siliqua 0.5-1 cm, with stigmatic horns 1-1.2 cm.

S; sandy and stony desert.

subsp. **livida** (Delile) Maire, Fl. Afr. Nord 14: 23 (1977).

Syns. *Cheiranthus lividus* Delile, Descr. Egypte, Hist. Nat. 67 (1814).

Matthiola livida (Delile) DC., Syst. Nat. 2: 174 (1821).

Stigmatic horns 0.3 mm.

N, M, R, S; sandy and stony wadis and plains.

subsp. **bicornis** (Sm.) P. W. Ball, Feddes Repert. 68: 194 (1963).

Syns. *Cheiranthus bicornis* Sm., Fl. Graec. Prodr. 2: 26 (1813).

Matthiola bicornis (Sm.) DC., Syst. Nat. 2: 177 (1821).

Stigmatic horns 4-5 mm, curved upwards.

M, S; sandy soils.

subsp. **hirta** (Conti) Greuter & Burdet, Willdenowia 13: 94 (1983).

Syns. *Matthiola pumilio* (Sm.) DC. subsp. *hirta* Conti, Mém. Herb. Boiss. 18: 69 (1900).

Matthiola humilis DC., Syst. Nat. 2: 177 (1821).

Matthiola longipetala subsp. *aspera*, sensu Täckh., Stud. Fl. Egypt, ed. 2, 181 (1974).

Matthiola longipetala subsp. *pumilio*, sensu Täckh., Stud. Fl. Egypt, ed. 2, 181 (1974).

Siliqua short and broad, 3-5 x 0.25 cm.

M, De, S; sandy plains and wadi beds.

Area of the species: Mediterranean region, Sinai, Arabia, Iran.

19. *Notoceras* R. Br.

Annual herbs, appressed-canescens with simple and branched hairs; leaves lanceolate, petiolate; petals minute, white; stamens free, edentate; style distinct; stigma capitate; fruit 2-celled, tardily dehiscent, rigid, tetragonous siliqua; valves with a distinct midrib and 2 terminal horns; seeds in 1 row per locule. 1 species, Canary Islands, Mediterranean region to Northwest India.

1. *Notoceras bicornis* (Aiton) Amo, Fl. Fan. Penins. Ibér. 6: 536 (1873).

Syns. *Erysimum bicornis* Aiton, Hort. Kew., ed. 1, 2: 394 (1789).

Notoceras canariensis R. Br. in W. T. Aiton, Hort. Kew., ed. 2, 4: 117 (1812).

Annual herb 10-30 cm, with simple or forked hairs; stems erect to procumbent, branched; leaves 2-3.5 x 0.2-0.4 cm, lanceolate to linear-lanceolate, petiolate, entire; racemes short, dense, leaf-opposed; pedicels 2 mm in fruit, thickened, appressed to stems; sepals 1 mm, hirsute, petals 1.5-2 mm, white; siliqua 5-8 x 1.5-2 mm, tetragonous, the valves rigid, 1-nerved, horned at the apex; horn 1 mm; seeds 2-4 per locule, compressed.

De, R, GE, S; sandy and stony deserts. Distribution as for the genus.

20. *Leptaleum* DC.

Annual herbs, glabrous or with simple and branched hairs; leaves filiform, entire, or pinnately dissected into filiform segments; inner sepals not saccate; petals white or pink; stamens 6 or reduced to 2; the longer filaments fused in pairs; stigma lobes fused into a small cone; fruit a siliqua, the valves dehiscent at the apex; seeds in 2 rows. 1 species, Southeast Europe, East Mediterranean region to Central Asia.

1. *Leptaleum filifolium* (Willd.) DC., Syst. Nat. 2: 511 (1821).

Syn. *Sisymbrium filifolium* Willd., Sp. Pl., ed. 4, 3: 495 (1800).

Annual herb, 5-20 cm, sparsely pubescent to glabrescent; stems prostrate to ascending, much branched from the base; leaves 3-6 cm, with 3-5 filiform segments; flowers axillary, solitary or in few-flowered racemes; pedicels 2-3 mm; petals 6-9 mm; siliqua 1.2-2.5 x 0.2-0.3 cm, linear, compressed, the valves with reticulate lateral veins; seeds oblong.

De, S; sandy and stony deserts. Distribution as for the genus.

21. *Anastatica* L.

Annual herb, stellate hairy-throughout; leaves simple; flowers small, in short axillary racemes; sepals not saccate; petals white; fruits appressed to the stems, indurated, 2-locular, with 1-2 seeds per locule, dehiscent when moistened; seeds ovoid, compressed, pendulous. 1 species, North Africa to Pakistan.

1. **Anastatica hierochuntica** L., Sp. Pl., ed. 1, 641 (1753).

Annual herb, 5-25 cm, stellate-hairy, canescent; stems procumbent to ascending, dichotomously branched; leaves 1-4 x 0.3-1.5 cm, spatulate, petiolate, obscurely dentate or entire; flowers almost sessile; sepals 1-2 mm; petals 2.5-3.5 mm; fruiting branches woody, incurved and forming a globular body enclosing the fruit, the branches spreading to expose the fruit when moistened; silicula 4-6 x 3.5 mm, ovoid; valves spoon-shaped, with 2 auricles at the apex; style persistent; seeds ovoid, compressed, orange-red, wingless.

O (Uweinat), D, R, GE, S; alluvial, sandy and stony desert. North Africa to Pakistan.

22. **Farsetia** L.

Annual or perennial herbs or subshrubs, densely covered with adpressed medifixed hairs; leaves entire; sepals not saccate; petals clawed or not; filaments of stamens free, unwinged; style distinct; stigma decurrent to globose, fruit a dehiscent siliqua or silicula, narrowly-linear to oblong; seeds broadly winged, in one row. 25 species, North Africa to Northwest India, tropical African mountains.

1. Siliqua 6-9 mm wide, broadly oblong
+ Siliqua 2.5-4 mm wide, narrowly oblong

1. **F. aegyptia**
2

2. Sepals 3-4.5 mm; siliqua 0.8-1.5 cm; style 2.5-4 mm
+ Sepals 0.6-1 cm; siliqua 2.5-4.5(-5) cm; style 0.5-2 mm

2. **F. stylosa**
3. **F. longisiliqua**

1. **Farsetia aegyptia** Turra, *Farsetia* Nov. Gen. 5, t. 1 (1765) subsp. **aegyptia**
Syns. *Farsetia oblongata* C. Presl, Abh. Königl. Böhm. Ges. Wiss., ser. 5, 3: 438 (1845).
Farsetia ovalis Boiss., Diagn. Pl. Orient. 8: 32 (1849).

Shrub 30-60 cm, canescent with appressed forked hairs, stems erect, much branched; leaves 1-5.5 x 0.2-0.3 cm, linear; racemes 5- to 10-flowered, lax; pedicels 3-8 mm; sepals 1-1.2 cm; petals 1.5-2 cm, greyish or greenish-brown, clawed; silicula 1-2.5 x 0.6-0.9 cm, broadly-oblong; style 1.5-3 mm; seeds 1.8-3 mm excluding the wings; wing 1.5-2 mm.

O, M, D, R, S; stony wadis and slopes. North Africa, Sinai, East Mediterranean region, Arabia to Pakistan and Afghanistan.

2. **Farsetia stylosa** R. Br. in Denham & Clapp., Narr. Travels Africa, App. 216 (1826).
Syns. *Farsetia hameltonii* Royle, Ill. Bot. Himal. Mts. 71 (1834).
Matthiola prostrata Hochst. & Steud. ex Steud., Nomencl. Bot. 2: 106 (1841).
Farsetia ramosissima Fourn., Bull. Soc. Bot. France 11: 57 (1864).
Farsetia depressa Kotschy, Sitzungsber., Kaiserl. Akad. Wiss., Math.-Naturwiss. Cl., Abt. 1, 52: 261 (1866).

Annual or short-lived perennial herb, 20-60 cm, sometimes woody at the base; stems branched, ascended; leaves 1-8 x 0.4-0.7 cm, linear to linear-elliptic; racemes lax, 8- to 12-flowered, much elongating in fruit; pedicels 3-7 mm in fruit; sepals 3-4.5 mm; petals

4-7 mm, white to mauve or brownish-yellow; siliqua 0.8-2.5 x 0.25-0.4 cm; style 2.5-4 mm; stigma capitate; seeds 1-2 mm, excluding the wings; wings 0.8-1.5 mm.

N, O, D, R; sandy plains and stony wadis. Tropical North and Northeast Africa, Arabia to Pakistan and India.

3. *Farsetia longisiliqua* Decne., Ann. Sci. Nat. Bot., ser. 2, 4: 69 (1835).

Perennial with woody base, 40-80 cm; stems richly branched; leaves 1-5(-7) x 0.1-0.5 cm, linear; racemes lax, 8- to 15-flowered, much elongating in fruit; sepals 0.6-1 cm; petals 1.2-2 cm, pink or pale yellow facing purple; siliqua 2.5-4.5(-5) x 0.25-0.5 cm, narrowly oblong; style 0.5-2 mm; stigma decurrent; seeds 1-2 mm, excluding the wings; wing 0.5-1.5 mm.

M, D, R, GE, S; stony wadis and slopes. Tropical Northeast Africa from Egypt to Somalia, Arabia.

23. *Neslia* Desv., nom. conserv.

Annual herbs with branched hairs; leaves simple, sagittate; the basal leaves petiolate; racemes ebracteate, dense in flower, elongating in fruit; flowers yellow; sepals not saccate, petals yellow, entire; fruit an indehiscent silicula, 1-locular, 1-seeded; valves reticulate; style short, jointed; stigma minute, slightly 2-lobed; seeds ovoid. 2 species, Mediterranean region, Southwest and Central Asia.

1. *Neslia apiculata* Fisch., Mey. & Avé-Lall. in Fisch. & Mey., Ind. Sem. Hort. Petrop. 8: 68 (1842).

Annual herb 20-25 cm, with spreading branched hairs; stems erect, branched above; leaves 2-6.5 cm, hirsute, entire or dentate; radical leaves oblong-lanceolate, sagittate; cauline leaves sessile, lanceolate to linear, sagittate-auriculate; inflorescences corymbose-paniculate, elongating in fruit; sepals 1.5-2.5 mm; petals 2-3.5 mm; pedicels 1-1.2 cm in fruit, spreading; siliqua 1.5-3 mm, subglobose, short-stipitate, reticulate, with an apiculate style.

M, S; weed of cultivation. Mediterranean region, Southwest and Central Asia.

24. *Fibigia* Medik.

Perennial herbs or shrubs with a tomentose-stellate indumentum; leaves simple; inflorescence racemose, ebracteate; flowers pedicellate; petals long-clawed; stigma capitate; fruit a silicula; seeds large, in 2 rows per locule, compressed, mostly winged. 10 species, East Mediterranean region to Afghanistan.

1. *Fibigia clypeata* (L.) Medik., Pfl.-Gatt. 90 (1792).

Syns. *Alyssum clypeatum* L., Sp. Pl. 651 (1753).

Farsetia rostrata Schenk, Pl. Specim. Aeg. 42 (1840).

Fibigia rostrata (Schenk) Boiss., Fl. Orient. 1: 257 (1867).

Perennial herb 15-40 cm, altogether densely tomentose-canescens, woody at the base; stems simple or branched, erect; basal leaves 3-10 cm, petiolate, spatulate to obovate,

entire or obscurely dentate; cauline leaves sessile; racemes dense, elongating in fruit; sepals 6-9 mm, the inner pair saccate; petals 1-1.6 cm, yellow; silicula 1.5-2.5 x 1 cm, elliptic-oblong; style 3-5 mm; seeds in 2 rows, flattened, winged.

De, S; rocky wadis. East Mediterranean region, West Asia.

25. *Ricotia* L., nom. conserv.

Annual or perennial herbs, glabrous or pilose; leaves entire, 3-foliolate, or pinnate; inflorescence a raceme; flowers white, pink or violet, pedicellate, conspicuous; calyx erect, inner sepals saccate; petals long-clawed; stigma 2-lobed or capitate; fruit a silicula, septum delicate or absent; pedicel deflexed; seeds in 1 or 2 rows per locule, compressed, wingless. 9 species, East Mediterranean region, Sinai.

1. *Ricotia lunaria* (L.) DC., Syst. Nat. 2: 284 (1821).

Syn. *Cardamine lunaria* L., Sp. Pl., ed. 1, 656 (1753).

Annual herb 10-40 cm, glabrous or sparsely hairy; stems procumbent, branching; leaves 4-10 cm, 1- to 3 pinnatisect, petiolate, the segments petiololate, acute; racemes few-flowered; flowers conspicuous; calyx 0.6-1 cm; petals 1.2-1.8 cm, long-clawed, pink, 2-fid; fruiting pedicels deflexed; silicula 2-3.5 x 0.6-1.4 cm, strongly flattened, 1-celled at maturity, lenticular to elliptical; style apiculate; valves net-veined, papery; seeds 5-6 mm diam., in 1 row, compressed, rounded.

S; stony ground. Sinai, Palestine, Lebanon.

26. *Alyssum* L.

Annual or perennial herbs, stellate-hairy; leaves entire; flowers in short racemes, elongating in fruit; sepals not saccate; petals white or yellowish; filaments of stamens simple or winged or toothed towards the base; stigma capitate; fruit a silicula, 2-loculed, seeds often mucilaginous. 190 species, Mediterranean region to Siberia.

1. Silicula glabrous

2

+ Silicula stellate-hairy

3

2. Silicula 3-4 mm, orbicular, broadest at the middle, the margins entire

1. *A. desertorum*

+ Silicula 3.5-6 mm, broadly-obovate, broadest above the middle, upper margins denticulate

2. *A. homalocarpum*

3. Fruiting pedicels appressed to the stem; silicula 2-3 mm, densely covered with minute stellate hairs; style 0.3 mm

3. *A. marginatum*

+ Fruiting pedicels spreading; silicula 4-6 mm, covered with conspicuous stellate hairs and simple or 2-armed bristles; style 1 mm

4. *A. simplex*

1. *Alyssum desertorum* Stapf, Denkschr. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl. 51: 302 (1886).

Annual herb 5-15 cm; stems erect or ascending, branched at the base; leaves 0.5-1.5(-2) x 0.1-0.3 cm; petals 2-2.5 mm, yellow, exceeding the sepals; silicula 3-4 mm, orbicular,

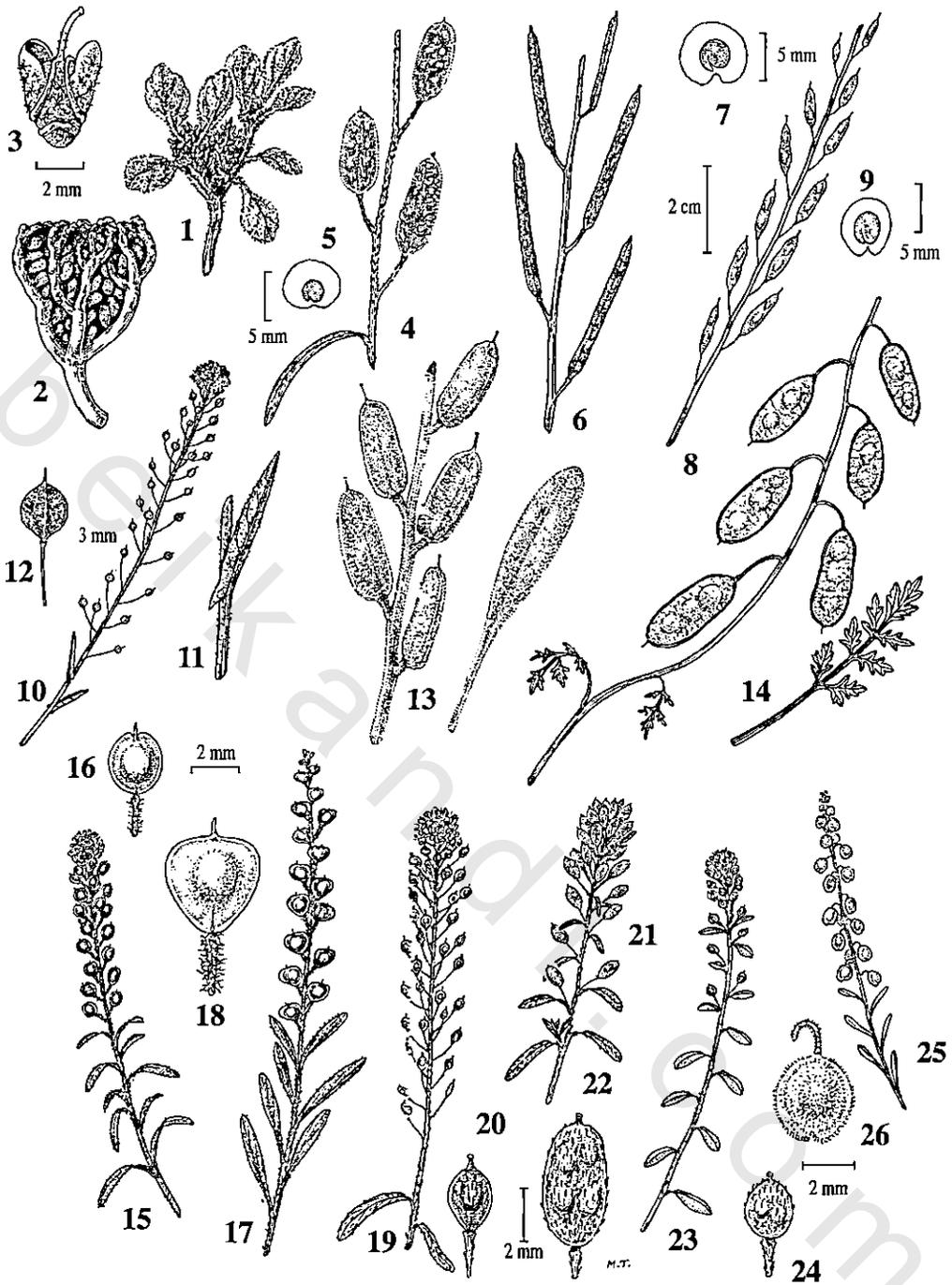


Plate 37. CRUCIFERAE: *Anastatica hierochurtica* 1, flowering branch; 2, fruiting branch; 3, fruit. *Farsetia aegyptia* 4, fruiting branch; 5, seed. *Farsetia longisiliqua* 6, fruiting branch; 7, seed. *Farsetia stylosa* 8, fruiting branch; 9, seed. *Neslia apiculata* 10, flowering and fruiting branch; 11, basal leaf; 12, fruit. *Fibigia chlypeata* 13, fruiting branch and basal leaf. *Ricotia lunaria* 14, fruiting branch and basal leaf. *Alyssum desertorum* 15, flowering and fruiting branch; 16, fruit. *Alyssum homalocarpum* 17, fruiting branch; 18, fruit. *Lobularia maritima* 19, flowering and fruiting branch; 20, fruit. *Lobularia libyca* 21, fruiting branch; 22, fruit. *Lobularia arabica* 23, fruiting branch; 24, fruit. *Clypeola jonthlaspi* 25, fruiting branch; 26, fruit. All drawings to the same scale except enlarged parts (scale given).

broadest at the middle, glabrous, the margins entire; seeds 1-2 per locule.

M; sandy and rocky ground. Southeast Europe, East Mediterranean region, Southwest and Central Asia.

2. **Alyssum homalocarpum** (Fisch. & C. A. Mey.) Boiss., Fl. Orient. 1: 285 (1867).

Syn. *Psilonema homalocarpum* Fisch. & C. A. Mey., Index Sem. Hort. Petrop. 6: 63 (1840).

Annual herb 5-15 cm, canescent-tomentose with appressed stellate hairs; stems erect, branched at the base; leaves 1-3 cm, oblanceolate to spatulate, obtuse; racemes dense, elongating in fruit; pedicels spreading in fruit; flowers minute; the petals included, yellow; silicula 3.5-6 mm, broadly-obovate, broadest above the middle, with scattered tubercles at the margins; style short, filiform; seeds 1 per locule, narrowly winged.

De, S; stony wadis and cliffs. East Mediterranean region, Sinai, Arabia, Iraq, Iran, Pakistan.

3. **Alyssum marginatum** Steud. ex Boiss., Ann. Sci. Nat. Bot., sér. 2, 17: 157 (1842).

Annual herb 5-10 cm; stems ascending, branched from the base; leaves 0.5-2.5 x 0.2-0.5 cm, oblanceolate; petals yellow, slightly longer than the sepals; fruiting racemes short, dense, cylindrical; pedicels appressed to the stem in fruit; silicula 2-3 mm, densely covered with minute stellate hairs; style 0.3 mm; seeds 2 per locule.

S; stony deserts. Southwest and Central Asia.

4. **Alyssum simplex** Rudolphi, J. Bot. (Schrader) 1799(2): 290 (1799).

Syns. *Clypeola minor* L., Fl. Monsp. (Nathhorts, Dissert.) no. 70, 21 (1766), non Fl. Monsp., Amoen. Acad. 4 (1759).

Alyssum campestre L., Sp. Pl., ed. 2, 2: 909 (1763), pro parte.

Alyssum nanum Pomel, Bull., Soc. Sci. Phys. Algérie 11: 236 (1874).

Alyssum minus (L.) Rothm., Repert. Spec. Nov. Regni Veg. 50: 77 (1941), nom. illeg.

Annual herb 5-20 cm, canescent or densely tomentose with stellate hairs; stems erect, branched at the base, sometimes simple; leaves 1-2.5 cm, obovate to oblanceolate; inflorescence dense; flowers 3 mm, petals exceeding the sepals, white, 2-fid; filaments of stamens winged; fruiting pedicels spreading; silicula 4-6 mm, covered with conspicuous stellate hairs and simple or 2-armed bristles; style 1 mm; seeds 1.8-2 mm, 1-2 per locule, narrowly-winged.

M, S; barley fields, sandy plains and wadis. Mediterranean region, West Asia.

27. **Lobularia** Desv., nom. conserv.

Annual or perennial herbs; hairs adpressed, medifixed; sepals not saccate at the base; petals white, entire; filaments of stamens not winged, without appendages; fruit a silicula; valves with a median vein; style distinct; stigma capitate; seeds 1-5 per locule. 4 species, Cape Verde and Canary Islands, Mediterranean region to Arabia.

1. Perennial
+ Annual

1. *L. maritima*
2

2. Silicula 4-6 mm; seeds 4-6 per locule
+ Silicula 2-3 mm; seeds 1-2 per locule

2. *L. libyca*
3. *L. arabica*

1. *Lobularia maritima* (L.) Desv., J. Bot. Agric. 3: 169 (1815).

Syns. *Clypeola maritima* L., Sp. Pl., ed. 1, 652 (1753).

Alyssum maritimum (L.) Lam., Encycl. 1: 98 (1783).

Koniga maritima (L.) R. Br. in Denham *et al.*, Narr. Travels Africa 215 (1826).

Perennial herb 10-30 cm, greyish-white. pubescent; stems branched at the base; leaves 2-4.5 x 0.2-0.8 cm, linear-lanceolate, acute; flowers fragrant; sepals 2 mm, spreading; petals 3-4 mm, white or pinkish; silicula 2.5-3.5 x 2-2.5 mm, obovate to suborbicular, valves appressed-pubescent; seeds 1 per locule, 1.5 mm with a narrow wing.

N, M, S; stony and sandy soils, Macaronesia, Mediterranean region.

2. *Lobularia libyca* (Viv.) C. F. W. Meissn., Pl. Vasc. Gen. 2: 11 (1837).

Syns. *Lunaria libyca* Viv., Fl. Libyc. Spec. 34 (1824).

Koniga libyca (Viv.) R. Br. in Denham *et al.*, Narr. Travels Africa 215 (1826).

Like *L. maritima*, but annual; leaves obtuse; silicula 4-6 mm, ovate; seeds 4-6 per locule.

M, Dw, S; coastal sands, edges of cultivation and waste ground. Canary Islands to Iran.

3. *Lobularia arabica* (Boiss.) Muschl., Man. Fl. Egypt 421 (1912).

Syns. *Koniga arabica* Boiss., Diagn. Pl. Orient., ser. 1, 8: 26 (1849).

Like *L. libyca*, but silicula 2-3 mm, with 1-2 seeds per locule, the valves 1-nerved.

M, S; coastal and adjacent sandy soils. Egypt, Palestine.

28. *Clypeola* L.

Annual herbs, stellate-hairy; leaves linear to spatulate, entire; inflorescence of dense racemes, ebracteate; flowers small, white or yellow; sepals not saccate; stamens free, filaments toothed; fruit a silicula, indehiscent, pendent, compressed, 1-celled, 1-seeded; seeds wingless. 9 species, Mediterranean region, West Asia.

1. *Clypeola jonthlaspi* L., Sp. Pl., ed. 1, 652 (1753).

Syns. *Clypeola microcarpa* Moris, Atti. Riun. Scienz. Ital. 13: 7 (1841).

Clypeola glabra Boiss., Ann. Sci. Nat. Bot., ser. 2, 17: 173 (1842).

Clypeola hispida C. Presl Abh. Königl. Böhm. Ges. Wiss., ser. 5, 3: 439 (1845).

Clypeola jonthlaspi subsp. *macrocarpa* (Caruel) Fiori, Nouvo Giorn. Bot. Ital., ser. 2, 17: 610 (1910).

Annual herb 5-20 cm, appressed stellate-hairy; stems erect, simple or branched; leaves 1-2 cm, linear-spatulate, petiolate; sepals persistent; petals 1-2 mm, almost equalling the

sepals; fruiting raceme elongate in fruit, dense; pedicels 2-3 mm in fruit, erect, spreading; silicula 3-5 mm, discoid, orbicular, glabrous or with an indumentum of simple or hooked hairs; the margin winged, entire; seeds pendulous.

S; stony wadis. Mediterranean region, West Asia.

29. *Diplotaxis* DC.

Annual or perennial herbs, glabrous, scabrous, or hispid with simple hairs; leaves pinnate, dentate or entire; inflorescence usually ebracteate, elongating in fruit; flowers conspicuous; sepals erect, the inner equal or saccate at the base; petals short-clawed; yellow, white, pink or lilac; stamens free, not dentate; style short; stigma usually 2-lobed; fruit a linear dehiscent siliqua, flattened, slightly torulose, 1-nerved; seeds in 2 rows per locule. 27 species, Europe, Mediterranean region to Northwest India.

- | | |
|---|--|
| 1. Flowers yellow | 2 |
| + Flowers white, purple, violet-pink or pink | 4 |
| 2. Plant hispid; siliqua pendent | 1 <i>D. harra</i> subsp. <i>harra</i> |
| + Plant glabrescent; siliqua spreading | 3 |
| 3. Siliqua 2-3 mm broad; beak 1 mm, obconical | 4. <i>D. muralis</i> var. <i>muralis</i> |
| + Siliqua 1.5-2 mm broad; beak 1-2 mm, linear conical | 4. <i>D. muralis</i> var. <i>simplex</i> |
| 4. Basal leaves lobed; flowers 1.2-1.6 cm; petals white, rarely pinkish;
style 3-6 mm | 3. <i>D. eruroides</i> subsp. <i>eruroides</i> |
| + Basal leaves entire or toothed, fleshy; flowers 1.6-2 cm, petals violet-pink; style
1-1.5 mm | 2. <i>D. acris</i> |

1. *Diplotaxis harra* (Forssk.) Boiss., Fl. Orient. 1: 388 (1867). subsp. *harra*
Syn. *Sinapis harra* Forssk., Fl. Aegypt.-Arab. 118 (1775).

Perennial herb 15-60 cm, hispid throughout; stems often woody at the base, branching; basal leaves 3-8(-12) x 1-4 cm, petiolate, obovate, coarsely dentate or lobed; stem leaves lanceolate; pedicels 0.8-1.2 cm; flowers conspicuous; sepals 4-7 mm, pilose; petals 0.8-1.2 cm, clawed, yellow; siliqua 3-4.5 x 0.2-0.3 cm, flattened, torulose, deflexed, beak short, stigma 2-lobed; seeds in 2 rows per locule.

O, D, S; sandy plains and stony wadis. North Africa, Somalia, Southwest Asia.

2. *Diplotaxis acris* (Forssk.) Boiss., Fl. Orient. 1: 389 (1867).
Syn. *Hesperis acris* Forssk., Fl. Aegypt.-Arab. 118 (1775).

Annual herb 10-40 cm, glabrous or glabrescent with a few spreading hairs towards the base; stems erect, branched mainly from the base; basal leaves 3-10 x 1-5 cm, forming a rosette, simple or lyrate-pinnate, fleshy, petiolate, entire or toothed; stem leaves small; flowers 1.6-2 cm; sepals 5-8 mm, erect; petals 1.5-2 cm, violet-pink, long-clawed; stigma 2-lobed, on 1-1.5 mm style; siliqua 2.5-5 x 0.2-0.3 cm, short-beaked, valves torulose, with a distinct midrib; seeds in 2 rows, orange-brown.

De, S; sandy plains and stony wadis. Spain, Sicily, North Africa, Sinai, Palestine, Arabia, Iraq.

NOTE: Leaves consumed as a green salad, tasting like *Eruca sativa* (salad rocket).

3. **Diplotaxis erucooides** (L.) DC., Syst. Nat. 2: 631 (1821) subsp. **erucooides**

Syns. *Sinapis erucooids* L., Cent. Pl. 2: 24 (1756).

Diplotaxis hispidula Ten., Syll. Fl. Neapol. 325 (1831).

Annual 10-50 cm, with a few appressed hairs; stems erect, branched mainly from the base; basal leaves 5-15 x 1-4 cm, petiolate, lobed; stem leaves smaller; pedicels 0.5-1.5 (-2) cm, elongating in fruit; flowers 1.2-1.6 cm, sepals 4-8 mm, spreading; petals 0.8-1.6 cm, white, rarely pinkish; siliqua 2-4 x 0.1-0.3 cm, erecto-patent; style 3-6 mm, stigma 2-lobed; valves torulose, with a distinct midrib; seeds 0.8 mm, in 2 rows per locule.

N, M, GE, S; waste ground, sandy desert soils close to cultivation. Europe, Mediterranean region, Sinai, Arabia, Iraq, Iran, Ethiopia.

4. **Diplotaxis muralis** (L.) DC., Syst. Nat. 2: 634 (1821).

Syns. *Sisymbrium murale* L., Sp. Pl., ed. 1, 658 (1753).

Diplotaxis scaposa DC., Syst. Nat. 2: 635 (1821).

Annual or short-lived perennial, 10-50 cm, foetid; stems branched from the base; leaves mostly confined to a basal rosette, long-petiolate, lyrate-pinnatifid; upper leaves (if present) oblong, subsessile, coarsely toothed; petals 5-7 mm, yellow; fruiting pedicels 0.6-1.2 cm, erect, spreading; siliqua 2.5-4.5 x 0.2-0.3 cm, torulose; beak 1-2 mm, seedless.

Two varieties occur in Egypt:

var. **muralis**

Annual or short-lived perennial with broad leaves; siliqua 2-3 mm broad, with a 1 mm obconical beak.

M, Dw; sandy soils, cultivated plots. North Africa, Europe.

var. **simplex** (Viv.) El Naggat, Taekholmia 11: 69 (1991).

Syns. *Sisymbrium simplex* Viv., Fl. Libyc. Spec. 36 (1824).

Diplotaxis simplex (Viv.) Spreng., Syst. Veg. 2: 914 (1825).

Diplotaxis muralis (L.) DC. subsp. *simplex* (Viv.) Jafri in Ali & Jafri, Fl. Libya 23: 37 (1977).

Annual with narrow leaves, siliqua 1.5-2 mm broad, with 1-2 mm linear-conical beak.

M; roadsides and weed of cultivation. Egypt, Libya, Tunisia.

30. **Brassica** L.

Annual, biennial or perennial herbs, glabrous or with simple hairs; basal leaves simple or lyrate; upper leaves often amplexicaul at the base; sepals erect or erecto-patent; the inner slightly saccate; petals yellow or white; filaments of stamens unappendaged, free; stigma capitate; fruit a siliqua, many-seeded, dehiscent, beaked, torulose; valves 1-nerved; beak 0- to 2-seeded; seeds in 1 row; globose. 35 species, Eurasia, Mediterranean region.

- | | |
|---|---|
| 1. Upper leaves amplexicaul
+ Upper leaves petiolate | 1. B. rapa
2 |
| 2. Fruit appressed to stem; fruiting pedicels 2-4 mm
+ Fruits spreading; fruiting pedicels over 4 mm | 4. B. nigra
3 |
| 3. Plant glabrous above, sparingly hairy below
+ Plant hispid or villous | 5. B. juncea
4 |
| 4. Annual, hispid; beak of siliqua 1-2 cm
+ Annual or short-lived perennial, villous; beak of siliqua 3-5 mm | 2. B. tournefortii
3. B. deserti |

1. **Brassica rapa** L., Sp. Pl., ed. 1, 666 (1753).
Syn. *Brassica campestris* L., Sp. Pl., ed. 1, 666 (1753).

Annual or biennial herb, 30-80 cm, often with a swollen taproot; lower leaves 5-30 x 4-10 cm, lyrate, with 2-5 lateral dentate lobes; upper leaves amplexicaul, entire; open flowers overtopping the buds; sepals spreading; petals 0.6-1.1 cm, yellow; siliqua 4-7.5 (-9) x 0.2-0.4 cm; beak 0.5-2.5 cm, 1-seeded or seedless.

N, O, M; escape from cultivation. Cultivated worldwide for its fleshy root, the turnip, escaping as a weed.

2. **Brassica tournefortii** Gouan, Ill. Observ. Bot. 44, t. 20A (1773).

Annual herb 15-80 cm, glabrous above, hispid below; stems erect and spreading, much branched; basal leaves mostly in a rosette, 4-25(-40) x 2-6(-12) cm, lyrate-pinnatisect, with 6-12 pairs of lateral serrate-dentate lobes; upper leaves short-petiolate, smaller, narrowly oblong; sepals 3-4 mm, petals 6-8 mm, pale yellow, long-clawed; racemes lax, elongate in fruit; pedicels 1-3.5 cm in fruit, spreading; siliqua 4-7 x 0.2-0.3 cm, torulose; beak 1-2 cm, 1- to 2-seeded

N, O, M, D, S; desert plains, sandy and stony wadis, edges of cultivation. North Africa, South and West Europe, Southwest Asia.

3. **Brassica deserti** Danin & Hedge, Notes Roy. Bot. Gard. Edinb. 32: 259 (1973).

Like *Brassica tournefortii*, but annual or short-lived perennial, 15-60 cm, villous, flowers lemon-yellow, showy; siliqua 2-5 cm, torulose, prominently nerved; beak 3-5 mm.

S; stony wadis. Endemic.

4. **Brassica nigra** (L.) Koch in Röhling, Deutschl. Fl., ed. 3, 4: 713 (1833).

Syns. *Sinapis nigra* L., Sp. Pl., ed. 1, 668 (1753).

Brassica bracteolata Fisch. & C. A. Mey., Index Sem. Hort. Petrop. 4: 33 (1838).

Annual herb 0.4-1.5(-2) m, sparingly hispid with stiff hairs, or glabrous; stems erect, branched above the base; basal leaves 10-35 x 3-12 cm, petiolate, lyrate-pinnatisect, the lateral lobes oblong-ovate, serrate-dentate; upper leaves short-petiolate, linear entire; inflorescence richly branched, dense; sepals 4-7 mm; petals 0.7-1.4 cm, yellow; pedicels

2-4 mm in fruit; siliqua 1-3 x 0.15-0.4 cm, cylindrical, torulose, appressed to stem, attenuate into a slender, seedless beak 2-5 mm; stigma capitate, 2-lobed; seeds 1.5 mm, globose brownish.

N, O, M, S; weed of cultivation. Macaronesia, Europe, Mediterranean region, Asia; adventive in temperate regions.

5. **Brassica juncea** (L.) Czernj. & Coss. in Czernj., Consp. Pl. Chark. 8 (1859).
Syn. *Sinapis juncea* L., Sp. Pl., ed. 1, 668 (1753).

Annual herb 40-80 cm, glabrous above, sometimes sparingly hairy below; stems erect, branched; basal leaves 3-15 x 1-4 cm, entire to lyrate-pinnatisect, petiolate, irregularly serrate; upper leaves narrowly-oblong, short-petiolate; petals 5-9 mm, bright yellow; siliqua 2.5-7 x 0.2-0.4 cm, spreading; beak 4-9 mm, narrowly conical, seedless.

N; weed of cultivation. South and East Asia, cultivated and naturalized in many temperate and warm regions.

31. **Erucastrum** C. Presl

Annual or perennial herbs, glabrous or with simple hairs; basal leaves lyrate, the upper less divided or entire; sepals erect, the inner slightly saccate; petals yellow or white; filaments of stamens unappendaged, free; stigma capitate or 2-fid; fruit a siliqua, linear, usually 4-angled, the valves 1-nerved, beak seedless; seeds in 1 row, subglobose. 20 species, Macaronesia, Mediterranean region, Europe.

1. **Erucastrum arabicum** Fisch. & C. A. Mey., Index Sem. Hort. Petrop. 5: 35 (1839).
Syn. *Brassica arabica* (Fisch. & C. A. Mey.) Fiori, Nuovo Giorn. Bot. Ital., ser. 2, 19: 445 (1912).

Annual herb 15-40 cm, glabrescent above, hispid below; stems erect or ascending, branched; lower leaves 4-12 x 1-3 cm, lyrate-pinnatifid, irregularly dentate, petiolate; upper leaves smaller, less divided, sessile; racemes densely flowered, becoming lax in fruit; pedicels 0.5-1.6 cm in fruit, ascending; petals 3-5.5 mm, yellow; siliqua 2-4.5 cm, 4-angled valves sparingly hairy to glabrous; beak 1.5-5 cm; stigma capitate; seeds 1-1.2 mm, obovoid, brownish, finely reticulate.

N, De; weed of cultivation, disturbed ground. Tropical and southern Africa, Arabia.

32. **Sinapis** L.

Annual herbs, with simple hairs; leaves pinnate; inner sepals not saccate; petals white or yellow; filaments of stamens unappendaged; stigma capitate; fruit a siliqua, beaked; valves distinctly 3- to 7-veined; seeds in 1 row per locule, globose. 7 species, Europe, Mediterranean region, West and Central Asia.

- | | |
|---|-----------------------|
| 1. Siliqua 4-3-seeded; beak flattened | 1. S. alba |
| + Siliqua 8-12-seeded; beak conical | 2 |
| 2. Siliqua 3.5-4 mm wide, ellipsoid, glabrous; beak 1-1.2 cm, seedless | 3. S. allionii |
| + Siliqua 2-3 mm wide, cylindrical, hispid; beak 1-1.8 cm, 1- to 2-seeded | 2. S. arvensis |

1. ***Sinapis alba*** L., Sp. Pl., ed. 1, 668 (1753).

Annual herb 20-80 cm, hispid; stems erect, branched, radical leaves 5-20 cm, lyrate-pinnatifid; upper leaves smaller, simple; flowering racemes dense; pedicels 5-9 mm; flowers conspicuous; sepals 5-9 mm; petals 0.9-1.6 cm, yellow, short-clawed; siliqua 2.5-4.5 x 0.3-0.4 cm, spreading, 4- to 8-seeded (2-4 per locule); valves 3- to 5-nerved, torulose, white-hispid; beak flattened, 1-seeded; seeds globose, brownish-yellow.

N, M; weed of cultivated fields, waste ground. North Africa, Europe, Southwest and Central Asia.

2. ***Sinapis arvensis*** L., Sp. Pl., ed. 1, 668 (1753).

Annual herb 20-80 cm, hispid or glabrescent; stems erect, branched; lower leaves 5-20 cm, petiolate, lyrate or pinnatifid to pinnatisect, irregularly dentate; upper leaves smaller, sessile; flowering racemes dense; pedicels 3-4 mm; flowers yellow; sepals 3.5-5 cm; petals 0.7-1.2 cm, clawed; siliqua 2.5-4.5 x 0.2-0.3 cm, spreading, torulose, 3- to 5-nerved, glabrous or hispid; beak 1-1.8 cm, 1- to 2-seeded; seeds 1.5 mm, globose, brown.

Two varieties occur in Egypt:

var. ***arvensis***

Plant glabrous or glabrescent, siliqua almost glabrous.

N, O, M; weed of cultivation.

var. ***orientalis*** (L.) Koch & Ziz, Cat. Palat. 12 (1814).

Syns. *Sinapis orientalis* L., Cent. Pl. 1: 19 (1755).

Brassica sinapistrum Boiss., Voy. Bot. Espagne 2: 39 (1839).

Siliqua hispid with stiff retrorse hairs.

N, O, M, De, S; cultivated fields, sandy soils, waste ground.

Area of the species: Mediterranean region, Europe, Southwest and Central Asia.

3. ***Sinapis allionii*** Jacq., Hort. Bot. Vindob. 79 (1772).

Syns. *Sinapis turgida* (Pers.) Delile, Descr. Egypte, Hist. Nat. 67 (1814), non Pers., Syn. Pl. 2: 207 (1806).

Sinapis arvensis L. subsp. *allionii* (Jacq.) Baillarg., Willdenowia 15: 69 (1985).

Annual herb 15-50 cm, glabrous; stems slightly furrowed, branched mainly in the upper part; leaves 5-12 cm, pinnatipartite to pinnatisect, the lateral lobes narrow, coarsely dentate; racemes many-flowered; pedicels 2-5 mm, accrescent and elongating in fruit; sepals spreading, petals yellow, veined, long-clawed; siliqua 1.5-4 x 0.35-0.4 cm including the beak, ellipsoid, with 3-6 prominent nerves, torulose; beak 1-1.2 cm, subulate-conical, seedless; seeds 2 mm, globose, dark brown.

N, M; weed of cultivation, especially in flax fields. Endemic.

33 *Eruca* Mill.

Annual herbs, glabrous or with simple hairs; leaves lyrate-pinnatisect to entire; inner sepals saccate; petals yellow with violet or brown veins; filaments of stamens unappendaged; stigma with decurrent lobes; fruit a dehiscent siliqua, with a flattened seedless beak; seeds in 2 rows per locule. 3 species, Mediterranean region, Northeast Africa, Southwest Asia.

1. *Eruca sativa* Mill., Gard. Dict., ed. 8, no. 1 (1768).

Syn. *Eruca lativalvis* Boiss., Fl. Orient. 1: 396 (1867).

Annual herb 10-60 cm, glabrous or sparingly hairy; stems erect, simple or branching; lower leaves 5-18 cm, lyrate-pinnatisect, petiolate; upper shorter, sessile; inflorescence of lax terminal racemes, much elongating in fruit; pedicels 2-5 mm, thickening in fruit; sepals 1-1.2 x 0.2 cm; petals 1.5-2.4 x 0.3-0.7 cm, pale lemon-yellow, with dark violet veins; apex truncate to broadly obtuse: long-clawed; siliqua 2-3.5 x 0.3-0.4 cm, valves 1-nerved; beak 0.5-1 cm; seeds 2 mm, ovoid, brownish.

N, O, M, De, S; weed of cultivation, also escape from cultivation. North Africa, Europe, Southwest Asia, widely cultivated in temperate regions.

NOTE: The leaves are consumed as a green salad (salad rocket).

34. *Erucaria* Gaertn.

Annual herbs, glabrous or with simple hairs; leaves fleshy, pinnatisect with linear lobes; inner sepals rarely saccate; petals white, rose or violet; filaments without appendages; stigma capitate; fruit a siliqua; the upper part indehiscent, 1- to 4-seeded, the lower cylindrical, dehiscent by 2 valves, 1- to 6-seeded. 6 species, East Mediterranean region, Arabia, Iran.

1. Upper segment of the siliqua much longer than the lower, gradually narrowed into a conical style 2

+ Upper segment of the siliqua almost equalling or shorter than the lower, abruptly narrowed into a filiform style 3

2. Siliqua 1.5-2.8 cm, strongly curved or hooked, the upper segment 4-5 times as long as the lower; flowers 5-7 mm, white or pink 1. *E. pinnata*

+ Siliqua 1-1.8 cm, straight or slightly curved, the upper segment 2-2.5 times as long as the lower; flowers 7-8 mm, rose, violet or white 3. *E. crassifolia*

3. Siliqua 1.2-1.7 cm, the upper segment 6-8 mm, terminating in a 4-5 mm filiform style; flowers 0.9-1.5 cm, pale lilac to mauve 2. *E. hispanica*

+ Siliqua 5-8 mm, upper segment terminating in a 2-3 mm style, (often longer than segment) flowers 0.8-1 cm, white or pink 4. *E. microcarpa*

1. *Erucaria pinnata* (Viv.) Täckh. & Boulos, Publ. Cairo Univ. Herb. 5: 37 (1974).

Syns. *Raphanus pinnatus* Viv., Fl. Libyc. Spec. 37 (1824).

Hussonia uncatata Boiss., Diagn. Pl. Orient. 8: 47 (1849).

Erucaria aegiceras Coss. in Coss. & Barratte, Ill. Fl. Atlant. 1: 47 (1884),
nom. illeg.

Erucaria uncata (Boiss.) Asch. & Schweinf., Mém. Inst. Egypt. 2: 40
(1889).

Erucaria uncata subsp. *aegiceras* Maire & Weiller in Maire, Fl. Afr. Nord
12: 397 (1965), nom. inval.

Hussonia pinnaia (Viv.) Jafri in Ali & Jafri, Fl. Libya 23: 67 (1977).

Erucaria pinnata (Viv.) El Nagggar, Taekholmia 11: 70 (1991).

Annual herb 15-40 cm, glabrous to glabrescent herb; stems branching, erect to ascending; leaves 3-10 cm, pinnatisect; the lobes linear to oblong, entire or lobed; racemes dense, elongate and lax in fruit; pedicels 1-2.5 mm, accrescent in fruit; flowers 5-7 mm; sepals subequal, erect; petals almost twice as long as the sepals, white or pink; siliqua 1.5-2.8 cm, strongly curved or hooked, the 2-segmented upper segment 4-5 times as long as lower, gradually narrowed into a conical style; seeds 1.8-2.2 mm, brownish.

O, M, D, S; edges of cultivation, sandy deserts. North Africa, Sinai, Palestine.

2. *Erucaria hispanica* (L.) Druce, Bot. Exch. Club Soc. Brit. Isles 3: 418 (1914).

Syns. *Sinapis hispanica* L., Sp. Pl., ed. 1, 669 (1753).

Bunias myagroides L., Mant. 96 (1767).

Erucaria aleppica Gaertn., Fruct. 2: 298 (1791).

Erucaria latifolia DC., Syst. Nat. 2: 675 (1821).

Erucaria myagroides (L.) Haláscy, Consp. Fl. Gr. 1: 123 (1900).

Annual herb 20-60 cm, glabrous; stems branched from the base, erect or ascending; leaves 4-15 cm; the lower 2-pinnatisect, with linear-dentate or entire lobes; racemes densely flowered, elongate in fruit; pedicels shorter than the calyx; flowers 0.9-1.5 cm; sepals 5-8 mm, subequal at base; petals 0.9-1.5 cm, pale lilac to mauve, long-clawed; siliqua 1.2-1.7 cm, straight or slightly curved, spreading or appressed to the stem, longitudinally-nerved, 2-segmented, the upper segment 6-8 mm, terminating in a 4-5 mm filiform style; seeds compressed, subglobose.

M, S; sandy and stony plains and wadis. Spain, Greece, Crete, Aegean Islands, East Mediterranean region, Sinai, Arabia, Iran, Iraq.

3. *Erucaria crassifolia* (Forssk.) Delile, Descr. Egypte, Hist. Nat. 244 (1814).

Syn. *Brassica crassifolia* Forssk., Fl. Aegypt.-Arab. 118 (1775).

Annual herb 12-30 cm, glabrous or pilose below; stems erect, branched from the base; leaves 3-10 cm, 1-2-pinnatisect, with linear lobes; flowers 7-8 mm, rose, violet or white; siliqua 1-1.8 cm, straight or slightly curved, 2-segmented; upper segment 2-2.5 times as long as the lower, gradually narrowed into a conical style, longitudinally-nerved.

M, D, S; sandy deserts, edges of cultivation, and coastal regions. Egypt, Palestine, ? Arabia, Iraq.

4. *Erucaria microcarpa* Boiss., Diagn. Pl. Orient. 8: 47 (1849).

Annual herb 10-40 cm, glabrous; stems erect or ascending, branched from the base; leaves 3-10 cm, the lower 2-3-pinnatisect; lobes small, oblong, entire; upper leaves



Plate 38. CRUCIFERAE: *Diplotaxis harra* 1, Fruiting branch and basal leaf. *Diplotaxis acris* 2, fruiting branch and basal leaf. *Brassica rapa* 3, fruiting branch, leafy branch and root. *Brassica nigra* 4, fruiting branch and basal leaf. *Erucastrum arabicum* 5, fruiting branch and basal leaf. *Sinapis alba* 6, fruiting branch. *Sinapis allionii* 7, fruiting branch, basal leaf and fruit. *Eruca sativa* 8, flowering branch and fruit. *Erucaria hispanica* 9, fruiting branch and basal leaf. *Erucaria crassifolia* 10, fruiting branch and basal leaf. *Erucaria microcarpa* 11, fruiting branch and basal leaf. *Rapistrum rugosum* 12, fruiting branch, basal leaf and fruit. All drawings to the same scale except enlarged parts (scale given).

smaller, with linear lobes; flowers 0.8-1 cm, white or pink; sepals 3-4 mm; petals 0.8-1 cm, clawed; racemes much-branched, elongate in fruit; pedicels 1.5-3 mm, accrescent in fruit; siliqua 5-8 mm, straight, 2-segmented; upper segment abruptly terminating into a 2-3 mm filiform style, often longer than the upper segment; valves 5-nerved; seeds 1 mm, globose-compressed, brownish.

O, M, De, S; sandy plains and desert wadis. Libya, Egypt, Palestine.

35. *Rapistrum* Crantz, nom. conserv.

Annual herbs, with stiff simple hairs; leaves lyrate-pinnatifid or simple; inner sepals slightly saccate; petals yellowish-white; inner filaments unappendaged; stigma capitate; silicula 2-segmented, the lower segment sterile or 1- to 3-seeded, dehiscent, the upper 1-seeded, subglobose, with a narrow beak. 2 species, Europe, Mediterranean region, West and Central Asia.

1. *Rapistrum rugosum* (L.) All., Fl. Ped. 1: 257 (1785).

Syns. *Myagrum rugosum* L., Sp. Pl., ed. 1, 257 (1753).

Rapistrum orientale (L.) Crantz, Cl. Crucif. Emend. 106 (1769).

Annual herb 20-80 cm, glabrous above, hispid below; stems erect; lower leaves 3-8 cm, petiolate, lyrate-pinnatifid; upper leaves 1.5-4 cm, subsessile, entire or dentate; racemes branched, elongating in fruit; flowers pedicellate; sepals 2.5-4 mm; petals 0.6-1 cm, yellow; pedicels 2-4 mm, thickened in fruit, silicula 0.7-1.1 cm, 2-segmented; the upper segment 3 mm, globose, the lower narrowly cylindrical; beak 1.5-4 mm; seeds ovoid-globose.

M, S; cultivated plots, roadsides. North Africa, Europe, West and Central Asia.

36. *Didesmus* Desv.

Annual herbs; leaves lyrate-pinnatisect to simple; inflorescence ebracteate, densely corymbose, much elongating in fruit; petals white with a purplish claw; style distinct; stigma capitate; silicula 2-segmented, the segments indehiscent; lower segment distinctly 4- to 6-angled, 1-seeded, persistent; the upper caducous, 1-seeded, terminating in a sharp conical or subulate beak; seeds ovoid, brownish. 2 species, North Africa, East Mediterranean region.

1. Leaves lyrate-pinnatisect or simple, serrate-dentate

+ Leaves 2-pinnatisect, with narrow lobes

1. *D. aegyptius*

2. *D. bipinnatus*

1. *Didesmus aegyptius* (L.) Desv., J. Bot. Agric. 3: 160 (1815).

Syns. *Myagrum aegyptium* L., Sp. Pl., ed. 1, 641 (1753).

Didesmus tenuifolius (Sm.) DC., Syst. Nat. 2: 659 (1821).

Annual herb 10-40 cm, sparingly hispid, with deflexed hairs; stems erect; leaves 3-10 cm, oblong-elliptic, dentate to lyrate-pinnatisect with 2-5 pairs of lobes; fruiting pedicels 3-5 mm; sepals 3.5-4.5 mm; petals 0.6-1 cm, white or purplish; silicula 0.6-1 cm, the lower segment with 4-6 swellings at the base; the upper segment ovoid or tetragonal; beak 2.5-4 mm; seeds 1.5 mm, smooth, brownish.

N; weed of cultivation. North Africa, Aegean Islands, Cyprus, Greece, Crete.

2. ***Didesmus bipinnatus*** (Desf.) DC., Syst. Nat. 2: 659 (1821).
Syn. *Sinapis bipinnata* Desf., Fl. Atlant. 2: 97 (1798).

Annual herb, 10-50 cm, sparsely hispid with deflexed hairs or glabrous; stems erect or ascending; leaves 2-pinnatisect, the lobes oblong-linear; petals white or purplish; siliqua 6-9 mm, similar to that of *D. aegyptius*; fruiting pedicels slightly deflexed.

M; roadsides, edges of cultivation. North Africa (except Morocco).

37. *Cakile* Mill.

Annual herbs, succulent, glabrous, glaucous; petals clawed, white, pink or violet; fruit a siliqua, transversely articulate, upper segment large, ovoid, almost 4-angled, not attenuate to a style, 1-2-seeded; lower segment obconical, usually 1-seeded, indehiscent. 7 species, coastal regions, Europe, Mediterranean region, West Asia, Australia, North America.

1. ***Cakile maritima*** Scop., Fl. Carniol., ed. 2, 2: 35 (1772) subsp. ***aegyptiaca*** (Willd.)
Nyman, Consp. Fl. Europ. 29 (1878).
Syns. *Cakile aegyptiaca* Willd., Sp. Pl., ed. 4, 3: 417 (1800).
Cakile hispanica Jord., Diagn. Esp. Nouv. 345 (1864).
Cakile littoralis Jord., Diagn. Esp. Nouv. 345 (1864).

Annual succulent herb, 15-60 cm; stems decumbent; leaves 4-10 cm, petiolate, glabrous, pinnatifid to pinnatisect, linear, obtuse, entire or dentate; inflorescence branched, ebracteate; flowers 0.8-1.2 cm, lilac or whitish; petals twice as long as the sepals, clawed; fruiting pedicels 2-3 mm, thickened; siliqua 1.5-2.5 x 0.4-0.6 cm, 2-jointed, tetragonous; the lower segment 3-4 mm, with lateral projections; upper segment much longer, pyramidal, each segment 1-seeded; seeds smooth, yellowish-brown.

N, M, S; seashores and adjacent sandy ground. Europe, Mediterranean region, West Asia.

38. *Zilla* Forssk.

Perennial spiny shrubs; stems richly branched; leaves fleshy, glabrous, spathulate, sinuate-crenate, few on young plants or new branches and mature plants almost leafless; racemes few-flowered, ebracteate; inflorescence axis spinescent; flowers conspicuous, lilac or violet; calyx saccate; petals long-clawed; fruit indehiscent silicule, ovoid-globose, 2-celled, woody, tapering into a conical beak, seeds 1 per locule, pendulous. 1 species, North Africa to Arabia.

1. ***Zilla spinosa*** (L.) Prantl in Engl. & Prantl, Natürl. Pflanzenfam. III(2): 175 (1891).
Syns. *Bunias spinosa* L., Mant. 96 (1767).
Zilla microcarpa (DC.) Vis. in Spongia, Comment. Med. 2: 209 (1836).

Shrub 0.5-1.5 m; stems densely dichotomously branched, spine-tipped; basal leaves 2-10 cm, spathulate, soon deciduous; cauline leaves few, small; old stems leafless; racemes few-flowered; flowers short-pedicellate. sepals 4.5-7 mm; petals 0.7-1.8 cm, violet to

lilac; pedicels 1-2.5 mm, thickened in fruit; silicula 0.6-1 cm, subglobose, 6-ribbed, tapering into a conical spiny beak; valves and septum woody; seeds ellipsoid, smooth.

Two subspecies occur in Egypt:

subsp. **spinosa**

Silicula subglobose, with inconspicuous outgrowths on the valves.

N, D, R, GE, S; sandy plains, stony wadis. North Africa, Southwest Asia.

subsp. **biparmata** (O. E. Schulz) Maire & Weiller, Bull. Soc. Hist. Nat. Afr. Nord 30: 260 (1939).

Syn. *Zilla biparmata* O. E. Schulz, Bot. Jahrb. Syst. 54, Beibl. 119: 55 (1916).

Silicula conspicuously covered with shield-like outgrowths or wings on the valves.

M, Dw; stony ground and sandy plains. Northwest Egypt to Morocco.

39. **Enarthrocarpus** Labill.

Annual hispid herbs; basal leaves lyrate, pinnately divided; stem leaves sessile, toothed; inflorescence bracteate, elongate in fruit; flowers conspicuous, short-pedicellate; sepals subequal; petals yellow, purple-veined; stamens edentate; style long; stigma capitate, slightly 2-lobed, fruit indehiscent long siliqua, 2-segmented, beaked, hispid or scabrous, terete to slightly compressed, constricted between the seeds and breaking into 1-seeded segments; seeds in 1 row per locule. 5 species, North Africa, Sinai, East Mediterranean region.

1. Siliqua conspicuously winged at the margins

+ Siliqua not winged

3. **E. pterocarpus**

2

2. Flowers 6-8 mm; siliqua slightly torulose, the lower segment 0.8-1.4 cm, the upper segment 3- to 6-seeded

+ Flowers 1-1.5 cm; siliqua strongly torulose, the lower segment 3-4 mm,

the upper segment 8- to 12-seeded

1. **E. lyratus**

2. **E. strangulatus**

1. **Enarthrocarpus lyratus** (Forssk.) DC., Syst. Nat. 2: 661 (1821).

Syn. *Raphanus lyratus* Forssk., Fl. Aegypt.-Arab. 119 (1775).

Annual herb 10-35 cm, hispid, with simple hairs; stems erect or ascending, branching from the base; basal leaves 3-8 cm, lyrate-pinnatisect, the lobes dentate; cauline leaves subsessile, dentate to incised; inflorescence bracteate throughout, dense; flowers 6-8 mm; sepals 4 mm; petals pale yellow, purple-veined; pedicels 3-6 mm; siliqua 2.5-4.5 cm, compressed, slightly torulose, recurved, hispid at the margin; lower segment 0.8-1.4 cm, 2- to 3-seeded; the upper 3-6-seeded, with 5- to 7 longitudinal ridges; beak 4-5 mm, narrowed towards the apex; seeds brownish.

N, O, M, De, S; roadsides, cultivated plots, sandy soils at edges of fields. East Mediterranean region, Sinai.

2. **Enarthrocarpus strangulatus** Boiss., Diagn. Pl. Orient. 8: 44 (1849).

Annual herb 10-50 cm, densely hispid-hirsute; stems procumbent or ascending, branched from the base; basal leaves 4-12 cm, lyrate-pinnatisect; lateral lobes dentate; cauline leaves subsessile, pinnatifid or dentate; inflorescence dense, the bracteate throughout; sepals 4-6 mm, hispid; petals 1-1.5 cm, cream or yellow, purple-veined, clawed; pedicels 0.8-1.2 cm, curved; siliqua 2.8-4.5 cm, slightly compressed, strongly torulose, hispid, longitudinally striate; the lower segment 3-4 mm, 1- to 2-seeded the upper segment 8- to 12-seeded, separating at maturity into 1-seeded segments; beak 4-5 mm, conical-flattened; seeds 1 mm, brownish.

M, S; cultivated plots, roadsides, disturbed ground. Libya, Egypt, Palestine.

3. **Enarthrocarpus pterocarpus** (Pers.) DC., Syst. Nat. 2: 661 (1821).

Syn. *Raphanus pterocarpus* Pers., Syn. Pl. 2: 209 (1806).

Annual herb 15-50 cm white-hispid; stems much-branched from the base, ascending; leaves mostly basal, 3-10(-15) cm, lyrate-pinnatifid to pinnatisect; lateral lobes dentate; cauline leaves subsessile, pinnatifid or dentate; inflorescence bracteate throughout; pedicels 0.8-1 cm, curved; flowers yellowish with violet veins; siliqua 2.5-5 cm, conspicuously winged at the margins; lower segment 1- to 2-seeded, persistent, the upper segment 6- to 13-seeded, breaking into 1-seeded segments at maturity; beak 1-1.2 cm, curved, seedless; seeds 1-1.2 mm, ellipsoid, brownish.

M, S; cultivated plots, roadsides. Egypt, Libya.

40. **Raphanus** L.

Annual or biennial herbs; basal leaves lyrate with a large terminal lobe; racemes ebracteate; flowers white, yellow or violet, sometimes purple-veined; inner sepals saccate; petals long-clawed; stamens 2-dentate; stigma 2-lobed; fruit 2-segmented, the lower short sterile, resembling the pedicel; the upper thick, long, indehiscent or breaking into 1-seeded segments; beak seedless. seeds spherical, pendulous, brownish. 3 species Europe, Mediterranean region to Central Asia.

1. **Raphanus raphanistrum** L., Sp. Pl., ed. 1, 669 (1753) subsp. **raphanistrum**

Annual herb 20-60 cm, glabrous to slightly hispid; stems erect, branched; basal leaves 5-20 cm, lyrate-pinnatisect, long-petiolate; cauline leaves short-petiolate, oblong-lanceolate, dentate-serrate; raceme elongate; sepals 0.6-1 cm, the inner saccate; petals 1.5-2.2 cm, white, lilac or yellow with purple veins; fruiting pedicels 1.2-2.5 cm, erect or spreading; siliqua 3-5.5 x 0.3-0.5 cm, longitudinally ridged, the lower segment very short, seedless; the upper 3- to 8-seeded, constricted between the seeds, breaking into 1-seeded segments; beak 1.5-2.5 cm, seedless.

N, M; roadsides, edges of cultivation. North Africa, Europe, Southwest and Central Asia.

41. **Carrichtera** DC., nom. conserv.

Annual herbs; stems leafy, branched from the base; leaves petiolate, 2- to 3-pinnatisect; racemes ebracteate; flowers short-pedicellate, small; petals yellow, white or cream,

sometimes purple-veined, clawed; stigma 2-lobed; silicula with a foliaceous, spatulate, 5-nerved beak; lower part of siliqua 2-locular, dehiscing by 2 coriaceous, 3-nerved valves; seeds 2-4 per locule, subglobose, brownish. 1 species, Macaronesia, Europe, North Africa, East Mediterranean region to Iran.

1. **Carrichtera annua** (L.) DC., Mém. Mus. Hist. Nat. 7: 250 (1821).

Syn. *Vella annua* L., Sp. Pl., ed. 1, 641 (1753).

Annual herb 5-30 cm, glabrous or sparingly hairy; stems branched from the base; leaves 1.5-6 cm, 2- to 3-pinnatisect, lobes linear to linear-oblong; racemes lax, elongating in fruit; flowers 0.6-1 cm, pedicellate; petals much longer than sepals; white or cream, purple-veined, long-clawed; pedicels deflexed; silicula 0.7-1 cm, lower part subglobose, valves 3-nerved with stiff bristles; beak glabrous, seedless; seeds subglobose, slightly compressed.

N, M, D, S; desert plains and wadis, edges of cultivation. Distribution as for the genus.

42. **Schouwia** DC., nom. conserv.

Annual herbs, glabrous; leaves fleshy, simple, the upper amplexicaul; inner sepals saccate; petals pink or purple; filaments unappendaged; stigma with decurrent lobes; fruit a compressed, 2-segmented dehiscent silicula, lower segment winged, many-seeded, the upper a narrow beak. 1 species, North Africa, Sahara to Arabia, Ethiopia.

1. **Schouwia purpurea** (Forssk.) Schweinf., Bull. Herb. Boiss. 4, App. 2: 183 (1896).

Syns. *Subularia purpurea* Forssk., Fl. Aegypt.-Arab. 117 (1775).

Schouwia arabica DC., Syst. Nat. 2: 644 (1821).

Schouwia thebaica Webb, Giorn. Bot. Ital. 2(2): 219 (1847).

Schouwia schimperi Jaub. & Spach, Ill. Pl. Orient. 3: 145 (1850).

Annual glaucous, glabrous herb 0.3-1.5 m; leaves 4-15 x 1.5-8 cm, obovate; upper leaves amplexicaul, auriculate; petals 0.8-1.2 cm; silicula 1.5-2.2 cm, suborbicular, narrowly winged; beak 4-6 mm, spine-like.

N, O, M, D, GE, S; desert plains and wadis, edges of cultivation. North Africa, Sahara to Arabia, Ethiopia.

NOTE: A prominent feature of the spring ephemeral vegetation, covering vast areas especially in the southern deserts, after a good rainy season.

43. **Savignya** DC.

Annual herbs; leaves simple, fleshy, sinuate-dentate; sepals slightly saccate; petals white or pale pink; filaments unappendaged; stigma capitate, silicula strongly compressed, dehiscent, short-beaked; seeds in 2 rows. 2 species, Morocco to Afghanistan.

1. **Savignya parviflora** (Delile) Webb, Giorn. Bot. Ital. 2(2): 215 (1847).

Syns. *Lunaria parviflora* Delile, Descr. Egypt, Hist. Nat. 248 (1814).

Savignya aegyptiaca DC., Syst. Nat. 2: 283 (1821), nom. illeg.

Annual glabrous herb 10-40 cm; stems erect, branched from the base; lower leaves 2-5 x



Plate 39. CRUCIFERAE: *Didesmus aegyptius* 1, fruiting branch and basal leaf. *Cakile maritima* subsp. *aegyptiaca* 2, fruiting branch and basal leaf; *Zilla spinosa* subsp. *spinosa* 3, fruiting branch. *Zilla spinosa* subsp. *biparmata* 4, fruit. *Enarthrocarpus lyratus* 5, fruiting branch and basal leaf. *Enarthrocarpus strangulatus* 6, fruiting branch and basal leaf. *Enarthrocarpus pterocarpus* 7, fruiting branch. *Raphanus raphanistrum* 8, fruiting branch. *Carrichtera annua* 9, fruiting branch and basal leaf. *Schowia purpurea* 10, fruiting branch and basal leaf. *Savignya parviflora* 11, fruiting branch and basal leaf. *Conringia orientalis* 12, fruiting branch. *Moricandia sinaica* 13, fruiting branch and basal leaf. *Moricandia nitens* 14, fruiting branch. All drawings to the same scale.

1-2.5 cm, oblong-elliptic to obovate, sinuate-dentate, petiolate; upper leaves linear-entire; calyx 2-3 mm; petals 3.5-5 mm; fruiting pedicels 1-2.5 cm, capillary, spreading or deflexed; silicula 1-1.4 x 0.5-0.8 cm, strongly compressed, shortly stipitate; valves yellow-green; septum membranous; style 1-2 mm; stigma 2-lobed; seeds 0.8-1 mm, discoid, broadly winged.

O, D, S; sandy and stony deserts. North Africa, Sinai, Palestine, Arabia, Iraq, Iran, Pakistan, Afghanistan.

44. *Conringia* Heister ex Fabr.

Annual herbs, glabrous; leaves oblong-obovate; the basal tapering at the base; the cauline auriculate-clasping; racemes ebracteate; flowers yellow, white or cream; inner pair of sepals saccate; petals clawed; stamens edentate; style long; stigma capitate, 2-lobed; fruit dehiscent siliqua, terete or tetragonous; beak seedless; valves 1- to 3-nerved; seeds in 1 row per locule, brown. 6 species, Mediterranean region to Central Asia.

1. *Conringia orientalis* (L.) Dumort., Fl. Belg. 123 (1827).

Syn. *Brassica orientalis* L., Sp. Pl., ed. 1, 666 (1753).

Annual herb 20-50 cm, glabrous, glaucous; stems erect, branching; leaves 2-5 cm, the basal subsessile, obovate; the cauline broadly oblong, amplexicaul-auriculate; racemes lax, elongating in fruit; sepals 5-6 mm; petals 0.8-1.2 cm; fruiting pedicels 0.5-1.2 cm, yellowish-green; ascending, accrescent; siliqua 8-12 cm, tetragonous; style 4-6 mm, stigma 2-lobed; valves 1-nerved, slightly keeled; seeds 2.5 mm, rough, brownish.

M; stony ground. Mediterranean region, West Asia.

45. *Moricandia* DC.

Annual or perennial herbs or shrubs, glabrous; leaves undivided, the basal sessile, the cauline amplexicaul; racemes ebracteate; flowers conspicuous; inner sepals saccate; petals pinkish-purple to white, clawed; stamens edentate; fruit a dehiscent, slightly tetragonous siliqua; valves keeled, 1-nerved, seeds in 1 or 2 rows, ellipsoid. 7 species, Mediterranean region to Baluchistan.

1. Cauline leaves 4-10 cm, broadly ovate to suborbicular, succulent; flowers

1-1.2 cm, pink; seeds in 2 rows

1. *M. sinaica*

+ Cauline leaves 1-4 cm, oblong-lanceolate, not succulent; flowers 1.5-2 cm,

pale violet with darker veins; seeds in 1 row

2. *M. nitens*

1. *Moricandia sinaica* (Boiss.) Boiss., Fl. Orient. 1: 386 (1867).

Syn. *Brassica sinaica* Boiss., Ann. Sci. Nat. Bot., ser. 2, 17: 85 (1842).

Perennial herb 40-70 cm, woody at the base, glabrous, glaucous; stems erect or ascending, whitish, much-branched; leaves 4-10 x 3-8 cm, succulent, entire; the lower oblong, tapering at the base, the cauline broadly ovate to suborbicular, clasping, auriculate; racemes dense, elongate and lax in fruit; pedicels 5-8 mm; flowers 1-1.2 cm, pink; calyx 5-6 mm; petals 1-1.2 cm, with a linear claw; siliqua 3-5.5 cm, linear, tetragonous; valves 1-nerved; style short, stigma 2-lobed; seeds 0.5-1 mm, subglobose, in 2 rows per locule.

De, S; stony wadis. Egypt, Arabia, Iran, Pakistan.

2. **Moricandia nitens** (Viv.) Durand & Barranté, Fl. Libyc. Prodr. 15 (1910).
Syn. *Hesperis nitens* Viv., Fl. Libyc. Spec. 38, t. 5, f. 3 (1824).
Moricandia dumosa Boiss., Diagn. Pl. Orient. ser. 1, 8: 25 (1849).

Dwarf shrub 15-50 cm; stems much-branched; leaves 1-4 cm, entire, the lower sessile or short-petiolate, the upper cauline oblong-lanceolate, clasping; racemes few-flowered, elongating in fruit; sepals 6-8 mm; petals 1.5-2 cm, pale violet with darker veins, long-clawed; siliqua 4-7 cm, spreading, narrowly-linear, tetragonous, straight, the valves 1-nerved beak 3 mm; stigma decurrent; seeds 1 mm, in 1 row per locule, brownish.

N, M, D, S; stony wadis and edges of cultivation. Libya, Egypt, Palestine.

46. **Pseuderucaria** (Boiss.) O. E. Schulz

Annual herbs, glabrous, glaucous; leaves fleshy, pinnately divided, petiolate; the lobes terete; racemes few-flowered, lax, ebracteate; flowers conspicuous, pedicellate, ebracteate; inner sepals saccate; petals violet or pink, clawed; stamens edentate; style long; stigma 2-lobed; siliqua linear, dehiscent; seeds small, in 1-2 rows, brownish, white-margined. 2 species, Morocco to Palestine.

1. Siliqua 1-1.5 mm wide, 30- to 60-seeded; seeds in 1 row 1. **P. teretifolia**
+ Siliqua 2-3 mm wide, 100- to 120-seeded;
seeds in 2 rows 2. **P. clavata** subsp. **clavata**

1. **Pseuderucaria teretifolia** (Desf.) O. E. Schulz, Bot. Jahrb. Syst. 54, Beibl. 119: 54 (1916).
Syn. *Brassica teretifolia* Desf., Fl. Atlant. 2: 94 (1798).

Annual herb 20-50 cm, glabrous; stems erect, branched; leaves 2.5-8 cm, pinnatisect; lobes linear, entire; sepals 7-9 mm; petals 1.2-1.6 cm, violet to pinkish, veined; pedicels 5-8 mm, accrescent in fruit; siliqua 4-6.5 x 0.1-0.15 cm; seeds 1-1.2 mm, 30-60 in 1 row.

Dw; sandy soils. Egypt to Morocco.

2. **Pseuderucaria clavata** (Boiss. & Reut.) O. E. Schulz, Bot. Jahrb. Syst. 54, Beibl. 119: 54 (1916) subsp. **clavata**
Syn. *Moricandia clavata* Boiss. & Reut. in Boiss., Diagn. Pl. Orient., ser. 2, 5: 25 (1856).

Annual herb 10-40 cm, glabrous; stems branched from the base, ascending; leaves 3-8 cm, petiolate, fleshy, 1- to 3-pinnatisect; the lobes linear, terete, obtuse; flowers conspicuous; sepals 6-9 mm; petals 1.2-2.2 cm, violet to pink, clawed; pedicels 3-6 mm, erect; siliqua 3.5-8 x 0.2-0.3 cm, linear, slightly torulose, compressed; beak conical-ovoid; stigma minute; seeds 100-120 per fruit, in 2 rows, ellipsoid, compressed.

M, D, S; sandy and stony deserts and plains. Libya, Egypt, Palestine.

47. **Aethionema** R. Br.

Annual or perennial herbs, glabrous; leaves entire; inflorescence racemose; sepals erect, the lateral saccate; petals entire; silicula flattened, winged, 2-locular, with 1-4 seeds in each loculus, opening by 2 valves or 1-locular, 1-seeded and indehiscent; seeds ellipsoid.

70 species, Mediterranean region, Southwest Asia.

1. **Aethionema carneum** (Banks & Sol.) Fedtsch., Fl. W. Tian-Shan 176 (1905).
Syn. *Thlapsi carneum* Banks & Sol. in Russ., Nat. Hist. Aleppo, ed. 2, 2: 257
(1794).
Aethionema cristatum DC., Syst. 2: 560 (1821).

Annual glabrous herb, 10-15 cm; stems simple or branched from the base; leaves entire; the lower oblong-ovate; the cauline sessile, lanceolate; racemes dense, elongating in fruit; flowers minute, pink, purple to white; sepals half as long as the petals; filaments of longer stamens almost connate at the base; fruit of 2 types: dehiscent, 2-locular, slightly flattened, with coarsely dentate wings; and indehiscent, 1-locular, 1-seeded, urceolate, the apex emarginate, the style shorter than the sinus.

S; cultivated ground. East Mediterranean region, Sinai.

48. **Lepidium** L.

Annual or perennial herbs or subshrubs; glabrous or with simple hairs; leaves simple or variously pinnately dissected; flowers ebracteate, small, in racemes or panicles, white or pink; sepals not saccate; petals longer or shorter than sepals, sometimes vestigial or absent; stamens 2, 4 or 6, free, edentate; style short; silicula compressed, 2-locular, 2-valved, dehiscent or not; valves usually winged; seeds 1-2 per locule, pendulous. 140 species, cosmopolitan, especially temperate.

- | | |
|--|-------------------------|
| 1. Cauline leaves clasping, auriculate | 4. L. draba |
| + Cauline leaves not clasping | 2 |
| 2. Perennial; leaves simple, entire or obscurely serrate; silicula not notched at the apex | 1. L. latifolium |
| + Annual; leaves pinnatifid to pinnatisect; silicula notched at the apex | 3 |
| 3. Silicula 3 mm, shortly and narrowly winged at the apex | 3. L. aucheri |
| + Silicula 4-6 mm, distinctly winged | 2. L. sativum |

1. **Lepidium latifolium** L., Sp. Pl., ed. 1, 644 (1753).

Perennial herb 30-80 cm, with creeping rhizome, glabrous or glabrescent; stems erect, branched; leaves to 20 x 5 cm, entire or obscurely serrate, the basal long-petiolate, spatulate; the cauline linear-lanceolate, short-petiolate; flowers 1.5 mm, in dense panicles; sepals white-margined, pilose; petals white; stamens 6; pedicels 2-4 times as long as the fruits; silicula 1-2 mm, ellipsoid-ovoid, terminating in a short style and capitate stigma; valves pilose, not winged; seeds minute, 1 per locule.

N (Cairo), M; moist ground. Europe, Mediterranean region, Asia.

2. **Lepidium sativum** L., Sp. Pl., ed. 1, 644 (1753).

Annual herb 10-60 cm, glabrous or sparsely pilose; stems erect, branched mainly in the upper parts; leaves 4-15 cm, the basal 2-pinnatisect, the cauline pinnatisect, the uppermost oblong-linear; racemes terminal and axillary, elongate in fruit; sepals shorter

than petals; petals 2 mm, white or lilac; silicula 4-6 x 3-5 mm, elliptic-oblong, distinctly winged, the apex notched; style projecting or included within the notch; seeds 1 per locule.

Two subspecies occur in Egypt:

subsp. **sativum**

Stems not spinescent; style not projecting from the apical notch of the silicula.

N, O; weed, also escape from cultivation (cress). Northern temperate regions.

subsp. **spinescens** (DC.) Thell., Vierteljahrsshr. Naturf. Ges. Zürich 51: 160 (1906).

Syn. *Lepidium spinescens* DC., Syst. Nat. 2: 534 (1821).

Stems spinescent, style projecting from the apical notch of the silicula.

N, De, S; wet ground. East Mediterranean region, West Asia.

3. **Lepidium aucheri** Boiss., Ann. Sci. Nat. Bot., sér. 2, 17: 195 (1842).

Annual herb 5-25 cm, glabrous or slightly pilose; stems prostrate or ascending, branched in the upper parts; basal leaves 2-6 cm, in a rosette, lyrate-pinnatifid, the lobes small, dentate; cauline leaves smaller, oblong-spathulate, subsessile; flowers 2 mm, white or cream, in terminal and axillary short, dense racemes; pedicels appressed to the stem in fruit; silicula 3 mm, shortly and narrowly winged at the apex; style within the notched apical sinus; seeds 1 per locule.

N, Dw; desert plains and edges of cultivation. Egypt, Southwest Asia.

4. **Lepidium draba** L., Sp. Pl., ed. 1, 645 (1753).

Syn. *Cardaria draba* (L.) Desv., J. Bot. Agric. 3: 163 (1815).

Perennial herb 10-50 cm, altogether grey-pubescent; stems erect, branching above; leaves 4-10 x 1-3.5 cm, the radical spathulate or lyrate; the cauline clasping-auriculate, dentate; inflorescence a terminal, dense, corymbose panicle; sepals 1.5-2 mm, scarious-margined; petals 3-4 mm, white, longer than sepals; pedicels 0.7-1.2 cm in fruit, filiform; silicula 3-4 x 3-5 mm, cordate, indehiscent; valves reticulate; style 1 mm, persistent; stigma capitate; seeds 1-2, 2 mm, ovoid, rugulose, brown.

M, S; weed of cultivation, roadsides. Cosmopolitan weed.

49. **Coronopus** Zinn., nom. conserv.

Annual or biennial herbs, glabrous or hairy; leaves pinnatifid to pinnatisect; racemes axillary, short; sepals not saccate; petals white, very small or absent; stamens 2-6, edentate; fruit an indehiscent silicula, 2-lobed with a narrow septum, 2-loculed, each locule 1-seeded. 10 species, cosmopolitan.

1. Silicula 3.5-5 mm wide, rugose-tuberculate; fruiting pedicels 0.5-2 mm

1. **C. squamatus**

+ Silicula 2-2.5 mm wide, finely reticulate; fruiting pedicels 3-4 mm

2

2. Silicula deeply emarginate at the tip

2. *C. didymus*

+ Silicula rounded and apiculate at the tip

3. *C. niloticus*

1. *Coronopus squamatus* (Forssk.) Asch., Fl. Brandenb. 1: 62 (1860).

Syn. *Lepidium squamatum* Forssk., Fl. Aegypt.-Arab. 117 (1775).

Annual or biennial herb 10-30 cm; stems prostrate to ascended; branched at the base; leaves 3-8 cm, long-petiolate, pinnatisect; lobes oblong, entire or toothed; flowering racemes axillary, short-pedunculate, dense; petals 2 mm; white, twice as long as the sepals; fruiting pedicels 0.5-2 mm; silicula 3.5-5 mm wide, reniform, rugose-tuberculate; style 1 mm; seeds globose, 1 per locule.

N, O, M; moist ground, along canals. West and Central Europe, Mediterranean region, West Asia, introduced into Australia, North and South America.

2. *Coronopus didymus* (L.) Sm., Fl. Brit. 691 (1800).

Syns. *Lepidium didymum* L., Mant. 92 (1767).

Senebiera didyma (L.) Pers., Syn. Pl. 2: 185 (1806).

Annual herb 15-40 cm, puberulous; stems prostrate to ascending; leaves 1-3.5 cm, 1-2-pinnatisect; lobes ovate-elliptic; racemes axillary, short, elongate in fruit; flowers minute, greenish; sepals 0.6-0.8 mm, with scarious margins; petals shorter than the sepals, often rudimentary; stamens 2-4; fruiting pedicels 3-4 mm; silicula 1.5-2 x 2-2.5 mm, didymous, indehiscent, deeply emarginate at the tip, with a narrow septum, reticulate rugose, seeds 1-1.5 mm, reniform, finely reticulate, 1 per locule.

N; weed of moist ground. Cosmopolitan.

3. *Coronopus niloticus* (Delile) Spreng., Syst. Veg. 2: 853 (1825).

Syns. *Cochlearia nilotica* Delile, Descr. Egypte, Hist. Nat. 101 (1814).

Senebiera nilotica (Delile) DC., Syst. Nat. 2: 527 (1821).

Like *C. didymus* but leaves less finely divided, pinnatifid or serrate; stems almost glabrous; raceme longer; silicula rounded and apiculate at the tip.

N, O, De; moist ground, Nile and canal banks. East Africa, ? Arabia.

NOTE: Since the construction of the Aswan High Dam the plant has become increasingly less common as it is usually confined to silty Nile and canal banks.

50. *Biscutella* L.

Annual and perennial herbs or shrubs; leaves entire or pinnatifid; petals usually clawed, yellow; fruit a compressed didymous silicula, indehiscent, breaking up at maturity; each locule 1-seeded, valves orbicular, glabrous or with simple clavate hairs; style long; seeds not winged. 40 species, Europe, Mediterranean region.

1. *Biscutella didyma* L., Sp. Pl., ed. 1, 653 (1753).

Syns. *Biscutella apula* L., Mant. Alt. 254 (1771), nom. illeg.



Plate 40. CRUCIFERAE: *Pseuderucaria clavata* 1, fruiting branch and basal leaf. *Aethionema carneum* 2, flowering and fruiting branch. *Lepidium sativum* 3, fruiting branch and basal leaf. *Lepidium aucheri* 4, fruiting branch and basal leaf; 5, fruit. *Lepidium draba* 6, fruiting branch; 7, fruit. *Coronopus squamatus* 8, fruiting branch, basal leaf and fruit. *Coronopus didymus* 9, flowering and fruiting branch, 9; 10, fruit. *Coronopus niloticus* 11, flowering and fruiting branch; 12, fruit. *Biscutella didyma* 13, fruiting branch and basal leaf. *Carmelina hispida* 14, fruiting branch and basal leaf. *Capsella bursa-pastoris* 16, flowering and fruiting branch and basal leaf; 17, fruit. *Hymenolobus procumbens* 18, habit; 19, fruit. All drawings to the same scale except enlarged parts (scale given).

Biscutella ciliata DC., Ann. Mus. Natl. Hist. Nat. 18: 297 (1811).
Biscutella leiocarpa DC., Ann. Mus. Natl. Hist. Nat. 18: 299 (1811).

Annual herb 10-40 cm; stems simple or branched; basal leaves 2-8 x 0.5-2.5 cm, all basal in a rosette or basal and cauline, obovate, dentate; racemes dense; pedicels erect; sepals 2 mm; petals 2-4 mm; silicula 4.5-5.5 x 6-9 mm.

Three varieties occur in Egypt:

var. **didyma**

Petals 4 mm, twice as long as the calyx.

M, De, S; sandy plains and rocky ground.

var. **depressa** (Willd.) El-Naggar, Taekholmia 11: 71 (1991).

Syn. *Biscutella depressa* Willd., Enum. Pl. Hort. Berol. 673 (1809).

Petals 1.5-2 mm, slightly exceeding the calyx; leaves all in a basal rosette; fruit with inflated margin.

M, S; weed of cultivation.

var. **elbensis** (Chrtek) El Naggar, Taekholmia 11: 71 (1991).

Syn. *Biscutella elbensis* Chrtek, Cas. Nar. Muz. (Prague) 145(4): 185 (1978).

Like var. *depressa* but leaves not forming a rosette; fruit margin not inflated.

GE; rocky wadis. Endemic.

Area of the species: Southern Europe, North Africa, Southwest Asia.

51. **Camelina** Crantz

Annuals or biennials with simple or branched hairs; cauline leaves sessile, often auriculate; inflorescence ebracteate; sepals erect; petals yellow or white; fruit an inflated silicula; style distinct; seeds numerous, in 2 rows per locule. About 7 species, Europe, Mediterranean region to Central Asia.

1. Petals 4-5 mm, yellow; whole plant hispid; pedicels in fruit 5-7 mm 1. **C. hispida**
+ Petals 5-9 mm, whitish or very pale yellow; plant hispid below, glabrous or
glabrescent above; pedicels in fruit 0.7-1.4 cm 2. **C. rumelica**

1. **Camelina hispida** Boiss., Ann. Sci. Nat. Bot., ser. 2, 17: 176 (1842).

Syn. *Camelina persistens* Rech. f., Ark. Bot., ser. 2, 1, 5: 304 (1949).

Annual herb 10-25 cm, altogether hispid throughout; stems erect, branched from the base or simple; basal leaves 2-5 cm, forming a rosette, oblong-lanceolate, dentate; cauline leaves smaller, clasping-sagittate, entire; racemes dense, elongating in fruit; sepals 2.5-3 mm, hispid; petals 4-5 mm, yellow, pedicels 5-7 mm in fruit and spreading; silicula 5-6 mm, obovoid-globose; valves turgid, glabrous or patent-hairy; styles longer or shorter than the fruit.

M; cultivated ground. East Mediterranean region, West Asia.

2. **Camelina rumelica** Velen., Sitzungsber. Königl. Böhm. Ges. Wiss. Prag, Math.-Naturwiss. Cl. 1887: 448, f. 13 a (1887).

Annual herb 15-40 cm, hispid below, glabrous or glabrescent above; stems erect or ascending; basal leaves forming a distinct rosette; petals 5-9 mm, whitish or very pale yellow; racemes elongate in fruit, lax; fruiting pedicels 0.7-1.4 cm, ascending or almost patent; silicula 5-8 mm; valves slightly compressed, rigid; seeds 1.5 mm.

M; cultivated plots. Egypt, South and Central Europe, Syria, Turkey, Iran to Afghanistan.

52. **Capsella** Medik., nom. conserv.

Annual or biennial herbs, glabrous or with simple and branched hairs; basal leaves entire or pinnatifid, the cauline sagittate-amplexicaul; inflorescence an ebracteate raceme; sepals not saccate; petals white, pink or yellowish; stamens without appendages; silicula triangular-obcordate; valves keeled, reticulate-veined; style distinct; stigma capitate; seeds up to 12 per locule. 5 species, temperate and warm regions.

1. **Capsella bursa-pastoris** (L.) Medik., Pfl.-Gatt. 85 (1792).

Syn. *Thlaspi bursa-pastoris* L., Sp. Pl., ed. 1, 647 (1753).

Annual herb 10-40 cm, sparsely hairy to glabrous; stems erect or spreading, branched from the base; lower leaves forming a rosette, petiolate, lobed; upper leaves simple, clasping; racemes elongate; sepals green; petals 2-3 mm, white, longer than the sepals; silicula 4-9 x 4-9 mm, the lateral margins usually straight or convex.

N; weed of cultivation. Cosmopolitan, especially temperate and warm regions.

53. **Hymenolobus** Nutt. ex Torr. & A. Gray

Delicate annual herbs, glabrous or with simple hairs; stems simple or branched from the base; leaves spatulate, sometimes lobed; inflorescence racemose; flowers small; sepals divergent, not saccate; petals white; stigma sessile; fruit a compressed silicula, ovate-elliptic, with rounded or truncate apex, dehiscing into 2 boat-shaped valves; seeds few to many per loculus, ovoid, mucilaginous. 5 species, Mediterranean region, Europe, Central Asia, Australia, North America, Chile.

1. **Hymenolobus procumbens** (L.) Nutt. ex Torr. & A. Grey, Fl. N. Amer. 1: 117 (1838).

Syns. *Lepidium procumbens* L., Sp. Pl., ed. 1, 643 (1753).

Capsella procumbens (L.) Fries, Novit. Fl. Suec. Mant. 1: 14 (1832).

Annual herb 5-15 cm, glabrous or glabrescent; stems simple or branched at the base; leaves lobed, the lobes elliptic-lanceolate; cotyledons persistent, obovate; inflorescence compact in flower, elongating in fruit; sepals oblong, hairy; petals white, 1 mm, slightly longer than the sepals; pedicels 4-7 mm, and spreading-ascending in fruit; silicula 2-3 mm, ovoid-ellipsoid, obtuse or slightly emarginate; seeds 2-4 per loculus.

M; saline soils. Mediterranean region, temperate Eurasia, North America, Chile, Australia, New Zealand.

RESEDACEAE

Annual or perennial herbs, or shrubs; leaves alternate, simple, entire or lobed; inflorescence a spike-like raceme; flowers bisexual, rarely unisexual, bracteate, the bracts deciduous; sepals 4-8; petals 4-8, free, entire or lacinate; stamens 3-25, inserted on a hypogynous or perigynous disc; carpels 3-7, superior, free, usually 1-ovular, or united into a 1-locular ovary, open above, with numerous ovules on parietal placenta; fruit a berry or capsule open at the apex or formed of 4-6 free carpels; seeds numerous, subglobose or reniform; endosperm absent. 6 genera, about 80 species, Mediterranean region extending to India, East Africa, Sahara, Macaronesia, southern Africa, Southwest USA, Mexico.

- | | |
|---|----------------------|
| 1. Shrubs, old branches spinescent | 2 |
| + Annual or perennial herbs, sometimes woody at the base; branches never spinescent | 3 |
| 2. Fruit a berry | 1. Ochradenus |
| + Fruit a capsule | 2. Randonia |
| 3. Fruit sessile | 5. Oligomeris |
| + Fruit pedicellate | 4 |
| 4. Fruit a many-seeded capsule | 3. Reseda |
| + Fruit of (5-)6 carpels, almost free, each 1(-2)-seeded | 4. Caylusea |

1. **Ochradenus** Delile

Dioecious or bisexual shrubs, often spinescent; leaves linear to narrowly ovate, entire, sessile, sometimes in fascicles, soon caducous; flowers unisexual or bisexual, in spikes or racemes; sepals 5-8; petals 0 or linear with an auriculate base; disc surrounding the ovary, fleshy, single or double; stamens 10-many; ovary sessile, of 3 fused carpels; placentation parietal; fruit a capsule or berry; seeds numerous. 10 species, Libya, Middle East to Pakistan, Socotra, Somalia and Ethiopia.

1. **Ochradenus baccatus** Delile, Descr. Egypte, Hist. Nat. 63 (1814).

Dioecious shrub 1-2.5 m, glabrous throughout; young branches slender, old branches spinescent; leaves 1-4 cm, linear; racemes many-flowered; pedicels 1-2 mm; flowers yellow; sepals 1-1.5 mm, oblong-ovate; petals usually absent; disc reflexed; stamens 10-18; berry 3-5.5 mm, globose, subsessile, white at maturity, drying red; seeds 1.5-1.8 x 1-1.5 mm, tuberculate, dark brown.

M, D, R, GE, S; stony wadis and hilly slopes. Libya to Pakistan, Somalia, Ethiopia.

2. **Randonia** Coss.

Small shrubs, glabrous; stems rigid, spinescent; leaves linear to obovate; flowers white, bisexual, in terminal bracteate racemes; sepals 7-8, persistent, connate at the base; petals 7-8, unequal, persistent; disc present; stamens 16-18, fused with the disc; ovary of 2-3 carpels, 1-locular, subglobose; ovules in 3 rows, numerous; capsule urceolate to globose, many-seeded; seeds rounded-reniform, brown. 3 species, Mauritania, North Africa, Somalia, Ethiopia.

1. **Randonia africana** Coss., Bull. Soc. Bot. Fr. 6: 392 (1859).

Shrub 0.5-1 m; stems divaricately branched, often spinescent, becoming leafless on old branches; leaves 0.5-1.5 x 0.1-0.15 cm, obovate to oblong, caducous; flowers white, short-pedicelled, in terminal, elongated, bracteate racemes; bracts 1-2 mm, deciduous; fruiting pedicels 2-3 mm; sepals 1-1.5 mm, persistent, subequal, glabrous; petals 2-3 mm; capsule 3-4 mm, papillose; seeds 1.5 mm.

M, Dw; desert plains. Mauritania, North Africa, Ethiopia.

3. **Reseda** L.

Annual or perennial herbs or subshrubs; leaves entire or variously dissected; flowers bisexual, in spike-like racemes, 4- to 6(-9)-merous; petals free, unequal, laciniate, with a basal appendage; disc present; stamens 10 to 20; ovary stipitate; carpels 3-6, usually slightly open at the apex; placentation parietal; capsule open at maturity, many-seeded. 60 species, Sahara, East Africa, Mediterranean region to Central Asia.

- | | |
|---|---------------------------|
| 1. Capsule 4-toothed | 2 |
| + Capsule 3-toothed | 3 |
| 2. Capsule not constricted at the apex, the teeth small | 1. R. decursiva |
| + Capsule constricted at the apex, the teeth conspicuous | 2. R. alba |
| 3. All leaves entire | 3. R. luteola |
| + Leaves 1-3-pinnatisect | 4 |
| 4. Calyx persistent | 5 |
| + Calyx deciduous | 9 |
| 5. Capsules pendulous; seeds tuberculate-wrinkled | 6 |
| + Capsules erect; seeds smooth | 8 |
| 6. Ovary sessile; filaments persistent | 6. R. arabica |
| + Ovary stipitate above the calyx; filaments deciduous | 7 |
| 7. Filaments narrow, subulate; plant papillose-scabrid | 7. R. orientalis |
| + Filaments broadened at apex, plant glabrous or slightly papillose | 8. R. phyteuma |
| 8. Petals white | 5. R. urnigera |
| + Petals yellow | 4. R. lutea |
| 9. Filaments deciduous; seeds smooth | 11. R. pruïnosa |
| + Filaments persistent; seeds tuberculate | 10 |
| 10. Annual; capsule scabrid | 10 R. stenostachya |
| + Perennial; capsule glabrous | 9. R. muricata |

1. **Reseda decursiva** Forssk., Fl. Aegypt.-Arab. LXVI (1775).

Syn. *Reseda alba* L. subsp. *decursiva* (Forssk.) Maire in Jahand. & Miare, Cat. Pl. Maroc 316 (1932).

Annual herb 10-30 cm, glabrous; stems erect or ascending, simple or branched from the base; leaves pinnatisect, the lobes linear-lanceolate, undulate; racemes bracteate; bracts small, persistent; flowers 2.5-3.5 mm, subsessile; sepals 5, persistent; petals 5, white, 3-partite longer than the sepals; stamens c. 10, the filaments short, persistent; capsule 4.5-7 mm, short-pedicellate; oblong-ovoid, with 4 small truncate teeth, not constricted below the teeth; seeds 0.8 mm, globose-reniform, tuberculate, yellowish-brown.

M, D, S; calcareous and sandy soils, desert wadis. South Spain, North Africa, Southwest Asia.

2. **Reseda alba** L., Sp. Pl., ed. 1, 449 (1753).

Annual herb 20-60 cm, glabrous; stems erect, simple or branched at the base; leaves 4-12 cm, pinnatisect, the lobes linear to oblong-lanceolate, entire; racemes bracteate, the bracts minute, persistent; flowers 3.5-5 mm; sepals persistent, shorter than the pedicels; petals 5-6, white, 3-partite, much longer than the sepals; stamens 10-13; filaments long, persistent; fruiting racemes dense; fruiting pedicels longer than the calyx; capsule 0.9-1.4 cm, oblong-ellipsoid, constricted at the apex below the 4 conspicuous teeth; seeds 1 mm, spherical-reniform, tuberculate, yellowish-brown.

N, M, De, S; desert sandy and stony wadis and plains. Europe, Mediterranean region, Sinai, Arabia.

3. **Reseda luteola** L., Sp. Pl., ed. 1, 448 (1753).

Syns. *Reseda crispa* Link, Enum. Pl. Hort. Berol. Alt. 2: 8 (1822).

Reseda gussonei Boiss. & Reut. in Boiss., Diagn. Pl. Orient., ser. 2, 1: 49 (1854).

Annual or short-lived perennial herb 15-80 cm, woody at the base; stems usually simple, sometimes branched; leaves 5-15 cm, entire, linear to oblong-lanceolate, often undulate; racemes 15-45 cm, sometimes branched, bracteate; bracts 2.5-4 mm, linear-subulate, persistent; flowers 3-4 mm, short-pedicellate; sepals 4, persistent, shorter than the petals; petals 4, 3-4 mm, light yellow; stamens c. 20, the filaments persistent; fruiting racemes elongate; fruiting pedicels shorter than capsules; capsule 4-6 mm, ovoid-truncate, 3-toothed, glabrous; seeds 1 mm, reniform, smooth, brownish.

N, M; sandy soil, edges of cultivation, roadsides. Europe, Mediterranean region, Southwest and Central Asia.

4. **Reseda lutea** L., Sp. Pl., ed. 1, 449 (1753).

Syn. *Reseda petrovichiana* Müll. Arg. in Rohlfs, Kufra 551 (1881).

Annual or short-lived perennial herb, 15-60 cm, subglabrous to papillose; stems erect or ascending, branched near the base; leaves 4-12 cm, ternately divided into linear, oblanceolate or spathulate lobes; racemes bracteate, dense; bracts deciduous; pedicels 2-6 mm; flowers 2.5-4 mm; sepals 6, persistent; petals longer than the calyx, yellow; stamens 15-20; filaments deciduous; fruiting raceme lax; fruiting pedicels exceeding the

calyx; capsule 0.8-1.8 cm, erect or deflexed, oblong-ellipsoid, angular, 3-toothed, glabrous or papillose; seeds 2 mm, reniform, slightly tuberculate or smooth, glossy, yellowish-brown.

M, S; calcareous ridges and stony wadis. West and South Europe, North Africa, Southwest Asia.

5. ***Reseda urnigera*** Webb, *Fragm. Fl. Aethiop.-Aegypt.* 25 (1854).

Syns. *Reseda boissieri* Müll. Arg., *Bot. Zeitung* (Berlin) 14: 37 (1856).

Reseda cahirina Müll. Arg., *Monogr. Resedac.* 176 (1857).

Reseda pampaniniana Maire & Weiller, *Bull. Soc. Hist. Nat. Afr. Nord* 30: 261 (1939).

Reseda maris-mortui Eig, *Pal. J. Bot., Jerusalem ser.*, 4: 71 (1948).

Annual herb 10-40 cm, glabrous or sparingly papillose; stems erect or ascending, branched; basal leaves spatulate, entire; upper leaves divided into 3 oblong-lanceolate lobes; flowering raceme lax, bracteate; bracts 2 mm, linear; pedicels 2-4 mm, papillose; flowers 2.5-4 mm; sepals 6, equalling the corolla, persistent; petals 6, 3-partite, white; stamens 13-20, filaments deciduous; fruiting racemes lax; fruiting pedicels 0.8-1.2 cm; capsule 0.8-1 cm, conspicuously stipitate, erect, oblong-ovoid, 3-denticulate; seeds 1 mm, reniform, smooth, brownish-yellow.

M, De, S; sandy plains and desert wadis. Libya, Egypt, Palestine, Syria, Lebanon.

6. ***Reseda arabica*** Boiss., *Diagn. Pl. Orient.* 1: 6 (1843).

Annual herb 10-40 cm, sparingly pruinose; stems erect, simple or branched from the base; leaves 3-8 cm, the basal oblong-lanceolate, entire; upper ternate with oblong-linear lobes; flowering racemes lax, bracteate; bracts 2-3 mm, mostly persistent; pedicels 2-4 mm; sepals 6, 3 mm; petals 2 mm, white; the 2 upper 3-lobed, the 4 lower 2-lobed or entire; stamens c. 20; filaments persistent; ovary sessile; fruiting pedicels 4-6 mm; capsule 0.6-1 cm, pendulous, globose-ellipsoid, 3-toothed; seeds 1.2 mm, reniform, tuberculate-wrinkled, yellowish-brown.

M, D, S; sandy and stony deserts and plains. North Africa, Sinai, Palestine, Syria, Arabia, Iraq, Iran.

7. ***Reseda orientalis*** (Müll. Arg.) Boiss., *Fl. Orient.* 1: 427 (1867).

Syn. *Reseda macrosperma* Reichb. var. *orientalis* Müll. Arg., *Monogr. Resedac.* 135 (1857).

Annual herb 10-40 cm, papillose-scatrid; stems ascending or decumbent, branching especially from the base; leaves entire, or ternate with oblong-linear lobes; flowering racemes lax, bracteate; bracts 3-5 mm persistent, linear-lanceolate; pedicels 5-9 mm; flowers 3.5-6 mm, fragrant; sepals 6, 4-6 mm, persistent; petals 3-4 mm, white, the 4 upper deeply many-lobed, the 2 lower entire; stamens 15-20; filaments narrow, subulate, deciduous; fruiting raceme lax; fruiting pedicels 1.2-1.8 cm; capsule 1-1.6 cm, pendulous, oblong-ovoid, 3-toothed; seeds 2-3 mm, reniform, tuberculate-wrinkled.

M, S; sandy plains and wadis. East Med.terranean region, Sinai.

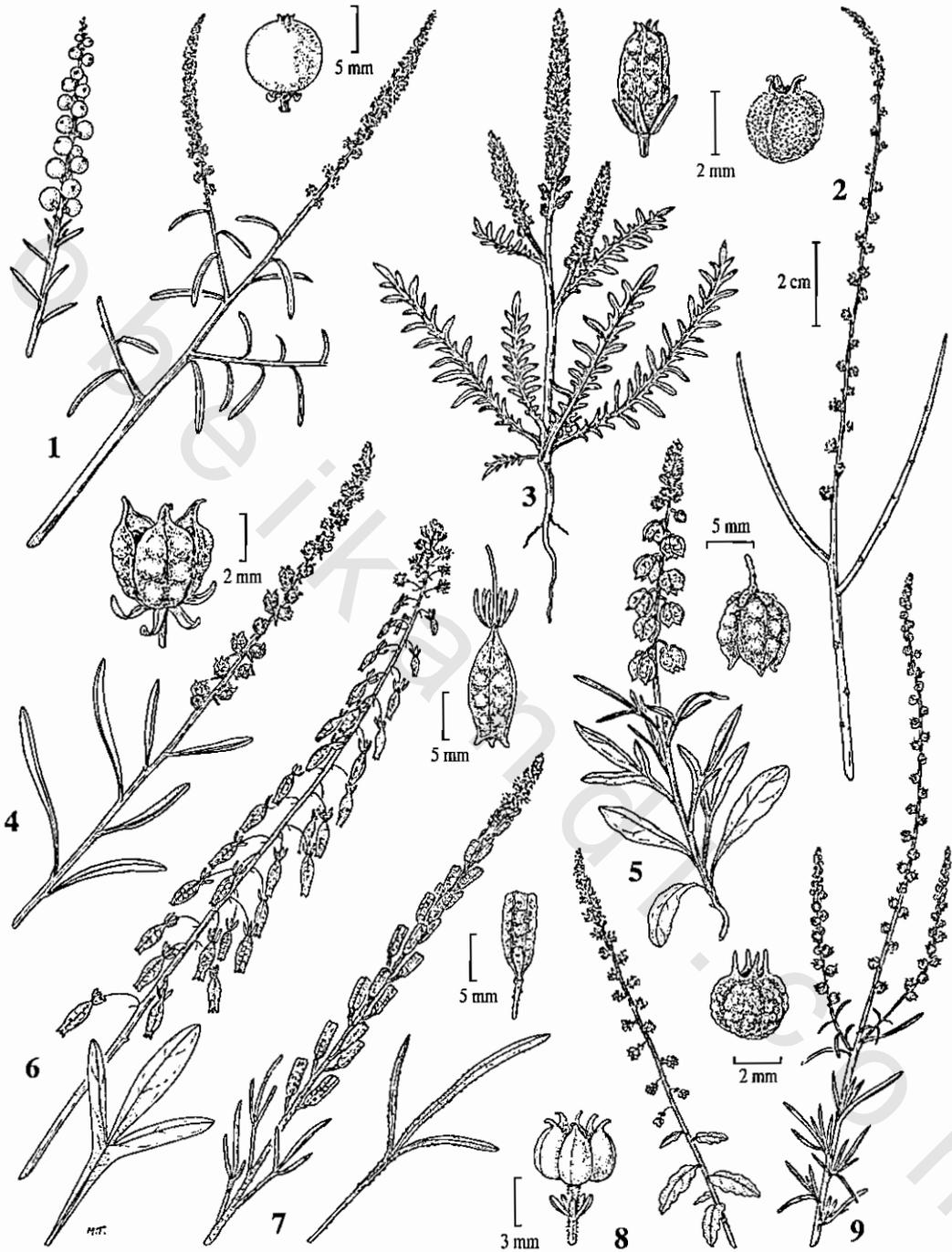


Plate 41. RESEDACEAE: *Ochradenus baccatus* 1, flowering (male) and fruiting (female) branches and fruit. *Randonia africana* 2, flowering and fruiting branch and fruit. *Reseda decursiva* 3, habit and fruit. *Reseda luteola* 4, flowering and fruiting branch and fruit. *Reseda arabica* 5, habit and fruit. *Reseda orientalis* 6, flowering and fruiting branch, basal leaf and fruit. *Reseda pruinosa* 7, flowering and fruiting branch, basal leaf and fruit. *Caylusea hexagyna* 8, flowering and fruiting branch and fruit. *Oligomeris linifolia* 9, flowering and fruiting branch and fruit. All drawings to the same scale except enlarged parts (scale given).

8. **Reseda phyteuma** L., Sp. Pl., ed. 1, 449 (1753).

Annual or short-lived perennial herb, 10-50 mm, glabrous or slightly papillose; stems ascending; leaves 1-6 cm, spatulate, sometimes 1- to 2-lobed; flowering racemes lax, bracteate; bracts 2.5-3 mm, linear; sepals 3-4.5 mm, up to 0.5-1.4 cm and accrescent in fruit; petals 3-5 mm, white; stamens 17-20; filaments broadened at apex, caducous; ovary stipitate above the calyx; fruiting pedicel 0.5-1 cm, capillary; capsule 1.2-1.5 cm, ovoid-cylindrical, pendulous; seeds 2-2.25 x 1.5-1.75 mm, reniform.

M (Agiba, near Mersa Matruh); coastal calcareous ridges. North Africa, South Europe.

9. **Reseda muricata** C. Presl, Abh. Königl. Böhm. Ges. Wiss., ser. 5, 3: 438 (1845).

Syn. *Reseda patzakiana* Rech. f., Anz. Oesterr. Acad. Wiss. Math.-Naturwiss. Kl. 8: 246 (1961).

Perennial herb 10-50 cm, scabrid-muricate, with a woody base; stems erect or ascending, branched near the base; cauline leaves 1-3.5 cm, ternately divided into linear lobes; lower leaves sometimes entire, linear-lanceolate; flowering racemes dense, bracteate; bracts 2.5-4 mm, linear, deciduous; pedicels 1-2 mm; flowers 3-4 mm; calyx 1.5-2 mm, sepals 6, deciduous; petals 2-3 mm, white, the 4 upper divided into 7 lobes, the 2 lower entire; stamens 12-18; filaments persistent; fruiting racemes elongating; fruiting pedicels 3-4 mm; capsule 6-8 mm, erect, broadly ovoid-elliptic to subglobose, the apex truncate, 3-denticulate; seeds 0.8 mm, reniform, smooth, glossy, yellowish-brown.

De, S; stony wadis. Egypt, Palestine, Arabia, Iraq.

10. **Reseda stenostachya** Boiss., Diagn. Pl. Orient. 1: 5 (1843).

Annual herb 15-50 cm, glabrous or slightly papillose; stems erect or ascending, leafy, branched; leaves 2-5 cm, rather fleshy, entire or ternately divided into 3 linear-lanceolate lobes; racemes somewhat dense, bracteate; bracts 1.5-3 mm, linear, deciduous; pedicels 1-2.5 mm; flowers 1-2.5 mm; calyx deciduous; petals 6, white, slightly longer than sepals, upper 4 petals 5- to 7-lobed, the lower 2 entire; stamens 15-20, filaments persistent; fruiting racemes dense; fruiting pedicels 2-4 mm; capsule 0.8-1.2 cm, oblong-conical, scabrid; seeds 0.8 mm, reniform, tuberculate, brownish.

S; stony wadis. Sinai, Palestine, ? Arabia.

11. **Reseda pruinosa** Delile, Descr. Egypte, Hist. Nat. 63 (1814).

Annual herb 20-80 cm, pruinose; stems erect, branched; leaves 2-6 cm, densely pruinose, the upper ternately divided; the lower entire, ovate to linear-lanceolate, petiolate; racemes dense, bracteate; bracts 3-4 mm, deciduous; pedicels 1-3 mm; flowers 2.5-4 mm; sepals 6, deciduous; petals 6, white; stamens 18-25; filaments deciduous; fruiting pedicels 3-5 mm; capsule 0.7-1 cm, oblong-obovate, pruinose; seeds 0.8 mm, reniform, smooth.

N, O, M, D, R, GE, S; sandy and gravelly deserts and plains, edges of cultivation. Sahara, Egypt, ? Arabia, Ethiopia.

4. *Caylusea* A. St. Hil., nom. conserv.

Annual or perennial herbs; leaves simple, entire; flowers bisexual in spike-like racemes; sepals 5, connate at the base; petals 5, free, unequal, with a basal appendage; floral disc present; stamens 10-15; ovary stipitate, carpels 5-6, fused at the base and slightly open above; fruiting carpels spreading and exposing the seeds; seeds 1(-2) per carpel. 4 species, Cape Verde Islands, tropical Africa to India.

1. *Caylusea hexagyna* (Forssk.) M. L. Green, Brit. Bot. Int. Bot. Congr. Cambridge 1930, Nomencl. Prop. 102 (1929).

Syns. *Reseda hexagyna* Forssk., Fl. Aegypt.-Arab. 92 (1775).

Caylusea canescens A. St. Hil., Deux. Mém. Réséd.: 38 (1837).

Caylusea jaberii Abedin, Willdenowia 15: 433 (1986).

Annual or short-lived perennial herb, 15-50(-80) cm; stems erect or decumbent, greyish-pubescent; leaves 1-5.5 x 0.2-1 cm, subsessile, linear-lanceolate, acuminate, the margins undulate; racemes spike-like, dense, bracteate; bracts minute, usually deciduous; pedicels 1-3 mm; sepals 5, 1-2 mm; petals 5, white, longer than the sepals, the upper 5- to 7-lobed, the lower 3-lobed; stamens 10-15; stipe 2-4 mm; carpels (5-)6, almost free, 2-3 mm, 1(-2)-seeded; seeds 1 mm, minutely tuberculate, yellowish-brown.

N, O, M, D, R, GE, S; sandy and stony deserts and plains edges of cultivation. North Africa, East Africa to Ethiopia, Crete, Palestine, Arabia, Iraq, Iran.

5. *Oligomeris* Cambess., nom. conserv.

Annual or perennial herbs or subshrubs; leaves entire, alternate or in fascicles; flowers in spike-like racemes, sessile, bisexual or unisexual; sepals 2-6, persistent; petals 2, white, entire or lobed, not clawed; floral disc absent; stamens 3-4(-10); ovary sessile, 3-5-carpelled; ovules numerous; stigmas as many as carpels; capsule 1-celled, open at apex; seeds smooth. 2 species, Macaronesia, North and South Africa, West Asia to Northwest India, southwestern North America.

1. *Oligomeris linifolia* (Vahl ex Hornem.) J. F. Macbr., Contr. Gray Herb., ser. 2, 53: 13 (1918).

Syns. *Reseda subulata* Delile, Descr. Egypte, Hist. Nat. 15 (1814), nom. nud.

Reseda linifolia Vahl ex Hornem., Hort. Hafn. 2: 501 (1815).

Oligomeris glaucescens Cambess. in Jacquem., Voy. Bot. 4: 24, t. 25 (1835).

Oligomeris subulata (Delile) Webb, Frag. Fl. Aethiop.-Aegypt. 26 (1854).

Annual herb 10-50 cm, glabrous; stems erect or decumbent, leafy, branched; leaves 1.5-8 x 0.1-0.3 cm, simple, alternate or in fascicles, narrowly linear, acuminate, entire; racemes spike-like, bracteate; bracts 1-2 mm, persistent; flowers 1.5-2.5 mm; sepals 1.5-2 mm; petals 1.5-2.5 mm, white, entire or 2-lobed; stamens 3; fruiting racemes elongate, lax; capsule 3-4 mm, sessile, depressed-globose, 4-carpellate, 4-dentate, papillose; seeds 0.5 mm, reniform, smooth, yellowish-brown, glossy.

N, M, D, R, S; sandy and stony deserts and plains, weed of cultivation in reclaimed land; edges of salt marshes. North and Central America, Macaronesia. Africa, West Asia to Northwest India.

MORINGACEAE

Description as for *Moringa*, the only genus in the family.

1. *Moringa* Adams.

Deciduous trees; leaves large, alternate, 2- to 3-pinnate, leaflets opposite, entire; stipules minute or absent; flowers bisexual, zygomorphic, in axillary panicles; sepals 5, free above the cup-shaped receptacle; petals 5, free, unequal; stamens 5, epipetalous, or inserted on the margin of the disc; staminodes 3-5; ovary superior, with 1 locule; ovules numerous; style filiform; stigma small; fruit a 3-valved capsule; seeds wingless or 3-winged. 12 species, dry regions of Africa and Asia.

1. *Moringa peregrina* (Forssk.) Fiori, Agric. Colon. 5: 59 (1911).

Syns. *Hyperanthera peregrina* Forssk., Fl. Aegypt.-Arab. 67 (1775).

Moringa aptera Gaertn., Fruct. Sem. Pl. 2: 315 (1791).

Moringa arabica Pers., Syn. Pl. 1: 461 (1805).

Deciduous tree 4-10 m, green, glaucous; leaves 20-30 cm, the axes persistent; leaflets, 1-2.5 x 0.1-0.5 cm, few, narrowly oblong-oblancoelate, caducous; panicles 15-25 cm, lax; flowers 1-1.5 cm, pinkish-white or pale yellow; sepals 7-9 mm; petals 0.8-1.5 cm; capsule 10-25 x 1-1.5 cm, pendulous, deeply ribbed longitudinally, torulose; seeds 1.2-1.5 x 0.8-1 cm, ovoid-trigonous, white.

S, De; rocky slopes and wadis. Tropical Northeast Africa, Southwest Asia.

CRASSULACEAE

(Partly after G. E. Wickens, *Taeckholmia* Add Ser. 5: 1-71 (1994), published 1996.)

Annual or perennial herbs (our species), rarely subshrubs, usually succulent; leaves opposite, or alternate, exstipulate; flowers bisexual, rarely unisexual then dioecious, actinomorphic, (3-)4- to 5-merous (our species); sepals free or united into a tube, persistent; petals as many as the sepals, free or united; stamens hypogynous or epipetalous, as many as the petals or twice as many; filaments free or adnate to the petals; scale-like nectaries usually present between the stamens and carpels; carpels superior, equal in number to the petals, free or slightly connate at the base, 1-locular; ovules numerous; style short or elongate; fruit follicular; seeds minute, elongate; embryo straight; endosperm present. 33 genera 1100 species, almost cosmopolitan, especially southern Africa, except Australia and West Pacific.

1. Slender annuals, flowers 3- to 4-merous, in cymose clusters in the leaf axils all along the stem

1. *Crassula*

+ Perennial herbs with stout or tuberous rootstock; flowers 5-merous, in terminal inflorescences

2

2. Leaves spatulate, sessile, crowded into a conspicuous rosette; sepals 4 mm

2. *Rosularia*

+ Leaves peltate, petiolate, not crowded into a rosette; sepals 1.5-2 mm

3. *Umbilicus*

1. *Crassula* L.

Annual or perennial herbs or small shrubs; usually succulent; leaves opposite, usually united at the base to form a sheath around the stem; inflorescence corymbose, subumbellate, capitate or thyrsoïd; flowers 3-4 or 5-(-9)-merous; sepals usually much shorter than the petals, free or slightly united at the base; petals slightly united at the base; stamens as many as the petals; nectary scales usually small; carpels free or slightly united at the base; ovules numerous, rarely 1 or 2. About 200 species, almost cosmopolitan, especially tropical and southern Africa.

1. *Crassula alata* (Viv.) A. Berger in Engl. & Prantl, Natürl. Pflanzenfam., ed. 2, 18a: 389 (1930).
Syn. *Tilaea alata* Viv., Pl. Aegypt. 16 (1831).

Slender annual herb 5-10 cm, glabrous; stems erect or prostrate, leafy; leaves 4-7 x 1-2 mm, subulate, the apex shortly aristate; flowers in dense cymose clusters, in the leaf axils along the entire length of the stem and its branches; pedicels 1-2.5 mm, slender, elongating in fruit; flowers 3- to 4-merous; sepals 1.5-2 mm, subulate-aristate; petals 0.8 x 0.3 mm, narrowly ovate-acuminate; stamens 5 mm; nectary scales inconspicuous; carpels 0.6 mm, narrowly ovoid, tapering to a short style; ovules 2 per carpel.

M; coastal sandy soils and calcareous slopes. Sicily, Crete, Cyprus, Libya, Egypt, Sudan (Red Sea), Palestine, Syria, Iraq, Kuwait, Iran, Northwest India.

2. *Rosularia* (DC.) Stapf

Perennial succulent, rosulate herbs; radical leaves crowded into conspicuous rosettes, sessile, flat, fleshy, spatulate to obovate, elliptic or linear; cauline leaves alternate, deciduous; inflorescence terminal, corymbose; bracts leafy; flowers few to many, 5- to 8-merous; calyx deeply 5-8-lobed; petals connate at the base, longer than the calyx; stamens adnate to petals; nectary scales oblong to square; carpels slightly connate at the base, ovules numerous; style slender, short. 27 species, North Africa, East Mediterranean region to Central Asia.

1. *Rosularia lineata* (Boiss.) A. Berger in Engl. & Prantl, Natürl. Pflanzenfam., ed. 2, 18a: 418 (1930).
Syns. *Umbilicus lineatus* Boiss., Diagn. Pl. Orient., ser. 1, 10: 14 (1849).
Cotyledon lineata (Boiss.) Dinsm. in Post & Dinsmore, Fl. Syria Pal. Sinai, ed. 2, 1: 490 (1932).
Sedum sempervivum, sensu Täckh., Stud. Fl. Egypt, ed. 2, 213 (1974).

Perennial rosulate herb, 10-20 cm, glandular-hirsute; rootstock stout; leaves 1-2.5 x 0.3-0.6 cm, spatulate; apex obtuse; margins shortly ciliate; inflorescence few-flowered; calyx 4 mm, campanulate, the lobes connate at the base; corolla 7-9 mm, rose-pink, cylindrical-campanulate; lobes 2 mm, triangular-ovate, acute; stamens included; nectary scales ligulate; carpels 4 mm, ovate, abruptly terminating in a style.

S; sheltered mountain cliffs. Sinai, Palestine, Syria.

3. *Umbilicus* DC.

Perennial succulent herbs, glabrous, with tuberous or rhizomatous rootstock; basal leaves petiolate, the lamina usually suborbicular, often peltate; cauline leaves smaller; inflorescence a terminal, bracteate, many-flowered, simple or branched raceme or panicle; flowers 5-merous; calyx small; corolla tubular, urceolate or campanulate, distinctly sympetalous; stamens 10, rarely 5, epipetalous, usually in 2 series; filaments short; carpels free; ovules numerous; style very short, follicles slender; seeds linear. 18 species, Mediterranean region to Iran, African mountains.

1. Corolla urceolate (Gebel Elba) 1. *U. botryoides*
+ Corolla cylindrical 2
2. Pedicels 0.2-1 cm; flowers somewhat pendulous, the corolla 5-8 mm, rhachis generally exceeding the vegetative portion of the flowering stem (Sinai) 2. *U. rupestris*
+ Pedicels usually less than 2 mm; flowers usually horizontal, the corolla 4.5 mm; rhachis generally shorter than the vegetative portion of the flowering stem 3. *U. horizontalis*

NOTE: Mature flowering material is essential for determination. Plants in early stages of flowering are difficult to identify.

1. *Umbilicus botryoides* Hochst. ex A. Rich., Tent. Fl. Abyss. 1: 308 (1848).
Syns. *Cotyledon umbilicus* L. var. *botryoides* (Hochst. ex A. Rich.) Engler, Abh. Acad. Wiss. 1891, 2: 230 (1892).
Cotyledon pendulinus Drar, Min. Agric. Tech. & Sci., Fuad I Agric. Mus. Bull. 149: 40 (1936).

Perennial tuberous herb, 15-40 cm; tuber 2-4 cm diam., subglobose to cylindrical, covered by fibrous roots; stems erect; basal leaves 2-9 cm diam., peltate, suborbicular, fleshy; margins crenate to sinuate; petiole 5-8(-13) cm; lower cauline leaves similar but smaller; upper leaves and bracts progressively smaller; racemes simple, rarely branched; pedicels 1-2(-6) mm; flowers at first horizontal, later becoming pendulous; sepals 2 x 1-2 mm, ovate-lanceolate to broadly triangular-ovate, shortly connate at the base, persistent; corolla urceolate; petals 8 x 5 mm, white, lanceolate, acuminate; filaments adnate to corolla tube to just below the lobes, free for 0.5 mm; anthers 0.5 mm diam., suborbicular; nectary scales 2 x 0.5 mm, linear-oblong, the apex retuse; carpels 5, erect, 3.5 mm; style 0.5 mm, recurved; stigma obliquely capitate.

GE; shaded rock crevices. Southeast Egypt, Sudan to Tanzania, Cameroon mountains.

2. *Umbilicus rupestris* (Salisb.) Dandy in Riddelsd., Hedley & Price, Fl. Gloucestershire 611 (1948).
Syns. *Cotyledon rupestris* Salisb., Prodr. 307 (1796).
Umbilicus pendulinus DC. in Lam. & DC., Fl. Fr., ed. 3, 4: 383 (1805).
Cotyledon tuberosa (L.) Halácsy, Consp. Fl. Graec. 1: 577 (1901).
Cotyledon pendulina (DC.) Vierh., Verh. Zool.-Bot. Ges. Wien 69: 224 (1919).

Perennial tuberous herb, 10-50 cm; tuber 1-3 cm diam., subglobose or ovoid, covered by fibrous roots; stems erect; basal leaves 3-4.5(-10) cm, peltate, subcircular, fleshy, the

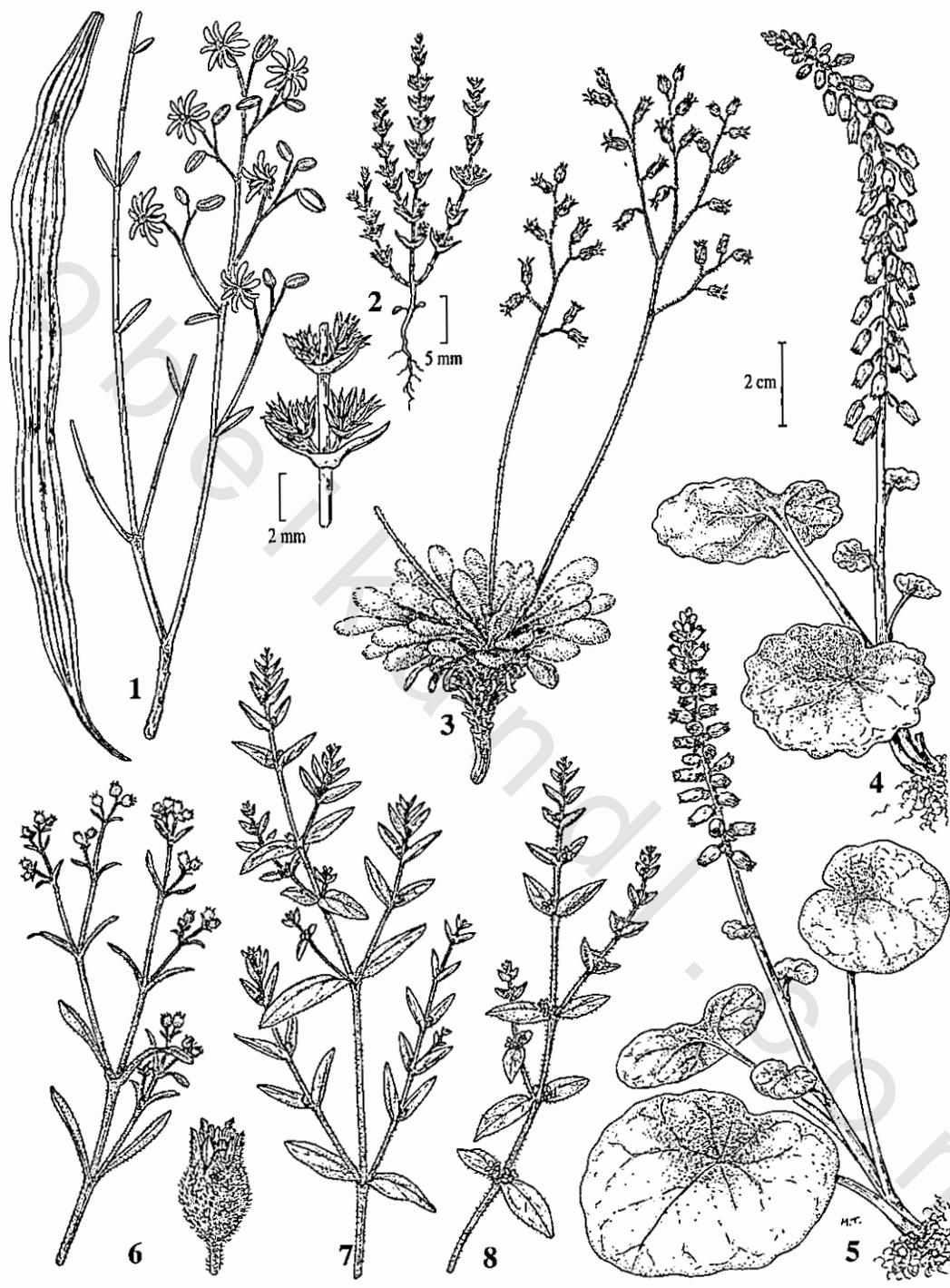


Plate 42. MORINGACEAE: *Moringa peregrina* 1, flowering branch and fruit. CRASSULACEAE: *Crassula alata* 2, habit and flowering branch. *Rosularia lineata* 3, habit. *Umbilicus rupestris* 4, habit. *Umbilicus horizontalis* 5, habit. VAHLIACEAE: *Vahlia dichotoma* 6, flowering and fruiting branch and fruit. *Vahlia digyna* 7, flowering and fruiting branch. *Vahlia geminiflora* 8, flowering and fruiting branch. All drawings to the same scale except enlarged parts (scale given).

margins coarsely crenate; petiole 3-9(-15) cm; cauline leaves progressively smaller and more shortly petiolate; racemes cylindrical, sometimes branched; pedicels 0.2-1 cm; flowers numerous, somewhat pendulous; sepals 1.5 x 1 mm, narrowly triangular, shortly connate at the base, persistent; petals 5-8 x 2.5-5 mm, greenish-yellow, often finely streaked and spotted with red; lobes 2-2.5 mm, broadly ovate-acuminate; filaments adnate to the corolla tube to just below the apex, free for 0.8 mm; anthers 0.8 mm, suborbicular; nectary scales 2 x 0.6 mm, narrowly oblong; apex truncate; carpels 5, 4 mm; style short; stigma obliquely capitate.

S; rocky regions. Macaronesia, West and South Europe, North Africa, Cyprus, East Mediterranean region, Sinai, Arabia.

3. **Umbilicus horizontalis** (Guss.) DC., Prodr. 3: 400 (1828).

Syns. *Cotyledon horizontalis* Guss. in Ten., Fl. Neap. Prodr., App. 5, pl. 13 (1826).

Umbilicus pendulinus DC. var. *horizontalis* (Guss.) Post, Fl. Syria, Palestine, Sinai, ed. 1, 314 (1896).

Perennial tuberous herb, 10-50 cm; tuber 1-2.5 cm diam., subglobose or ovoid, covered by fibrous roots; stems erect; basal leaves (2-)5-10 cm, peltate, suborbicular, fleshy, the margins shallowly crenate; petiole 4-10 cm; cauline leaves abruptly smaller, reniform; raceme elongate, simple, rarely branched; pedicels 0.5-1(-2) mm; flowers numerous, horizontal or pedulous; sepals 1-1.5 x 1 mm, broadly triangular; petals 5-7 mm, greenish-yellow, often finely spotted and streaked with red, tubular; lobes 1.5-2 mm, erect, broadly lanceolate to ovate-acuminate; filaments free for 0.3 mm; anthers 0.5 mm, suborbicular; nectary scales 1.5 x 0.4 mm, narrowly oblong, the apex truncate; capsule 4 mm; style short; stigma obliquely capitate.

Two varieties occur in Egypt:

var. **horizontalis**

Flowers usually horizontal, spreading; corolla tubular, the lobes lanceolate.

M, S; rocky coastal (M) and hilly inland (S) regions.

var. **intermedius** (Boiss.) D. F. Chamb. in Davis, Fl. Turkey 4: 213 (1972).

Syns. *Umbilicus intermedius* Boiss., Fl. Orient. 2: 769 (1872).

Umbilicus pendulinus DC. var. *intermedius* (Boiss.) Post, Fl. Syria, Palest., Sinai, ed. 1, 314 (1896).

Flowers drooping; corolla usually urceolate, the lobes ovate.

Area of the species: Mediterranean region, Southwest Asia.

NOTE: The occurrence of var. *intermedius* in Egypt is doubtful. The records from Sinai and Eastern Desert were most probably based on misidentifications as the plants have been confused with *U. rupestris*.

VAHLIACEAE

Mainly after D. M. Bridson, *Taeckholmia* Add. Ser. 2: 1-13 (1983).

Description as for *Vahlia*, the only genus in the family.

1. *Vahlia* Thunb., nom. conserv.

Annual or perennial herbs or subshrubs, glabrous or pubescent with multicellular often gland-tipped hairs; leaves opposite, sessile to subsessile, simple, ovate to linear, exstipulate; inflorescence axillary, bearing paired sessile to pedunculate flowers; flowers bisexual, regular; calyx-tube adnate to the ovary, campanulate to subglobose; lobes 5, valvate, persistent; petals 5, valvate, shorter than or just exceeding the calyx lobes; stamens 5, alternate with the petals, inserted on the margin of an epigynous disc; filaments free; anthers dorsifixed; ovary inferior, 1-locular; styles 2 (or ?3) spreading, stigma capitellate; ovules numerous; fruit a capsule, subglobose or ovoid, dehiscent by 2 (-?3) valves; all floral parts, (except anthers) persistent; seeds numerous, oblong, minute. 5 species, Africa, Madagascar, Iraq, Iran, India, Vietnam.

1. Peduncles and pedicels 0.2-2.2 cm; style arms separate to base;
filaments without appendages at the base 1. *V. dichotoma*
+ Peduncles and pedicels reduced, not exceeding 2 mm; style arms joined shortly
above the base; filaments with appendages at the base 2
2. Petals distinctly shorter than calyx-lobes; style-arms never exceeding calyx lobes,
not exceeding 1.3 mm 2. *V. digyna*
+ Petals slightly longer or subequalling the calyx-lobes; style arms often exceeding
calyx-lobes, 2.2-3.5 mm 3. *V. geminiflora*

1. *Vahlia dichotoma* (Murray) Kuntze, Rev. Gen. Pl. 227 (1891).

Syns. *Heuchera dichotoma* Murray, Nov. Comm. Soc. Reg. Sci. Gott. 3: 64, t. 1
(? 1773).

Oldenlandia pentandra Retz., Obs. Bot. 4: 22 (1786).

Oldenlandia dichotoma (Murray) Spreng., Pl. Min. Cog. Pugil Prim. 2: 36
(1815).

Vahlia silenoides DC., Prodr. 4: 54 (1830).

Vahlia tomentosa DC., Prodr. 4: 54 (1830).

Annual herb 5-50(-65) cm, rarely slightly woody at the base, sparsely crispate pubescent, very rarely glandular-pubescent; stems erect, branched; leaves 0.6-7 x 0.1-0.6 cm, linear to lanceolate, sessile, the apex acute; peduncles 0.2-2.2 cm, (1-)2-flowered; pedicels 5 (-8) mm; calyx-tube 1.3-2.5 mm, pubescent; calyx lobes 1-2.8 x 0.7-1.1 mm, ovate-lanceolate to triangular, acute, glabrous to pubescent outside; petals 1-2.6 x 0.6-1.7 mm, white to yellow; filaments 0.5-1.7 mm, without appendages at the base; anthers 0.3-1 mm; style-bases distinctly thickened, free to the disc; styles 0.6-2 mm; capsule 2-3.3 mm, sparsely hairy; seeds 0.2-0.3 mm, ovoid to cylindrical, straw-coloured.

N (Aswan Nile Islands); sandy and silty banks of Nile islands. Africa, Madagascar, India, Sri Lanka, Vietnam.

2. *Vahlia digyna* (Retz.) Kuntze, Rev. Gen. Pl. 227 (1891).

Syns. *Oldenlandia digyna* Retz., Obs. Bot. 4: 23 (1786).

Vahlia ramosissima DC., Prodr. 4: 54 (1830).

Vahlia viscosa Roxb., Fl. Ind., ed. Carey, 2: 89 (1832), nom. superfl.

Annual herb 5-35 cm; stems erect, branched, covered with patent or crispate, often glandular hairs; leaves 0.5-2.5(-5) x 0.2-0.6(0.9) cm, ovate to ovate-lanceolate, the apex acute, tapering or rounded at base, sparsely hairy to pubescent; flowers sessile or peduncles and pedicels to 1 mm; calyx-tube 1-1.2 mm, sparsely hairy, the lobes 1.3-2 x 0.6-1.2 mm, ovate, acute; petals 1-1.3(-1.6) x 0.55-1 mm, yellow, fading to white, shorter than sepals, rounded to ovate, apiculate; filaments 0.3-1.1 mm; anthers 0.15-0.4 mm; style-bases distinctly thickened, not separating from the disc; styles 0.7-1.3 mm; capsule 1.4-2.2 mm; seeds 0.15-0.25 mm, ovoid-cylindrical, straw-coloured.

N (Aswan and Qena); weed along silty Nile banks. West, East and southern Africa to Botswana, India, Pakistan.

3. *Vahlia geminiflora* (Delile) Bridson, Kew Bull. 30: 179 (1975).

Syns. *Bistella geminiflora* Delile, Cent. Pl. Afr. Voy. Méroé rec. M. Cailliaud, 7, 97, t. 2, f. 2 (1826).

Vahlia weldenii Rchb., Iconogr. Bot. Exot. Hort. Bot. 1: 62, t. 91 (1827).

Annual herb 10-35 cm, densely covered with long, patent, usually gland-tipped hairs; leaves 1-4 x 0.4-1 cm, lanceolate-ovate to ovate, the apex acute, the base rounded or tapering; flowers subsessile; pedicels and peduncles usually not exceeding 1 mm, but occasionally with peduncles to 4 mm; calyx-tube 1.5-3 mm, densely glandular-hairy; calyx-lobes 2.4-4.1 x 1.3-2.3 mm, ovate, acute; petals 2.1-3.7 x 1.3-3.4 mm, ovate to circular, yellow, usually drying with a maroon spot at the base; filaments 1.2-3.6 mm, with a conspicuous basal appendage; anthers 1.2-1.6 mm; style-bases distinctly thickened, not separating for 0.3-0.6 mm above the disc; styles 2.2-3.5 mm; capsule 1.3-2.5 mm, subglobose; seeds 0.2-0.3 mm, ovoid, straw-coloured.

N, (Qena, Aswan, Nubia); weed of cultivation. Egypt, Iraq, Iran, Sudan, Ethiopia, Mali, Nigeria.

ROSACEAE

Trees, shrubs or herbs; stems sometimes climbing or armed with thorns; leaves simple or compound, alternate, stipulate; flowers bisexual, actinomorphic, often conspicuous, in various types of inflorescences or solitary; receptacle flat, concave, convex or hollow, sometimes enlarged and fleshy in fruit; sepals 4-5; epicalyx sometimes present; petals 5, free, inserted on the margin of the disc; stamens 4-numerous; carpels 1-many, free or united, often fused with the receptacle to form a hypanthium; styles as many as the carpels, free or united; ovules 1-2 per carpel; fruit an achene, follicle, drupe or pome, rarely a capsule; seeds with a small embryo, endosperm usually absent, cotyledons fleshy. 95 genera, 2825 species, cosmopolitan, especially temperate and northern hemisphere.

1. Leaves simple, entire or lobed 2
+ Leaves 2 or more pinnate 3

2. Leaves entire 6. **Cotoneaster**

+ Leaves lobed

5. *Crataegus*

3. Shrubs

4

+ Annual or perennial herbs

5

4. Leaves ternate or palmate with 5 leaflets

1. *Rubus*

+ Leaves imparipinnate

2. *Rosa*

5. Annuals; flowers solitary

4. *Potentilla*

+ Perennials; flowers in terminal heads

3. *Sanguisorba*

1. *Rubus* L.

Shrubs, frequently armed with sharp prickles and acicles (needle-like prickles); vegetative stems (turions) procumbent, with erect flowering stems branched off them, leaves imparipinnate or ternate, leaflets toothed; flowers few to many, in panicles; sepals 5; epicalyx absent; petals 5, white or pink, sometimes absent; stamens many; receptacle domed, bearing few to many 1-seeded carpels, each developing into a fleshy drupelet. About 250 species, cosmopolitan.

1. *Rubus sanctus* Schreb., Icon., Descr. Plant. 1: 15, t. 8 (1766).

Shrub; stems 1-2 m, prostrate or arching, angled, grooved, with a short compact white tomentum and prickles; prickles straight or curved, robust, often reddish; leaves ternate or palmate with 5 leaflets; leaflets 2-8 x 1.5-4 cm, broadly obovate, biserrate, acute, greenish and subglabrous on the upper surface, greyish-white on the lower; stipules linear; flowers numerous, in lax panicles; pedicels and calyx tomentose; sepals 4-5 mm, ovate, acute; petals 0.8-1.2 cm, pink; stamens with pilose anthers; fruit with several black, glabrous, juicy drupelets.

N, M, S; hedges, terraces, walls, naturalized. West and Central Europe, Mediterranean region, Southwest Asia to western Himalayas.

2. *Rosa* L.

Shrubs, usually deciduous; stems prickly, rarely smooth; leaves imparipinnate; leaflets elliptic to ovate-lanceolate, serrate; flowers solitary or in corymbs; sepals 5, reflexed in fruit; epicalyx absent; petals 5, large, white, yellow or reddish-purple; stamens numerous; styles numerous, free or fused into a stylar column; receptacle concave, enclosing the numerous carpels, becoming fleshy and coloured when ripe. About 125 species, North temperate, tropical mountains.

1. *Rosa arabica* Crép., Bull. Soc. Bot. Belg. 8: 344 (1869).

Shrub 0.5-1.5 m, glandular, all prickles alike; leaflets obovate, deeply double-serrate, sparsely glandular on the upper surface, densely glandular beneath, not hairy; stipules undivided; peduncle, sepals and receptacle glandular-puberulent; styles hirtulous; stigmas broad.

S; rocky ground. Endemic.

3. *Sanguisorba* L.

Perennial or rarely annual unarmed herbs; leaves alternate, imparipinnate; stipules sheathing, adnate to petiole; inflorescence terminal, densely capitate or spicate; flowers bisexual and female, 2- to 3-bracteate; calyx-tube constricted at throat, persistent; calyx-lobes 4(-6), petaloid, caducous; petals absent; stamens 4 or more; filaments exerted, filiform or dilated above; ovary inferior; carpels 1(-3), free, with 1 ovule, enclosed in calyx-tube (hypanthium); style filiform; stigmas feathery or capitate; achenes 1(-3), enclosed in the dry hypanthium. About 10 species, North temperate regions.

1. *Sanguisorba minor* Scop., Fl. Carn., ed. 2, 1: 110 (1771) subsp. *verrucosa* (Link ex G. Don) Holmboe, Bergens Mus. Skr., ser. 2, 1, 2: 100 (1914).

Syns. *Poterium verrucosum* Link ex G. Don, Gen. Syst. 2: 595 (1832).

Sanguisorba verrucosa (Link ex G. Don) A. Braun & Bouché, Ind. Sem. Hort. Berol., App. 1: 11 (1867).

Perennial herb 20-60 cm, unarmed, with a rootstock and ascending or erect annual stems; stems angular, branched, leafy below; leaves 8-25 cm, the leaflets 3-10 pairs, ovate-oblong, serrate, glabrescent on the upper surface, densely hairy beneath; bracteoles 2-3 mm, membranous; flowers sessile, in dense terminal heads; calyx-lobes 4, c. 5 mm, reddish-green, spreading, broadly elliptic; stamens numerous; achene 4-5 mm, indurate, densely covered with elongated verrucose tubercles.

M, S; field margins and waste ground. Mediterranean region, Sinai.

4. *Potentilla* L.

Perennial herbs, rarely annuals or subshrubs; leaves palmately or pinnately compound; flowers bisexual, solitary or in cymes; calyx (3-)5-lobed, persistent; epicalyx present; petals as many as the calyx-lobes, usually conspicuous, yellow or white, rarely red or purple; stamens 10-30; carpels 10-numerous, free, inserted on a convex or conical receptacle; styles caducous; fruit of numerous 1-seeded achenes. About 500 species, North temperate and boreal regions.

1. *Potentilla supina* L., Sp. Pl., ed. 1, 497 (1753).

Annual herb 10-35 cm; stems decumbent or ascending, much branched from the base, hairy; basal leaves 3-8 x 1-3 cm, long-petiolate, pinnately divided into 5-9 leaflets; leaflets alternate or subopposite, ovate-elliptic, dentate; upper leaves shortly-petiolate, usually 3-foliolate or reduced to 1 leaflet; stipules 2-5 mm; flowers solitary, borne opposite to the leaves; pedicels 0.5-2 cm, recurved in fruit; sepals 5, 2-4 mm; epicalyx longer than the sepals; petals shorter than the sepals, yellow; stamens 15-20; filaments short; achenes 1 mm, hairy, rugose.

N, S; Nile and canal banks. Central and South Europe, North Africa, West Asia to Afghanistan and Tibet.

5. *Crataegus* L.

Trees or shrubs, deciduous, often spinose; leaves pinnatifid or variously lobed, serrate; stipules usually conspicuous; flowers in corymbs or rarely solitary; petals 5, white or

pinkish; stamens 5-25; carpels 1-5, free at apex; styles as many as carpels, carpel wall hard and bony at maturity; ovules 2; fruit fleshy, 1-seeded (pyrene), crowned with the persistent calyx. About 280 species, North temperate.

1. Leaves pubescent, with crisped whitish hairs beneath; young shoots densely white-hairy 1. *C. azarolus*
+ Leaves glabrous or glabrescent beneath; young shoots glabrous or sparsely hairy 2. *C. x sinaica*

1. *Crataegus azarolus* L., Sp. Pl., ed. 1, 477 (1753).

Syns. *Crataegus azarolus* L. var. *aronia* L., Sp. Pl., ed. 1, 477 (1753).

Crataegus aronia (L.) Bosc ex DC., Prodr. 2: 629 (1825).

Shrub or small tree, 1-3.5 m; young shoots densely white-hairy, armed with thorns; leaves 2-5 cm, obovate, 3- to 5-lobed, tapering to a petiole, leathery, pubescent, with crisped whitish hairs on the lower surface, deciduous; corymbs axillary, 4- to 8-flowered; pedicels 0.6-2 cm; calyx tube 3-4 mm, campanulate, the lobes short, deflexed; petals 4-7.5 mm, white; fruit 1.3-1.5 cm, globose, crowned by the persistent calyx, red at maturity.

S; in the mountains. East Mediterranean region, Sinai.

2. *Crataegus x sinaica* Boiss., Diagn. Pl. Orient. 2, 2: 48 (1856).

Syn. *Crataegus azarolus* L. x *monogyna* Jacq., Sec. Planch, Compt. Rend. Acad. Sci. Par. 74: 613 (1872).

Shrub 1-2 m; twigs spine-tipped; young shoots glabrous or sparsely hairy; leaves like those of *C. azarolus* but glabrous or glabrescent beneath; flowers few in axillary corymbs; fruit globose-ovoid, 1- or 2-seeded, red at maturity.

S; in the mountains. Sinai, Syria, Saudi Arabia.

6. *Cotoneaster* Medik.

Unarmed shrubs; leaves simple, entire, deciduous; flowers in cymes or corymbs, or solitary; petals white or pink; stamens about 20; styles and carpels 2-5, almost free; fruit globose or obconical, fleshy, crowned by the persistent calyx, 2- to 5-seeded (pyrenes). About 250 species, Old World temperate regions.

1. *Cotoneaster orbicularis* Schldtl., Linnaea 27: 544 (1854).

Type: W. Schimper 270, 445, 19 Mai et 11 Aug. 1835, Pl. Arab. Petr., in M. Stae Catherinae, labelled *Cotoneaster nummularia* Fisch. et Meyer? (BM ! K !).

Shrub 0.2-2 m; stems much branched, intricate; twigs rather spinescent; leaves 0.5-1.2 (-1.8) x 0.3-0.8 cm, orbicular to broadly elliptic, glabrous or glabrescent on the upper surface, densely white-grey pubescent and with a prominent midrib beneath; entire, the apex rounded, apiculate; petiole 1-2 mm, pubescent; flowers 2-5 in axillary cymes, peduncles 3-6 mm; pedicels 0.5-1.5 mm; calyx 3 mm, glabrous or glabrescent; calyx tube campanulate; lobes 0.5-1 mm, triangular, acute; corolla 2 mm, suborbicular, white; fruit 5-7 x 3-4 mm, an ovoid, pyriform or obconical reddish pome, crowned by the persistent calyx.



Plate 43. ROSACEAE: *Rubus sanctus* 1, flowering and fruiting branch. *Sanguisorba minor* subsp. *verrucosa* 2, flowering and fruiting branch and fruit. *Potentilla supina* 3, flowering and fruiting branch. *Crataegus azarolus* 4, flowering and fruiting branches. *Crataegus x sinaica* 5, fruiting branch. *Cotoneaster orbicularis* 6, flowering and fruiting branches. NEURADACEAE: *Neurada procumbens* 7, habit and fruit. All drawings to the same scale except enlarged parts (scale given).

S (Mt. Catherine); rocky slopes. Sinai, Oman, Armenia.

NEURADACEAE

Description as for *Neurada*, the only genus in the family.

1. *Neurada* L.

Annual herbs; leaves pinnately lobed, alternate; stipules small; flowers inconspicuous, axillary, solitary, bisexual, actinomorphic, pedicellate; receptacle discoid, enlarged and woody in fruit; calyx 5-lobed and alternating with 5 epicalyx-lobes; petals 5, free; stamens 10; ovary immersed in the receptacle, 5- to 10-loculed, with 1 ovule per locule; styles 5-10, becoming spinescent; fruit dry, woody, orbicular, flattened, indehiscent, few-seeded, smooth on the lower surface, spiny on the upper. 1 species, North Africa, East Mediterranean region, Sinai, Sahara, Sudan, Ethiopia, Arabia to Indian Desert.

1. *Neurada procumbens* L., Sp. Pl., ed. 1, 441 (1753).

Annual herb 10-40 cm, densely grey-tomentose; stems prostrate; leaves 0.5-3 x 0.3-1.5 cm, oblong-ovate, sinuate-pinnatifid; sepals 2-2.5 x 1-1.5 mm, ovate-triangular, acute; petals 1 x 1 mm, white, cream or pinkish; fruit 1-2.2 mm diam., with 2-8 mm spines.

O (Wadi Natrun), M, D, R, GE, S; sandy plains and desert wadis. Area of the species as for the genus.

LEGUMINOSAE

Herbs, shrubs, trees or lianes; leaves alternate, pinnate, 1- or 3-foliolate, digitate, 2-pinnate or simple; stipules usually present; flowers zygomorphic or actinomorphic, solitary or in spikes, racemes or panicles, usually bisexual; sepals usually united; petals 5, fewer or 0, free or less often some or all united; stamens 10, sometimes more or fewer, inserted with the petals at the rim of the receptacle; filaments free or united or diadelphous; ovary of 1 carpel, superior, 1- to several-ovulate; fruit a legume (pod) usually dehiscent into 2 valves, less often indehiscent or a lomentum splitting into 1-seeded segments; seeds with scanty endosperm or none. About 642 genera, 18,000 species, widely distributed in temperate and tropical regions.

Key to the subfamilies:

1. Flowers papilionaceous, consisting of a posterior petal, standard (vexillum),
2 lateral petals, (wings), and 2 anterior petals forming the keel; stamens 10, all united
(monadelphous) or 1 free and 9 united (diadelphous) **I. Papilionoideae**
- + Flowers not as above **2**
2. Flowers irregular; petals imbricate in bud, free or some united; stamens 10 or fewer
by abortion; leaves various, rarely 2-pinnate; seeds without an
areole **II. Caesalpinioideae**
- + Flowers regular; petals valvate in bud, often united at the base; stamens as many or
twice as many as the petals or numerous, the anthers minute;
leaves usually 2-pinnate; seeds with an areole on each side **III. Mimosoideae**

I. Subfamily **Papilionoideae**

Herbs, shrubs, trees or lianes, mostly unarmed; leaves usually pinnate, 3-foliolate, digitate, rarely 1-foliolate or simple; flowers zygomorphic; sepals united at the base into a tube, calyx-lobes imbricate or valvate; petals 5, imbricate, consisting of a standard (vexillum) outermost, wings (2 lateral) and keel (2 innermost); stamens 10, rarely less, variously united, rarely free; pod usually dehiscent; seeds without areoles. About 425 genera, 12,150 species, widely distributed in temperate and tropical regions.

1. Leaves simple or absent	2
+ Leaves compound, digitate, pinnate or trifoliolate	8
2. Plant thorny	32. Alhagi
+ Plant unarmed	3
3. Flowers white	6. Retama
+ Flowers yellow, pink, red or purple	4
4. Leaves 5-15 cm; pod circinnate or contorted	15. Scorpiurus
+ Leaves much shorter, pod not as above	5
5. Pod subglobose, oblong-elliptic or terete	6
+ Pod flattened	7
6. Annual herbs; pod terete	21. Indigofera cordifolia
+ Shrubs; pod subglobose or oblong-ellipsoid	2. Crotalaria
7. Pod indehiscent, 1-3-segmented	28. Taverniera
+ Pod dehiscent, not segmented	23. Tephrosia kassasii
8. Leaves with tendrils (tendrils reduced to a mucro in <i>Vicia ervilia</i>)	9
+ Leaves without tendrils	11
9. Stipules much longer than the leaflets	35. Pisum
+ Stipules smaller than the leaflets or (<i>Lathyrus aphaca</i>) stipules leaf-like	10
10. Stems winged (unwinged in <i>Lathyrus aphaca</i>); leaflets 1 pair	34. Lathyrus
+ Stems not winged; leaflets 2 or more pairs	33. Vicia
11. Leaves digitate, with more than 3 leaflets	3. Lupinus
+ Leaves 3-foliolate or pinnate	12
12. Leaves 3-foliolate	13
+ Leaves pinnate	33
13. Leaflets with stipels (small stipules)	14
+ Leaflets without stipels	15
14. Leaves with conspicuous resinous gland-dots on the lower surface; pod 1-3-seeded	38. Rhynchosia
+ Leaves without gland-dots on the lower surface; pod 6-15 or	

more-seeded	37. Vigna
15. Withered corolla persistent; pod enclosed in the persistent calyx, not exposed	16
+ Corolla caducous; pod exposed	17
16. Herbaceous annuals or perennials	11. Trifolium
+ Small shrubs	31. Ebenus
17. Leaflets dentate, serrate or sinuate-plicate	18
+ Leaflets entire	24
18. Pod 1-2-seeded	19
+ Pod at least 3-seeded	20
19. Pod aerial, not constricted; leaflets sinuate-plicate, pubescent and gland-dotted on both surfaces	19. Cullen
+ Pod subterranean, constricted; leaflets not as above	9. Medicago hypogaea
20. Pod spirally twisted, usually spiny	9. Medicago
+ Pod not spirally twisted, not spiny	21
21. Flowers solitary or in racemes; pod not curved	22
+ Flowers mostly in umbellate racemes or clusters; pod mostly curved	23
22. Pod dehiscent, not veined	7. Ononis
+ Pod indehiscent or tardily dehiscent, variously veined	10. Melilotus
23. Petals free or wings adhering to the keel by a tooth	8. Trigonella
+ Keel very strongly adherent to the wing by a wing spur in a keel invagination	9. Medicago
24. Pod 1-seeded, with a long sword-shaped beak	20. Bituminaria
+ Pod not as above	25
25. Foetid shrub, 1-2.5 m; pod 10-15 cm	1. Anagyris
+ Annual and perennial herbs or small shrubs; pod much shorter	26
26. Pod a loment, segments 1-seeded	27
+ Pod not as above	28
27. Pod falcate or coiled, smooth, terete, of <i>c.</i> 8 cylindrical or sausage-shaped segments	16. Coronilla
+ Pod straight, spiny, flattened, of 1-3 rounded segments	28. Taverniera
28. All or some hairs 2-armous	29
+ All hairs simple	30
29. Standard hairy on the dorsal surface; stigma terminal, capitate	21. Indigofera
+ Standard glabrous; stigma oblique, discoid	22. Microcharis

30. Calyx 3-lobed, the lateral lobes 2-fid; flowers yellowish-cream
+ Calyx not as above; flowers yellow, red, pink, purple or white 4. **Lotononis** 31
31. Pod inflated 2. **Crotalaria**
+ Pod not inflated 32
32. Calyx deeply 2-lipped, the upper lip 2-fid, the lower 3-toothed
+ Calyx not 2-lipped, the teeth subequal 5. **Argyrolobium**
14. **Lotus**
33. Standard hairy on the dorsal surface 34
+ Standard glabrous 35
34. Hairs 2-ramous, all or some 21. **Indigofera**
+ Hairs simple 23. **Tephrosia**
35. Pod of indehiscent segments 36
+ Pod not as above 37
36. Segments of the pod ovoid-orbicular or quadrangular, spiny or spinulose;
seeds reniform 29. **Hedysarum**
+ Segments of the pod horseshoe-shaped, not spiny; seeds curved or horseshoe-
shaped 18. **Hippocrepis**
37. Pod much inflated, membranous, indehiscent 25. **Colutea**
+ Pod not as above 38
38. Leaflets with brown setaceous stipels (small stipules) 1-2 mm 36. **Clitoria**
+ Leaflets without stipels 39
39. Leaflets 5, the basal pair stipule-like, subsessile; stipules minute or 0 14. **Lotus**
+ Leaflets and stipules not as above 40
40. Pod orbicular, flattened 41
+ Pod not as above 42
41. Flowers in many-flowered racemes 30. **Onobrychis ptolemaica**
+ Flowers few, in pedunculate axillary clusters 13. **Hymenocarpus**
42. Flowers in terminal heads or axillary clusters; pod included in inflated hairy calyx,
1-2-seeded 12. **Anthyllis**
+ Flowers and pod not as above 43
43. Pod indehiscent, with a conspicuous crest of irregular
spinose lobes 30. **Onobrychis crista-galli**
+ Pod not as above 44
44. Leaves paripinnate; pod 10-20(-25) cm 24. **Sesbania**
+ Leaves imparipinnate or paripinnate; pod 1-8.5 cm 45
45. Stipules free, always with dark markings (“glands”) at the apex; pod compressed,
with a 2-3 cm hooked beak 17. **Securigera**
+ Stipules and pod not as above 46

46. Pod 5-6 mm, sessile, 1-seeded, included in the calyx,
densely villous 27. *Astracantha*
+ Pod usually longer, stipitate, 2- or more-seeded, if included in the calyx
not villous 26. *Astragalus*

1. *Anagyris* L.

Foetid shrubs or trees; leaves 3-foliolate, rarely simple, petiolate; stipules connate; calyx campanulate; stamens free; pod compressed, torulose; seeds large, compressed. 2 species, Canary Islands, Mediterranean region, Iraq, Arabia.

1. *Anagyris foetida* L., Sp. Pl., ed. 1, 374 (1753).
Syn. *Anagyris neapolitana* Ten., Syll. Fl. Neapol. 198 (1831).

Foetid shrub 1-2.5 m; racemes short, axillary; calyx teeth subequal; corolla 2-2.5 cm, greenish-yellow; standard much shorter than the wings and keel, often blotched with a blackish spot; pod 10-15 cm, pendulous, broadly linear, irregularly torulose; seeds purplish, embedded in cellular pulp.

M, S; open grasslands and disturbed habitats. Mediterranean region, Sinai, Iraq, Arabia.

2. *Crotalaria* L.

Herbs or shrubs; leaves alternate, 1- to 3(-7)-foliolate; racemes terminal or leaf-opposed; calyx usually 5-lobed, rarely 2- to 4-lobed; corolla usually yellow; keel with a prominent beak; stamens connate; anthers 5 long and 5 short; pod inflated, dehiscent, 1-many-seeded. About 600 species, tropics and subtropics, mainly Africa.

- | | |
|---|---------------------------|
| 1. Shrubs; leaves 1-foliolate or plant leafless | 2 |
| + Annuals; leaves 3-foliolate | 3 |
| 2. Stems villous; pod pubescent | 1. <i>C. thebaica</i> |
| + Stems glabrous or appressed-hairy; pod glabrous | 2. <i>C. aegyptiaca</i> |
| 3. Flowers 1-2(-3) | 3. <i>C. microphylla</i> |
| + Flowers numerous, in racemes | 4 |
| 4. Flowers 5-6 mm, in short dense racemes | 4. <i>C. impressa</i> |
| + Flowers 1-1.2 cm, in lax elongate racemes | 5. <i>C. senegalensis</i> |

1. *Crotalaria thebaica* (Delile) DC., Prodr. 2: 128 (1825).
Syn. *Spartium thebaicum* Delile, Descr. Egypte, Hist. Nat. 250, t. 37/1 (1814).

Shrub to 60 cm; stems stiff, spinescent, ribbed, villous, leafy at flowering; leaves 0.5-2 x 0.3-0.6 cm, ovate to oblong-elliptic, villous; stipules absent; racemes 4- to 6-flowered; flowers c. 8 mm; calyx 2-lipped; standard yellow, veined brown; pod 6-8 mm, subglobose, pubescent, 2- to 3-seeded; seeds c. 3 mm, smooth.

N, O (Uweinat), D; edges of cultivation, desert wadis, dunes. Egypt, Sudan, Chad.

2. **Crotalaria aegyptiaca** Benth., J. Bot. (London) 2: 473 (1843).

Shrub to 60 cm, much branched, usually leafless at flowering; stems ribbed, glabrous or appressed-hairy; leaves 3-8 x 2-3 mm, ovate to oblong-elliptic, pubescent; stipules absent; racemes (4-)6- to 9-flowered; flowers c. 1 cm; calyx 2-lipped; standard yellow with reddish stripes; pod c. 1 cm, oblong-ellipsoid, glabrous, 2-6-seeded; seeds c. 3 mm, smooth.

N, D, R, S; desert wadis and plains. Egypt, southern Palestine, UAE, Oman, Yemen, northern Somalia.

3. **Crotalaria microphylla** Vahl, Symb. Bot. 1: 52 (1790).

Syn. *Crotalaria sennii* Chiov., Fl. Somalia 2: 157 (1932).

Annual; stems many from the base, prostrate, slender, with stiff appressed white hairs; leaves mostly 3-foliolate; stipules 1-2 mm, linear; leaflets 0.5-2.5 x 0.2-0.5 cm, linear to oblanceolate; flowers 1-2(-3), leaf-opposed; calyx 3-5 mm; standard c. 1 cm, pale yellow; pod 1.2-1.5 x 0.6-0.8 cm, oblong-obovoid, 20- to 30-seeded; seeds 1.5-2 mm, triangular, rugulose.

GE; sandy deserts. Mauritania to Red Sea coast in Southeast Egypt and Sudan, extending to Somalia, Yemen and Saudi Arabia.

4. **Crotalaria impressa** Nees ex Walp., Repert. Bot. Systemat. 1: 590 (1842).

Syns. *Crotalaria striata* A. Braun., Wildwachsende Abyssin. Pflanzen. Flora 24: 280 (1841), non DC. (1825), nom. illeg.

Crotalaria abyssinica D. Dietr., Synopsis Plant. 4: 933 (1847).

Crotalaria astragalina Hochst. ex A. Rich., Tent. Fl. Abyss. 1: 155 (1847).

Annual or short-lived perennial, to 1 m; stems erect, branched from the base; leaves 3-foliolate; stipules absent; leaflets 1-4 x 0.4-0.8 cm, linear to narrowly elliptic-oblong; racemes crowded, the rachis elongating in fruit; calyx 2.5-3 mm; standard yellow with purplish veins; pod 1-1.5 x 0.5 cm, subsessile, c. 15-seeded; seeds 2 mm, oblique-cordiform, smooth or minutely punctate.

GE; sandy coastal and inland plains. Southeast Egypt, Red Sea coastal region of Sudan and Djibouti, northern Ethiopia.

5. **Crotalaria senegalensis** (Pers.) DC., Prodr. 2: 133 (1825).

Syn. *Crotalaria maxillaris* Klotzsch in Peters, Reise Mosamb. Bot. 1: 58 (1862).

Annual or short-lived perennial to 1 m; stems erect and spreading, appressed-pubescent; leaves 3-foliolate; stipules 1-3 mm, linear-subulate; leaflets 2-6 x 0.5-2.5 cm, elliptic-oblong, lanceolate or elliptic, appressed hairy on lower surface; racemes 10-45 cm, 15- to 40-flowered; flowers 1-1.5 cm, lax; calyx 5-7 mm, appressed-hairy; standard bright yellow, hairy outside; pod 1-1.6 x 0.5-0.8 cm, oblong-ellipsoid, pubescent, 6- to 15-seeded; seeds c. 2.5 mm, oblique-cordiform, smooth.

GE; sandy plains. Cape Verde, tropical West Africa to Red Sea Hills, Ethiopia, tropical South Africa, Yemen.

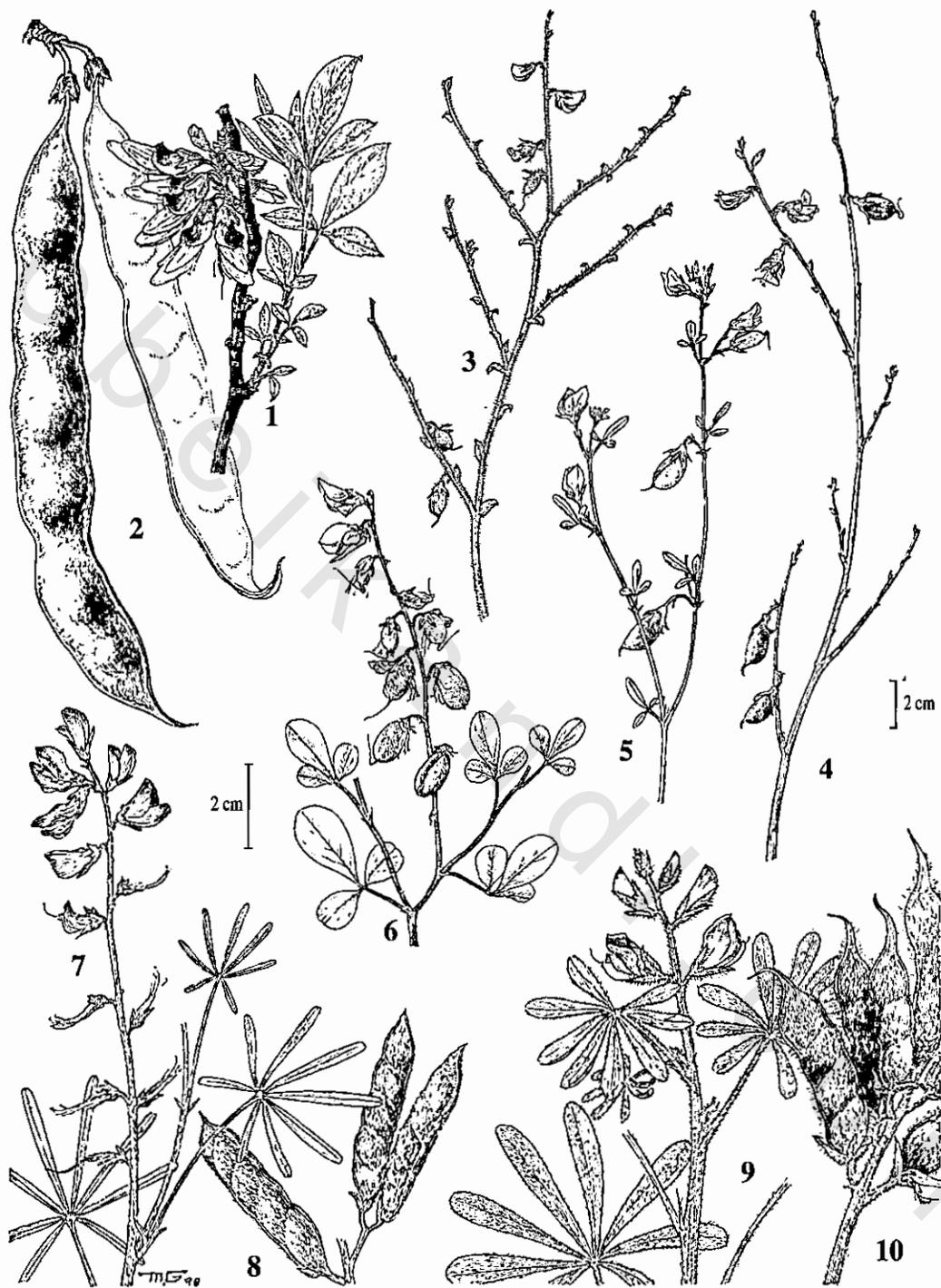


Plate 44. LEGUMINOSAE: *Anagyris foetida* 1, flowering branch; 2, fruits. *Crotalaria thebaica* 3, flowering and fruiting branch. *Crotalaria aegyptiaca* 4, flowering and fruiting branch. *Crotalaria microphylla* 5, flowering and fruiting branch. *Crotalaria senegalensis* 6, flowering and fruiting branch. *Lupinus angustifolius* 7, flowering branch; 8, fruits. *Lupinus digitatus* 9, flowering branch; 10, fruits. All drawings to the same scale.

3. *Lupinus* L.

Annual or perennial herbs, sometimes shrubs; leaves palmate, 5- to 12-foliolate, stipulate; racemes usually many-flowered; flowers conspicuous; corolla variously coloured; stamens connate into a tube; pod dehiscent, 2-many-seeded, compressed, torulose, hairy; seeds large, compressed. About 200 species, mainly North and South America, Mediterranean region.

- | | |
|--|----------------------------|
| 1. Leaflets linear to linear-oblong, 1-3 (-5) mm wide | 1. <i>L. angustifolius</i> |
| + Leaflets oblong-lanceolate, obovate, cuneate at the base, 1-2 cm diam. | 2 |
| 2. Flowers deep blue, the standard yellow-spotted | 2. <i>L. digitatus</i> |
| + Flowers lilac to pale blue | 3 |
| 3. Pod 1-2 cm in diameter; seeds tuberculate | 3. <i>L. palaestinus</i> |
| + Pod 0.8-1.2 cm in diameter; seeds smooth | 4. <i>L. albus</i> |

1. *Lupinus angustifolius* L., Sp. Pl., ed. 1, 721 (1753).

Syn. *Lupinus leucospermus* Boiss. & Reut. in Boiss., Diagn. Pl. Orient. 9: 8 (1849).

Annual to 50 cm; stems erect, simple or branched; leaves 5- to 8-foliolate; leaflets glabrous on the upper surface, appressed pilose beneath; racemes few or many-flowered; flowers 1-1.15 cm; calyx 5-8 mm, persistent; corolla 1-1.5 cm, blue or bluish-white; pod 3-6 x 8-1.2 cm, c. 5 seeded, oblong-linear, appressed villous; seeds 4-6 mm diam., grey-brown mottled with white, smooth.

N; alluvial soils and fields. Mediterranean region.

2. *Lupinus digitatus* Forssk., Fl. Aegypt.-Arab. 131 (1775).

Syn. *Lupinus varius* L. subsp. *orientalis*, sensu Täckh., Stud. Fl. Egypt, ed. 2, 225 (1974).

Annual to 75 cm, villose with white and rusty hairs; stems erect, not or slightly branched, stipules 1-1.5 cm; leaves 7- to 10-foliolate; leaflets oblong-obovate, hairy on both surfaces; racemes whorled; flowers 1.5-2.2 cm, the pedicels about 1/2 as long as the calyx; calyx 1/2 as long as the corolla; pod 5-8 x 1.5-2.5 cm, 2- to 5-seeded, hirsute; seeds c. 1.2 cm diam., suborbicular.

N, D; fallow fields and desert sandy soils. Egypt. Endemic.

NOTE: According to Greuter *et al.* (1989) this species is a part of the *L. digitatus* complex, known only from Egypt.

3. *Lupinus palaestinus* Boiss., Diagn. Pl. Orient. 9: 9 (1849).

Annual to 30 cm; like *L. digitatus* but pedicels \pm equalling the calyx; corolla lilac to pale blue.

S; sandy and loamy soils. Sinai, Palestine.

4. **Lupinus albus** L., Sp. Pl., ed. 1, 721 (1753).

Syn. *Lupinus termis* Forssk., Fl. Aegypt.-Arab. 131 (1775).

Annual to 60 cm; stems erect, branched at the base; leaves to 20 cm, 6- to 9-foliolate; stipules c. 2 cm; petiole much longer than the leaflets; racemes many-flowered, exceeding the leaves; flowers c. 1.5 cm, alternate or obscurely whorled; calyx 2-lipped; corolla c. 2 times as long as the calyx; standard white-lilac; pod 4-6 x 0.8-1.4 cm, 2- to 4-seeded, pilose; seeds 1.2-1.4 cm diam., orbicular-quadrangular, yellowish to pale brown.

N, O; cultivated and escaping from cultivation, loamy and sandy soils. East Mediterranean region.

4. **Lotononis** (DC.) Eckl. & Zeyh., nom. conserv.

Herbs or shrubs; leaves mostly 3-foliolate, stipulate; racemes opposite leaves, usually capitate; calyx 3-lobed, the lateral lobes 2-fid; stamens connate into a tube; pod dehiscent, many-seeded. About 120 species, mostly southern Africa.

1. **Lotononis platycarpa** (Viv.) Pic. Serm., Webbia 7: 331 (1950).

Syns. *Lotus platycarpus* Viv., Pl. Aegypt. Dec. 4: 14 (1830).

Lotononis persica (Jaub. & Spach) Boiss., Fl. Orient. 2: 30 (1872).

Annual or short-lived perennial, to 25 cm, appressed-tomentose; stems many, branched, prostrate to ascending; leaves 3-foliolate; leaflets 3-8 mm, oblanceolate; flowers 1-5, subumbellate, subsessile; corolla yellowish-cream; standard c. 4 mm, shorter than the keel; pod c. 6 mm, c. 8-seeded; seeds reniform, wrinkled.

O (Uweinat), De, R, S; sandy deserts. Africa, Arabia, extending eastwards to Pakistan.

5. **Argyrolobium** Eckl. & Zeyh., nom. conserv.

Herbs or dwarf shrubs; leaves digitately trifoliolate; flowers in short racemose or umbellate inflorescences, opposite leaves, rarely solitary; calyx deeply 2-lipped, the upper lip 2-fid, the lower 3-toothed; corolla yellow; stamens united into a closed tube; pod linear-oblong, flattened, dehiscent. About 70 species, mainly southern Africa, tropical Africa highlands and Mediterranean region.

1. Flowers in lax head-like clusters

3. **A. saharae**

+ Flowers solitary or in 2- to 3-flowered racemes

2

2. Leaves densely silvery-appressed-hairy on both surfaces; flowers 4-6 mm, short-pedicellate, solitary

2. **A. uniflorum**

+ Leaves slightly silvery-appressed-hairy beneath, glabrous on the upper; flowers 6-9 mm, in 2- to 4-flowered racemes, rarely solitary

1. **A. arabicum**

1. **Argyrolobium arabicum** (Decne.) Jaub. & Spach, Sci. Nat. Bot., ser. 2, 19: 46 (1843).

Syns. *Cytisus arabicus* Decne., Ann. Sci. Nat. Bot., ser. 2, 4: 78 (1835).

Argyrolobium abyssinicum Jaub. & Spach, Ann. Sci. Nat. Bot., ser. 2, 19: 48 (1843).

Annual or short-lived perennial herb, woody at the base in perennial specimens, to 60 cm; stem single, much branched, ascending; leaves to 3.5 cm; leaflets 0.5-2.5 x 0.2-0.8 cm, linear-elliptic to broadly-elliptic, strigose on the lower surface; flowers solitary or in lax 2- to 4-flowered racemes; corolla 6-9 mm, ± equalling the calyx; pod 2.5-4 x 0.3-0.4 cm, oblong-linear, silvery-strigose, 6- to 12-seeded, constricted between the seeds.

S, GE; sandy and rocky hillsides and wadis. Egypt, Arabia, Iran, Red Sea Hills in Sudan, Ethiopia, Eritrea, westwards to Jebel Marra and Tibesti.

2. **Argyrolobium uniflorum** (Decne.) Jaub. & Spach, Ann. Sci. Nat. Bot., ser. 2, 19: 45 (1843).

Syns. *Cytisus uniflorus* Decne., Ann. Sci. Nat. Bot., ser. 2, 3: 265 (1835).

Argyrolobium sinaicum Bciss., Diagn. Pl. Orient. 2: 14 (1843), nom. illeg.

Dwarf shrub to 25 cm, silvery appressed-hairy; stems spreading to erect or ascending; leaves 1-2 cm; leaflets oblong-linear; flowers c. 5 mm, solitary, opposite leaves; pod c. 3 x 0.2-0.3 cm, torulose, silvery-hairy, 5- to 10-seeded; seeds c. 2 mm, smooth.

M, D, S; desert wadis and plains. North Africa, Central Sahara, East Mediterranean region, Sinai.

3. **Argyrolobium saharae** Pomel, Bull. Soc. Sci. Phys. Algérie 11:177 (1874).

Illustration: Fl. Afr. Nord 16: 10C, f. 44 (1987).

Dwarf shrub to 20 cm; stems many, much branched from the base, leaflets 5-8 x 2 mm, densely villose on both surfaces; flowers 2-5, in umbellate sessile heads or on short peduncles, opposite leaves and terminal; flowers c. 1 cm, yellow; calyx c. 7 mm; standard 7-10 x 5-8 mm, rounded, emarginate; pod 1.5-2 x 0.3 cm, 3- to 6-seeded; seeds 2.5-3 mm in diameter, suborbicular, smooth.

O (Uweinat); sandy and stony deserts. Southwest Egypt, western Sahara of Morocco.

6. **Retama** Raf., nom. conserv.

Shrubs or small trees; stems spartoid; leaves simple, small, soon deciduous; racemes lateral; corolla much longer than the calyx; stamens all connate into a closed tube; pod indehiscent or dehiscent, 1- to 2-seeded; seeds spherical, without caruncle. About 4 species, Canary Islands, Mediterranean region and Middle East.

1. Pod obovoid-ellipsoid, attenuate into a beak, the ventral suture filiform

1. **R. raetam** subsp. **raetam**

+ Pod obovoid, with a short mucro, the ventral suture dilated

2. **R. monosperma** subsp. **bovei**

1. **Retama raetam** (Forssk.) Webb & Bethel., Phyt. Canar. 3 (2, 2): 56 (1842) subsp. **raetam**

Syns. *Genista raetam* Forssk., Fl. Aegypt.-Arab. 214 (1775).

Retama duriaei (Spach) Webb, Ann. Sci. Nat. Bot., ser. 2, 20: 279 (1843).

Lygos raetam (Forssk.) Heywood, Feddes Repert. 79: 53 (1968).

Shrub 0.5-2 m; stems erect or spreading; branches green, grooved; racemes 1- to 5-flowered; corolla 1-1.5 cm, white with purplish tips; standard equalling or longer than the wings; pod 1-2 x 0.5-1 cm, indehiscent; seeds brownish.

M, D, S; desert wadis. North Africa, East Mediterranean region, Sinai.

2. **Retama monosperma** (L.) Boiss., Voy. Bot. Espagne 2: 144 (1840) subsp. **bovei** (Spach) Maire in Jahand. & Maire, Cat. Pl. Maroc 357 (1932).
 Syns. *Spartium bovei* Spach, Ann. Sci. Nat. Bot., ser. 2, 19: 297 (1843).
Retama bovei (Spach) Webb, Otia Hispan., ed. 2, 24 (1853).

Shrub to 3 m; differs from *R. raetam* subsp. *raetam* by the larger flowers 1.5-1.7 cm; standard shorter than the wings; pod 1-1.5 x 1 cm; seeds reddish-brown or olive-green.

M; sand dunes. Egypt, Algeria, Morocco.

7. **Ononis** L.

Shrubs or herbs; leaves usually 3-foliolate; stipules leaf-like; flowers axillary or in terminal leafy racemes, spikes or panicles; corolla pink, purple, yellow or white; stamens united at least at the base; pod dehiscent, exerted from or enclosed in the calyx; seeds smooth or tuberculate. About 75 species, Canary Islands, Europe, Mediterranean region to Iran, Ethiopia.

- | | |
|---|------------------------|
| 1. Shrubs | 2 |
| + Annuals | 3 |
| 2. Leaves mostly 1-foliolate, sessile or subsessile; stipules sheathing | 2. O. vaginalis |
| + Leaves mostly 3-foliolate, petiolate; stipules not sheathing | 1. O. natrix |
| 3. Flowers pink or pink and white | 4 |
| + Flowers white or yellow | 7 |
| 4. Pod pendent, 9- to 15-seeded | 3. O. reclinata |
| + Pod not pendent, 2- to 6-seeded | 5 |
| 5. Stipules of floral leaves white, conspicuous; calyx-tube glabrous, striate, white in fruit | 6. O. mitissima |
| + Stipules of floral leaves green, inconspicuous; calyx-tube glandular-pubescent, not white in fruit | 6 |
| 6. Leaflets of middle cauline leaves with 10-15 teeth; flowers in dense spikes, the standard 6-7 mm; pod 1- to 3-seeded | 9. O. diffusa |
| + Leaflets of middle cauline leaves with 4-6 teeth; flowers in lax spikes, the standard 4-5 mm; pod 2- to 5-seeded | 8. O. serrata |
| 7. Flowers 1.3-2 cm | 5. O. pubescens |
| + Flowers 0.7-1 cm | 8 |
| 8. Leaves 0.5-1.5 cm, subsessile, mostly 1-foliolate; pod 7-9 mm | 7. O. variegata |
| + Leaves 1-5 cm, petiolate, mostly 3-foliolate; pod 1-1.8 cm | 4. O. sicula |

1. **Ononis natrix** L., Sp. Pl., ed. 1, 717 (1753).

Shrubby perennial to 60 cm, glandular-hairy; stems rigid, erect or ascending, leafy; leaves 1-5 cm, 3-foliolate, the upper sometimes 1-foliolate; stipules \pm equalling the petiole; leaflets variable in shape and size, serrate; peduncles 1-flowered, distinctly aristate; flowers 1-1.6 cm, in terminal, loose, leafy racemes; corolla yellow; pod 1.2-1.8 cm, cylindrical, beaked, glandular-hairy; seeds c. 2 mm, subglobose, tuberculate.

Two subspecies occur in Egypt:

1. Leaflets broad, 5-10 mm wide
+ Leaflets narrow, 0.5-3 mm wide

subsp. **natrix**
subsp. **stenophylla**

subsp. **natrix**

M; stony sub-coastal desert.

subsp. **stenophylla** (Boiss.) Sirj., Beih Centralbl. 49 (2): 470 (1932).

Syn. *Ononis natrix* var. *stenophylla* Boiss., Fl. Orient. 2: 59 (1872).

S (El Arish-Rafah region); maritime coastal sand dunes.

Area of the species: Mediterranean region, Sinai.

2. **Ononis vaginalis** Vahl, Symb. Bot. 1: 53 (1790).

Syn. *Ononis vestita* Viv., Fl. Libyc. Spec. 40 (1824).

Shrub to 50 cm, woolly-canescens glandular-viscid; stems rigid, erect; branches ascending; leaves 1-(-3)-foliolate; stipules sheathing, imbricate, conspicuous; leaflets small, subsessile; peduncles 1-flowered, exceeding the leaves; flowers 0.8-1.6 cm; corolla yellow with purplish stripes; pod 1-1.6 cm, 5- to 8-seeded; seeds c. 2 mm in diameter, tuberculate.

M; coastal sand. East Mediterranean region, North Africa.

3. **Ononis reclinata** L., Sp. Pl., ed. 2, 1011 (1763).

Annual to 20 cm, densely covered with simple, short glandular hairs; stems erect or ascending; leaves 1-2 cm, mostly 3-foliolate, the uppermost and some of the lower 1-foliolate; stipules shorter than the petiole; peduncles 1-flowered, not aristate; flowers 5-8 mm, pink, in dense, terminal leafy racemes; pod pendent, 5-8 x 2.5-4 mm, oblong; seeds orbicular-reniform, strongly tuberculate.

N, M, De, S; alluvial soils, sandy and stony deserts. Macaronesian Islands, Wales, Mediterranean region to Iran, Ethiopia.

4. **Ononis sicula** Guss., Cat. Pl. Hort. Boccadifalco 78 (1821).

Annual to 20 cm, glandular-hispid; stems erect or ascending; leaves 3-foliolate, the lowermost sometimes 1-foliolate; stipules equalling or slightly longer than the petiole; peduncles 1-2.5 cm, axillary, with a 5-8 mm arista; flowers 7-9 mm; corolla yellow,

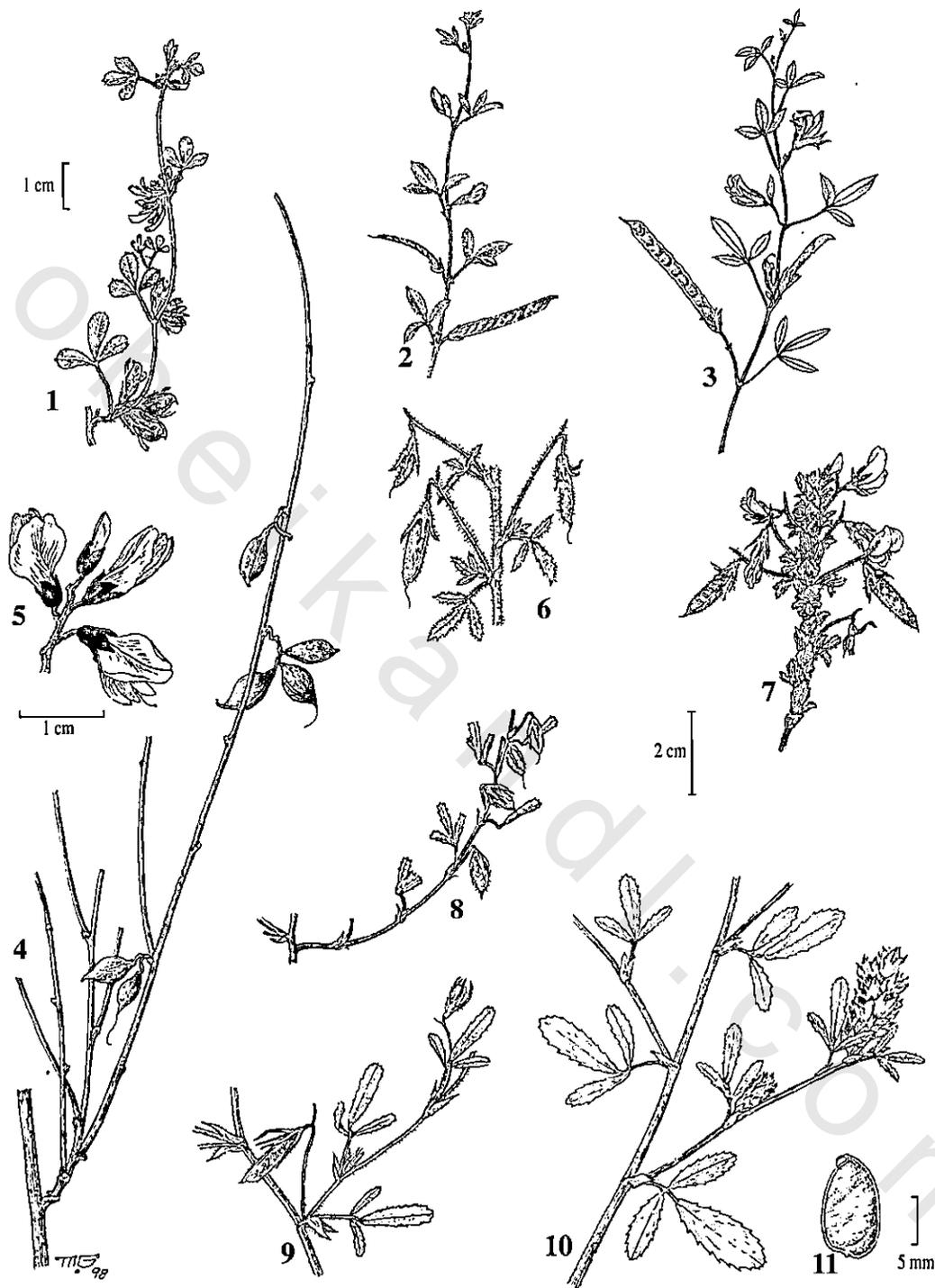


Plate 45. LEGUMINOSAE: *Lotononis platycarpa* 1, flowering and fruiting branch. *Argyrolobium uniflorum* 2, flowering and fruiting branch. *Argyrolobium arabicum* 3, flowering and fruiting branch. *Retama raetam* 4, fruiting branch; 5, flowering branchlet. *Ononis natrix* 6, fruiting branch. *Ononis vaginalis* 7, flowering and fruiting branch. *Ononis reclinata* 8, fruiting branch. *Ononis sicula* 9, flowering and fruiting branch. *Ononis mitissima* 10, fruiting branch; 11, pod. All drawings to the same scale except enlarged parts (scale given).

shorter than the calyx; pod 1-1.8 cm, 10- to 24-seeded, pendent; seeds 1.25 mm, reniform-orbicular, tuberculate.

M, S; coastal sand and stony deserts. Southeast Mediterranean region, eastwards to Iran.

5. ***Ononis pubescens*** L., Mant. Alt. 267 (1771).

Annual to 50 cm, glandular-viscid; stems erect; leaves 2.5-7 cm, mostly 3-foliolate; stipules to 1.8 cm; flowering branches corymbose; flowers 1.3-2 cm, yellow, solitary, on short peduncles; pod 1-1.2 cm, 1- to 3-seeded, deflexed, hairy; seeds c. 3 mm, subglobular, smooth.

S; inland deserts. Mediterranean region, Sinai.

6. ***Ononis mitissima*** L., Sp. Pl., ed. 1, 717 (1753).

Annual to 75 cm, sparsely glandular-hairy; stems erect or ascending; leaves 2-6 cm, 3-foliolate, the uppermost often simple; stipules adnate to the petiole, striate, glabrescent; flowers c. 1 cm, in dense spicate inflorescences; corolla slightly longer than the calyx, pink, drying blue; pod 6-8 mm, ovoid, \pm equalling the persistent calyx, 2- to 3-seeded; seeds 1.5 mm, tuberculate.

N, M, De; alluvial soils and sandy desert plains. Mediterranean region.

7. ***Ononis variegata*** L., Sp. Pl., ed. 1, 717 (1753).

Annual to 15 cm, glandular-hairy; stems procumbent to ascending; leaves 0.5-1.5 cm, mostly 1-foliolate, rarely 3-foliolate; stipules 2.5-5 mm, adnate to the short petiole; leaflets and stipules prominently nerved; flowers c. 1 cm, solitary on peduncles shorter than the calyx, in leafy racemose inflorescences; corolla yellow, 2 times as long as the calyx; pod c. 8 mm, oblong-ovoid, 7- to 12-seeded; seeds smooth.

S (Rafah); littoral sandy soil. Mediterranean region, Sinai.

8. ***Ononis serrata*** Forssk., Fl. Aegypt.-Arab. 130 (1775).

Syns. *Ononis glaucescens* Pomel, Bull. Soc. Sci. Phys. Algérie 11: 167 (1874).

Ononis marmorata Murb., Acta Univ. Lund, ser. 2, 18 (3): 58 (1922).

Annual to 40 cm, glandular-hairy; stems decumbent to ascending; leaves 1-3 cm, 3-foliolate except the 1-foliolate floral leaves; leaflets of middle cauline leaves serrate, with 4-6 teeth; stipules inconspicuous; flowers 0.6-1.2 cm; corolla slightly longer than the calyx, pink with a white keel; pod 5-7 x 3-4 mm, \pm equalling the persistent calyx, 3- to 5-seeded; seeds c. 1 mm diam., strongly tuberculate.

M, De, S; sandy sub-coastal soils, desert wadis and plains. Canary Islands, Southwest Europe, North Africa, East Mediterranean region, Sinai, Arabia, Iraq.

9. ***Ononis diffusa*** Ten., Fl. Napol. 1: XLI (1811).

Like *O. serrata*, but leaflets of middle cauline leaves serrulate with 10-15 teeth, flowers in dense spicate inflorescences, the standard 6-7 mm; pod 1- to 3-seeded; seeds c. 2 mm diam.

N (Cairo); alluvial soil. Mediterranean region.

8. *Trigonella* L.

Annual (our species) or perennial herbs, rarely shrubs, usually with strong smell; leaves 3-foliolate, stipulate; stipules adnate to the petiole; flowers in axillary racemes, umbellate, spicate or \pm sessile in the leaf axils, rarely solitary; calyx campanulate, 5-toothed; corolla yellow, white or lilac; petals free or wings adhering to the keel by a tooth; stamens diadelphous; pods cylindrical or compressed, dehiscent or indehiscent, 1-many-seeded, sometimes beaked; seeds smooth or tuberculate. About 50 species, mainly Mediterranean region and southern Africa.

- | | |
|---|-----------------------------|
| 1. Pod flat, papery, the valves membranous with ciliate or dentate margins | 2 |
| + Pod cylindrical or slightly compressed, the valves hard | 3 |
| 2. Pod obliquely ovate, 0.8-1.2 cm diam., the margin dentate | 11. <i>T. schlumbergeri</i> |
| + Pod oblong, 0.5-0.8 cm diam., the margin spiny ciliate | 1. <i>T. arabica</i> |
| 3. Flowers solitary | 2. <i>T. berythea</i> |
| + Flowers and fruits in racemes, umbels or clustered in the leaf axils | 4 |
| 4. Flowers and fruits sessile or subsessile, directly borne in the leaf axils; peduncles very short or absent | 5 |
| + Flowers and fruits in racemes or umbellate, long-pedunculate | 8 |
| 5. Corolla shorter than the calyx; pod 2-3 mm, 1- to 2-seeded | 4. <i>T. occulta</i> |
| + Corolla longer than the calyx, pod 4-8(-10) mm, 3- to many-seeded | 6 |
| 6. Pods spreading, curved or wavy, tapering towards the apex | 7 |
| + Pods deflexed, straight, apex rounded | 6. <i>T. laciniata</i> |
| 7. Pods stellary spreading, curved, the valves with prominent transverse nerves | 5. <i>T. stellata</i> |
| + Pods wavy, sharply folded, eel-like | 3. <i>T. anguina</i> |
| 8. Pod tapering into a long seedless acute beak | 10. <i>T. cylindracea</i> |
| + Pod not tapering into a seedless beak | 9 |
| 9. Pod falcate or semicircular | 9. <i>T. hamosa</i> |
| + Pod straight or slightly curved | 10 |
| 10. Pod 0.7-1.2 x 0.15-0.2 cm, the valves with prominent oblique transverse ridges and longitudinal nerves | 8. <i>T. maritima</i> |
| + Pod 4-7 x 0.25-0.3 cm, the valves not ridged | 11 |
| 11. Leaves few-toothed at the apex, pods erect | 7. <i>T. media</i> |
| + Leaves sharply dentate, laciniate; pods deflected | 6. <i>T. laciniata</i> |

1. **Trigonella arabica** Delile, Voy. Arabie Pétrée 86 (1830).

Annual to 40 cm, glabrescent; stems erect or ascending; leaves 1-2 cm; stipules dentate-incised; leaflets 0.5-1.2 x 0.2-0.8 cm, entire or few-toothed at the apex; peduncle exceeding the leaves; racemes 3- to 5-flowered, umbellate; flowers 8-9 mm; corolla white or rarely cream; pod 1.2-2.5 x 0.4-0.6 cm, oblong-linear, transversely nerved, 2- to 7-seeded; seeds compressed, minutely tuberculate.

M, S; sandy coastal and subcoastal soils, desert plains. East Mediterranean region, Sinai.

2. **Trigonella berythea** Boiss. & Blanche in Boiss., Diagn. Pl. Orient., ser. 2, 2: 10 (1856).

Annual to 25 cm, glabrescent or hairy; stems few or single-stemmed, erect or ascending; stipules acute; leaflets 1-2.5 x 0.8-1.5(-2) cm, obovate-cuneate, denticulate at the truncate apex; flowers 1-1.5 cm; corolla bluish; pod 5-10 x 0.5 cm, glabrous or slightly pilose, with parallel longitudinal nerves, tapering into a c. 3 cm beak; seeds 3-4 x 2.5 mm, ovoid, minutely tuberculate.

M, S; sandy soils. East Mediterranean region; Sinai.

NOTE: Similar and closely related to the commonly cultivated Fenugreek *T. foenum-graecum* L.

3. **Trigonella anguina** Delile, Descr. Egypte, Hist. Nat. 254, t. 38, 2 (1814).

Annual to 25 cm, glabrous to sparsely white-hairy; stems prostrate, many from the base, leaves 1.5-3 cm; stipules 3-5 mm, acuminate; flowers 3-4 mm; corolla yellow; pod 4-8 mm, sharply folded, 2- to 6-seeded; seeds 1.25-1.5 mm, ovoid, smooth.

N, M, D, S; sandy deserts, alluvial soils, silty depressions. Macaronesian Islands, North Africa, Sinai, Arabia, southern Iran, Pakistan; introduced into tropical Africa.

4. **Trigonella occulta** Ser. in DC., Prodr. 2: 185 (1825).

Annual to 20 cm; sparingly pilose to densely villous; stems erect or ascending; stipules 4 mm, conspicuous, sharply dentate-laciniate; leaflets dentate-incised; calyx 3-4 mm, deeply lobed, lobes narrowly lanceolate, rigid, spiny-tipped; corolla shorter than the calyx; pod 2-3 mm, ovoid, 1- to 2-seeded.

N, M, Dw; sandy soils. Endemic.

5. **Trigonella stellata** Forssk., Fl. Aegypt.-Arab. 140 (1775).

Annual to 35 cm, glabrous or glabrescent; stems many, prostrate, often stiff at the base; leaves 2-5(-8) cm; stipules 2-3 mm, semisagittate, the lower denticulate; leaflets 0.4-1 x 0.3-0.8 cm, obovate-cuneate to broadly deltoid; flowers c. 4 mm; corolla about twice as long as the calyx, yellow; pod 5-8 x 1-2 mm, slightly compressed, tapering towards the apex; seeds c. 1.5 mm, ovoid, smooth.

N, M, D, R, S. North Africa, extending to Macaronesia, East Mediterranean region, Sinai, Arabia, Iraq, Iran.

6. **Trigonella laciniata** L., Sp. Pl., ed. 2, 1095 (1763).

Annual to 30 cm, glabrous or glabrescent; stems erect or ascending, many from the base, or simple and branched above; leaves 1.5-3 cm; stipules 3-5 mm, lanceolate-acuminate, serrate-laciniate at the base; leaflets 0.5-1.2 x 0.3-0.6 cm, obovate-cuneate, sharply serrate-denticulate towards the truncate apex; flowers on short 3- to 10-flowered peduncles or directly borne in the leaf axils; corolla slightly longer than the calyx, yellow; pod 6-8 x 2.5-3 mm, oblong, slightly compressed, reticulate, 6- to 10-seeded; seeds c. 1.5 mm, ovate, smooth.

N, O, M, D, S; sandy soils. Egypt, Sudan, Saudi Arabia.

7. **Trigonella media** Delile, Descr. Egypte, Hist. Nat. 71 (1814).

Annual to 20 cm; leaflets obcordate-deltoid, few toothed at the apex; stipules slightly to deeply dissected; otherwise similar to *T. laciniata* but flowers 3-6 in a pedunculate umbellate racemes; pod erect, subcylindrical.

N (Cairo); alluvial soil. Endemic.

8. **Trigonella maritima** Poir. in Lam., Encycl. Suppl. 5: 361 (1817).

Annual to 30 cm, glabrous; stems procumbent; leaves 1.5-2.5 cm; stipules semisagittate, sharply dentate; leaflets 0.5-1 x 0.3-0.6 cm, deltoid to obcordate, denticulate; flowers 5-7 mm, in 5-10-flowered umbellate racemes; corolla 2-3 times as long as the calyx, yellow; pod 0.6-1.2 x 0.2 cm, deflexed, slightly compressed, curved to arcuate, tapering at the apex, appressed-hairy, with longitudinal nerves and transverse oblique ridges; seeds 1 mm, ovoid, smooth.

N (around the lakes), M, S; sandy and alluvial soils. Mediterranean region, Sinai.

9. **Trigonella hamosa** L., Syst. Nat., ed. 10, 1180 (1759).

Syns *Trigonella labra* Thunb., Prodr. Pl. Cap. 137 (1800).

Annual to 35 cm, glabrous to glabrescent; stems erect to procumbent; leaves 1-4.5 cm, stipules 2-3.5 mm, irregularly serrate; leaflets 0.5-1.5 x 0.4-1.2 cm, obovate- to cuneate-oblong, denticulate towards the truncate or retuse apex; peduncle 1.5-3 cm; flowers 4-5 mm, in a 6- to 12-flowered subumbellate raceme; corolla about twice as long as the calyx, yellow; pod 0.8-1.2 cm, subcylindrical, falcate to semicircular, reticulate-veined, 8- to 16-seeded; seeds 1.25 mm, ovoid, smooth.

N, O, M, S; cultivated ground, sandy soils. East Mediterranean region, Sinai, Arabia to Afghanistan and India.

10. **Trigonella cylindracea** Desv., J. Bot. Agric. 3: 77 (1814).

Annual to 25 cm, appressed-hairy; stems decumbent; leaves 0.8-2 cm; stipules minute; leaflets 3-8 x 3-5 mm, obovate-cuneate to oblong; peduncle 1.5-3.5 cm; flowers 4-6 mm, in a 6- to 10-flowered umbellate raceme; corolla about twice as long as the calyx, yellow; pod 1.5-2 cm, cylindrical, arcuate, tapering into a long seedless acute beak, 2- to 5-seeded; seeds 2.5 mm, oblong-cylindrical, smooth.

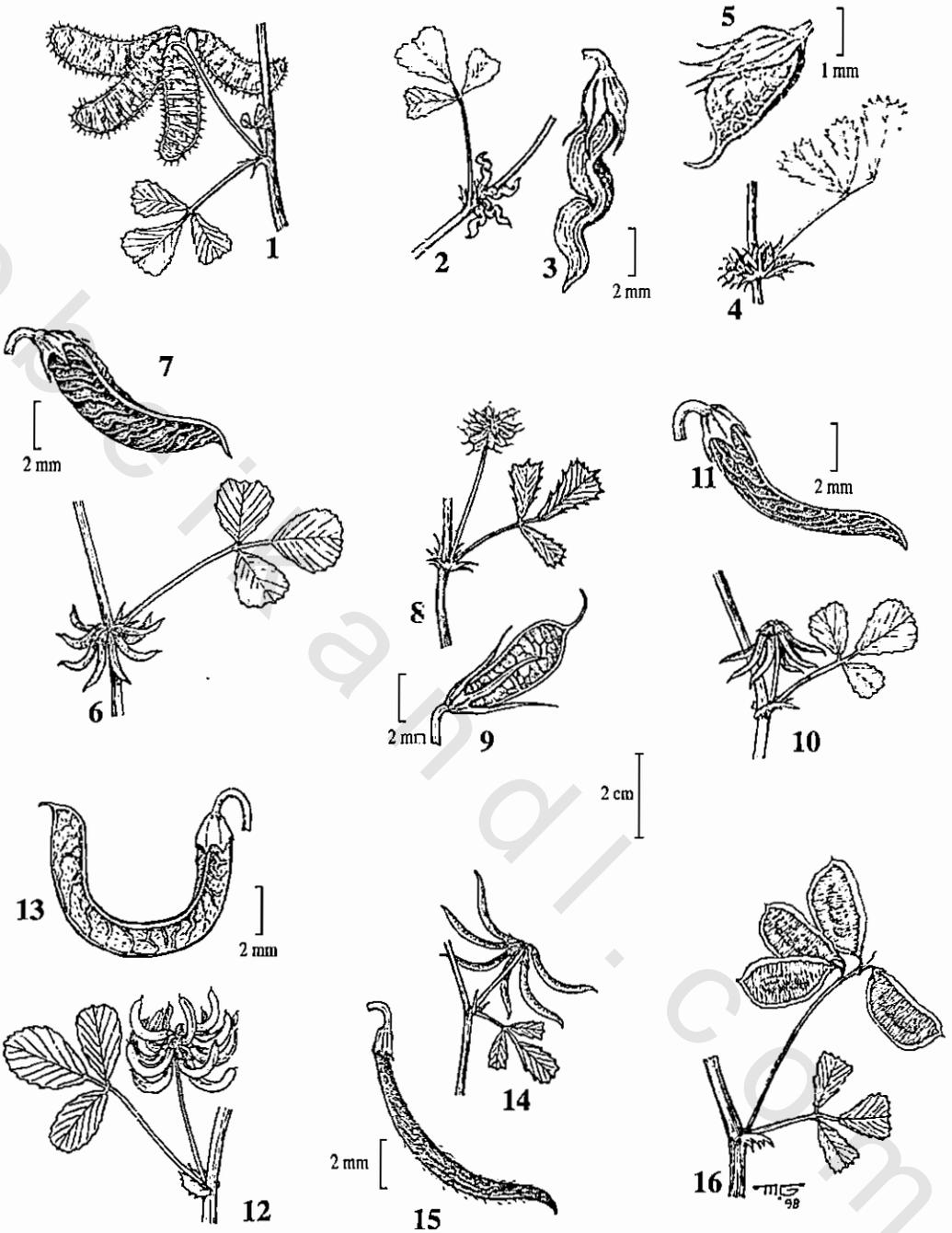


Plate 46. LEGUMINOSAE: *Trigonella arabica* 1, fruiting branch. *Trigonella anguina* 2, fruiting branch; 3, pod. *Trigonella occulata* 4, fruiting branch; 5, pod. *Trigonella stellata* 6, fruiting branch; 7, pod. *Trigonella laciniata* 8, fruiting branch; 9, pod. *Trigonella naritima* 10, fruiting branch; 11, pod. *Trigonella hamosa* 12, fruiting branch; 13, pod. *Trigonella cylindracea* 14, fruiting branch; 15, pod. *Trigonella schlumbergeri* 16, fruiting branch. All drawings to the same scale except enlarged parts (scale given).

M, S; sandy deserts. East Mediterranean region, Sinai, Saudi Arabia, Iran.

11. **Trigonella schlumbergeri** Boiss., Fl. Orient. Suppl. 163 (1888).

Annual to 20 cm, almost glabrous; stems erect to ascending or procumbent; leaves 1-3 cm; stipules minute; leaflets 4-7 x 3-7 mm; obovate-deltoid, dentate towards the truncate apex; flowers c. 5 mm on 2- to 4-flowered racemes; corolla white; pod 1-1.8 x 0.8-1.2 cm, papery, transversely-striate; seeds 1 mm, minutely-tubercled.

S; sandy and stony deserts. East Mediterranean region, Sinai.

9. **Medicago** L.

Annual and perennial herbs (our species) or rarely shrubs, glabrous to pubescent, sometimes glandular hairy; leaves 3-foliolate, stipulate; flowers in axillary racemes, heads or umbels, or solitary; calyx-teeth subequal; corolla yellow or orange, rarely violet or white; standard with major basal vein, usually with more than 3 branches near the base; horn of wing large, c. $\frac{1}{3}$ as long as the wing limb; keel very strongly adherent to the wing by a wing spur in a keel invagination; androecium with apex of fused portion of anther column arched, alternating free portions of filaments often relatively thick; stigma fungiliform; style always short; fruits diverse, short or long, straight, curved or coiled, cylindrical, compressed or flat; sutures spiny, tuberculate, winged, fimbriate or without appendages; seeds usually smooth, sometimes rugose or papillose. 85 species, Mediterranean region, West and Central Asia, Ethiopia, southern Africa.

- | | |
|---|---------------------------|
| 1. Pod cylindrical or slightly compressed, linear | 2 |
| + Pod spirally coiled, falcate, reniform or ovoid | 3 |
| 2. Raceme 6- to 15(-20)-flowered, pod 0.8-1.5 cm | 16. M. monspeliaca |
| + Raceme 1- to 6(-8)-flowered, pod 2-4.5 cm | 17. M. polyceratia |
| 3. Pod reniform or ovoid, 1-2-seeded | 4 |
| + Pod spirally coiled, several-seeded | 5 |
| 4. Racemes 15- to 20(-30)-flowered; pod 2-3 mm, 1-seeded, with prominent reticulate veins | 2. M. lupulina |
| + Racemes 1-flowered; pod subterranean, 6-9 mm, 2-seeded, appressed-tomentose | 18. M. hypogaea |
| 5. Perennials, woody at the base; racemes 5-15(-25)-flowered | 6 |
| + Annuals; racemes 1- to 6-flowered | 7 |
| 6. Plant glabrous or appressed-hairy; flowers blue, purple or lilac | 15. M. sativa |
| + Plant woolly-canescens; flowers yellow or orange-yellow | 1. M. marina |
| 7. Pod 1.2-1.5(-2) cm diam., unarmed; seeds tuberculate | 4. M. orbicularis |
| + Pod 1-1.2(-1.5) cm diam., armed with marginal spines; seeds smooth | 8 |
| 8. Pod 1-3 mm diam., the spines vertical | 3. M. coronata |
| + Pod 0.3-1.2 mm diam., the spines horizontal | 9 |

9. Spines as long as or longer than the diameter of the pod, usually hooked at tip 10
 + Spines much shorter than the diameter of the pod, not hooked at tip 11
10. Stipules coarsely toothed or lacinate; racemes 1- to 2(-3)-flowered; coil surface of the pod with 6-16 prominent S-shaped radial veins, some of them branched 14. *M. laciniata*
 + Stipules entire or obscurely denticulate; racemes 3- to 6-flowered, coil surface of the pod with 6-8 strongly curved radial veins 13. *M. minima*
11. Pod and spines densely clothed with multicellular glandular and eglandular hairs 12
 + Pod and spines glabrous or thinly clothed with simple hairs 13
12. Plant hairy; stipules 2.5-3.5 cm; pod 0.5-1(-1.5) cm diam., discoid, cylindrical, strongly indurate at maturity; coil surface with c. 15 strongly bent radial veins 10. *M. rigidula*
 + Plant sparingly hairy or glabrous; stipules 0.8-1.5 cm; pod 1-1.5(-1.7) cm diam., globular to broadly ovoid, not indurate at maturity; coil surface with distinct c. 7 anastomosing veins 12. *M. intertexta* var. *ciliaris*
13. Leaflets pilose or pubescent 14
 + Leaflets glabrous or subglabrous 16
14. Inflorescence 3- to 8-flowered, subcapitate 11. *M. turbinata*
 + Inflorescence 1- to -3-flowered 15
15. Pod 3-8 mm thick, 3-6 mm diam., glabrous; pod coils very compact; spines spreading or horizontal 8. *M. littoralis*
 + Pod 0.6-1.2 cm thick, 0.7-1.2 cm diam., pilose; pod coils not compact; spines forming a right angle with the coil surface and closely appressed to the pod 9. *M. truncatula*
16. Leaflets with a conspicuous dark blotch 6. *M. arabica*
 + Leaflets without a dark blotch 17
17. Racemes shorter than the leaves, deflexed in fruit; flowers bright yellow; coil surface of the pod distinctly reticulate; spines horizontal, thick, or reduced to tubercles 5. *M. polymorpha*
 + Racemes longer than the leaves, erect, in fruit; flowers orange-yellow; coil surface with c. 12 distinct anastomosing radial veins; spines \pm appressed to pod, grooved 7. *M. granadensis*

1. *Medicago marina* L., Sp. Pl., ed. 1, 779 (1753).

Perennial herb 15-35 cm, woolly-canescens; stems ascending or prostrate; leaves 1-2 cm; stipules 3-5 mm, subentire; leaflets 0.7-1.4 x 0.4-0.7 cm, obovate-cuneate, dentate towards the mucronulate apex; peduncle 1.5-2.5 cm; racemes 5- to 12-flowered; pedicels equalling the narrowly-linear bracts; flowers 0.8-1 cm; calyx 4-5 mm, canescent; corolla 0.8-1 cm, yellow to orange-yellow; pod 4.5-6 mm diam., discoid or cylindrical, canescent; coils 2-3, loose, unarmed or with short spines; seeds 3 x 2 mm, brown.

M, S; coastal sands. Mediterranean region, Sinai.

2. *Medicago lupulina* L., Sp. Pl., ed. 1, 779 (1753).

Annual or short-lived perennial herb, 15-50 cm, pubescent; stems decumbent to ascending; leaves 1.5-3 cm; stipules 4-6 mm, lanceolate, dentate to entire; leaflets 0.5-1.5 x 0.3-0.7 cm, obovate, cuneate, apiculate, serrulate towards the apex; peduncle 1-1.5 cm, elongating in fruit; racemes 15- to 20(-30)-flowered, spicate; pedicels 1-1.5 mm; flowers 2-4 mm, yellow, pod 2-2.8 mm, with a single coil, 1-seeded, reniform, spineless, reticulate, black when ripe; seeds brownish-yellow.

M, O, S; moist ground, edges of cultivation. Mediterranean region, Europe, Asia; grown for fodder and naturalized in many temperate regions.

3. *Medicago coronata* (L.) Bartal., Cat. Piante Siena 61 (1776).

Syn. *Medicago polymorpha* L. var. *coronata* L., Sp. Pl., ed. 1, 780 (1753).

Annual herb 10-25 cm; stems much branched from the base, with spreading eglandular or glandular hairs; stipules 1.5-3.5 cm; petiole 0.5-2 cm; leaves 1.5-4 cm; leaflets 3-8 x 2-6 mm, broadly obovate, dentate, pilose on both surfaces; peduncle 1.5-3.5 cm; racemes capitate, 5- to 15-flowered; flowers 2-3 mm; corolla yellow, about twice as long as the calyx; pod 1-3 mm diam., shortly cylindrical, coils 2-3, loose, spiny; spines 1-1.5 mm, vertical on both sides of the pod; seeds 1-3 in each pod, 2-3 mm, yellowish brown.

M, Dw (south of Mersa Matruh), S; waste ground and hillsides. Mediterranean region, Sinai, Iraq.

4. *Medicago orbicularis* (L.) Bartal., Cat. Piante Siena 60 (1776).

Syns. *Medicago ploymorpha* var. *orbicularis* L., Sp. Pl., ed. 1, 779 (1753).

Medicago marginata Willd., Enum. Pl., Hort. Berol. 802 (1809).

Annual herb 20-50 cm, almost glabrous; stems many from the base, procumbent, quadrangular, grooved; stipules 3.5-4.5 mm, finely laciniate; petiole 1-3.5 cm; leaves 2-4.5 cm; leaflets 0.5-1.2 x 0.4-1 cm, cuneate-obovate, denticulate, the apex truncate-apiculate or retuse; terminal leaflet petioliolate; peduncles 1-2 cm, elongating in fruit, 1- to 2(-4)-flowered; pedicels 1.5 mm; bracts minute, subulate; flowers 4-5.5 mm, yellow, calyx 1/2 as long as the corolla; pod 1.2-1.5 cm diam., discoid, glabrous, 3- to 4 (-6)-coiled, unarmed, surface of coils reticulate-veined; seeds 3-6 in each coil, c. 2.5 mm, trigonous, yellowish-brown, tuberculate.

N, M, S; weed of cultivation and roadsides. Mediterranean region, Sinai, Arabia, Iran, Ethiopia; adventive in temperate regions.

5. *Medicago polymorpha* L., Sp. Pl., ed. 1, 779 (1753).

Syns. *Medicago nigra* Krock., Fl. Siles 2(2): 224 (1790).

Medicago denticulata Willd., Sp. Pl., ed. 4, 3: 1414 (1802).

For full synonymy, see Greuter *et al.* Med-Checklist 4: 143 (1989).

Annual herb 15-40 cm, glabrous, glabrescent at first; stems many at the base, branched above, procumbent or ascending, quadrangular, grooved; stipules 6-9 mm, laciniate; petiole 1-5.5 cm; leaves 2-6.5 cm; leaflets 0.5-1.5 x 0.4-1.2 cm, cuneate-obovate, denticulate towards the truncate-or retuse-apiculate apex; peduncles 0.5-1.8 cm, 2- to 6 (-8)-flowered; pedicels 1 mm; bracts 1 mm, acuminate; calyx 2-2.5 mm; corolla 4-5 mm,

yellow, standard longer than the wings; pod 4-6 mm diam., discoid, armed; spines short or reduced to tubercles, or long, not thickened at the base, in one plane; coils 2-5, loose coil surface distinctly reticulate; seeds 2.75 x 1.5 mm, 1-2 in each coil, yellowish-brown, smooth.

N, O, M, D, S; cultivated, waste and moist ground. Mediterranean region, Asia; introduced and naturalized in many temperate regions.

NOTE: According to Heyn (The annual species of *Medicago*. Scripta Hierosolymitana 12, 1963), three varieties of *M. polymorpha* are recognized, based mainly on the size of the pod, the presence or absence of spines on the pod, and the number of coils. Zohary (Fl. Palaest. 2: 146, 1972) lists the 3 varieties and provides a key to separate them:

var. polymorpha

var. **vulgaris** (Benth.) Shinnars, Rhodora 58: 310 (1956) emend. Heyn, Scr. Hieros. 75 (1963).

var. **brevispina** (Benth. emend. Heyn) Heyn, Scr. Hieros. 77 (1963).

1. Pod not spiny; margin of coils smooth or tuberculate
+ Pod spiny

var. **bervispina**
2

2. Broadest coil 0.5-1 cm diam., coils 4-6, if less than 4
then coil over 6 mm diam.

+ Broadest coil 2.5-4.5 mm diam., coils 1 1/2-3 1/2

var. **polymorpha**
var. **vulgaris**

Townsend (Fl. Iraq 3: 130-135, 1974) concludes that all these varieties are sympatric and grade into one another. He adds that a somewhat greater development of spines is observed in the Iraqi material than by Heyn (*l. c.*) and this is where the sharpest demarcation between varieties appears to lie. As to the Egyptian material, only some specimens could be referred to these varieties.

6. Medicago arabica (L.) Huds., Fl. Angl., ed. 1, 288 (1762).

Syns. *Medicago polymorpha* var. *arabica* L., Sp. Pl., ed. 1, 780 (1753).

Medicago maculata Willd., Sp. Pl., ed. 4, 3: 1412 (1802).

Annual herb 15-50 cm; stems procumbent or ascending, branched from the base, glabrous or sparsely hairy with multicellular hairs; stipules 5-9 mm, dentate, acuminate; leaflets 1-2.5 x 0.5-2 cm, cuneate-obovate, denticulate, towards the obtuse or emarginate-apiculate apex, glabrous or subglabrous, usually with a dark purple blotch; peduncles 1-2 cm, shorter than the petiole, bearing 2-4 flowers; pedicels 1 mm; bracts 1 mm; calyx 3-4 mm; corolla 5 mm, yellow; pod 5-7 mm diam., 5-7 mm thick, cylindrical or subglobose, glabrous or thinly clothed with simple hairs; coils 3-6, the dorsal margin spinose; spines 2-4 mm, spreading, grooved; seeds 3 x 1.5 mm, 1-2 in each coil, oblong-ellipsoid, yellowish-brown, smooth.

M, S; waste ground and roadsides. Mediterranean region, Europe, Asia; introduced to temperate regions.

7. **Medicago granadensis** Willd., Enum. Pl. Hort. Berol. 803 (1809).

Syn. *Medicago galilaea* Boiss., Diagn. Pl. Orient. 9: 10 (1849).

Annual herb 15-35 cm, hairy; stems procumbent to ascending, branched; stipules ovate-oblong, dentate-laciniate; leaflets 1-2 x 0.5-0.9 cm, obovate to elliptic, dentate-serrate towards the apiculate apex, glabrous or subglabrous; peduncles 2-4.5 cm, bearing 2-5 flowers; calyx hairy; corolla 4-5 mm, yellow to orange-yellow; pod 5-8 mm thick, 0.8-1.2 cm diam., barrel-shaped, coils 5-7, coil surface with distinct c. 12 anastomosing radial veins; spines 1-2 mm, grooved, slightly appressed to pod; seeds 4-5 mm, 1-2 in each coil, dark brown, smooth.

N; weed of cultivation. East Mediterranean region.

8. **Medicago littoralis** Rohde ex Loisel., Not. Fl. France 118 (1810).

Syns. *Medicago arenaria* Ten., Cat. Pl. Hort. Neapol. App. 1: 66 (1815).

Medicago cylindracea DC., Cat. Pl. Hort. Monsp. 123 (1813).

For full synonymy, see Greuter *et al.* Med-Checklist 4: 139 (1989).

Annual herb 10-25 cm hairy; stems prostrate or ascending branched from the base; stipules 3-4.5 mm, lanceolate, deeply dentate-laciniate; petiole 0.5-1.5 cm; leaflets 3-8 x 2-6 mm (oasis variant to 1.6 cm wide), obovate, appressed pilose on both surfaces; apex truncate or emarginate, sharply denticulate; racemes 1- to 3-flowered, the peduncles 0.5-1.2 cm; calyx hairy; corolla 3-5 mm, yellow or orange-yellow; pod 3-8 mm thick, 3-6 mm diam., glabrous; short-cylindrical or discoid, flat on both ends, coils 2-6, very compact, spinose; spines 1-4 mm, spreading or horizontal; seeds 1-2 in each coil, 2-3 x 1.5-2 mm, brownish-yellow, smooth.

N, M, O, D, S; littoral sand, stony wadis and plains. Mediterranean region, Sinai, Macaronesia.

NOTE: Two varieties are known: var. *littoralis*, pod spinose, spines 1-4 mm; and var. *inermis* Moris, Fl. Sard. 1: 439 (1837), pod unarmed or with very short tubercles, not spinose. Apparently most of the Egyptian plants belong to var. *littoralis*, but intermediate variants are known, including one from the oases with broad leaflets.

9. **Medicago truncatula** Gaertn., Fruct. Sem. Pl. 2: 350 (1791).

Syns. *Medicago tribuloides* Desr. in Lam., Encycl. 3: 637 (1792).

Medicago uncinata Willd., Sp. Pl., ed. 4, 3: 1417 (1802).

Annual herb 10-25 cm, hairy; stems many from the base, quadrangular, grooved; stipules 4-6 mm, lanceolate, acuminate; leaves 1.5-3.5 cm; petiole 1-4 cm; leaflets 0.5-1.2 x 0.3-1 cm, obovate-cuneate, denticulate towards the apex, appressed-hairy on both surfaces, terminal leaflet petioliolate; peduncles 0.5-2.5 cm, 1- to 3-flowered; pedicels 1 mm; bracts shorter than the pedicels; calyx 4-5 mm, densely pilose; corolla 5.5-7 mm, yellow, slightly longer than the calyx; pod 0.6-1.2 cm thick, 0.7-1.2 cm diam., discoid or cylindrical, pilose; coils 3-6; spines on coil margins 6-10, 2.5-3 x 1.5 mm, thickened at the base, forming a right angle with the coil surface and closely appressed to the pod, oblong-ovoid, yellowish-brown, smooth.

M, O, S; weed of cultivation, sandy and alluvial soils. Mediterranean region, Sinai, Atlantic Islands; introduced and naturalized elsewhere.

10. **Medicago rigidula** (L.) All., Fl. Pedem. 1: 316 (1785).

Syns. *Medicago gerardii* Willd., Sp. Pl., ed. 4, 3: 1415 (1802).

Medicago depressa Jord., Cat. Graines Jard. Dijon 1848: 28 (1848).

For full synonymy, see Greuter *et al.* Med-Checklist 4: 144 (1989).

Annual herb 10-25 cm, hairy or glaucular-hairy; stems procumbent, branched from the base; stipules 2.5-3.5 mm, ovate-lanceolate, toothed; leaflets 3-8 x 3-6 mm, obovate-cuneate, serrate-dentate towards the obtuse or truncate apex; peduncles 1-2 cm, bearing 1-2(-4) flowers; calyx hairy; corolla 5-7 mm, longer than the calyx, yellow; pod 0.5-1.2 cm thick, 0.5-1(-1.5) cm diam., discoid, cylindrical, much indurate at maturity, coil surface with c. 15 strongly bent radial veins, pod and spines densely clothed with multicellular glandular hairs; seeds 2.5-3.5 mm, 1-2 in each coil, yellowish-brown, smooth.

N, M; edges of cultivated fields, waste ground, roadsides. Mediterranean region, extending eastwards to Iran.

11. **Medicago turbinata** (L.) All., Fl. Fed. 1: 315 (1785).

Syns. *Medicago polymorpha* L. var. *turbinata* L., Sp. Pl., ed. 1, 780 (1753).

Medicago polymorpha L. var. *tuberculata* Retz., Observ. Bot. 2: 23 (1781).

Medicago tuberculata (Retz.) Willd., Sp. Pl., ed. 4, 3: 1410 (1802).

Medicago spinulosa DC. in Lam. & DC., Fl. Fr., ed. 3, 5: 569 (1815).

Annual herb 15-50 cm, pilose; stems much branched at the base, strongly angular, pilose with long simple hairs; stipules 5-8 mm, lacinate; petiole 0.5-3.5 cm; leaflets 0.8-2.5 x 0.5-1.5 cm, obovate, rhomboid-ovate or lanceolate, sharply serrulate, the apex rounded or acute, pilose on both surfaces; inflorescence 3- to 8-flowered, subcapitate; peduncles 1-3.5 cm; calyx 3.5 mm, hairy; corolla 5-6.5 mm, orange-yellow; pod 0.8-1.2 cm thick, 5-8 mm diam., barrel-shaped, with flattened ends; coils 5-7(-9), closely adpressed, indurate at maturity, glabrous, unarmed or slightly spinose; seeds 1-2 in each coil, 3.5-4.5 mm, yellowish-brown, smooth.

M, Dw (Giza Pyramids region); cultivated and waste ground. Mediterranean region, Iraq.

12. **Medicago intertexta** (L.) Mill. var. **ciliaris** (L.) Heyn, Scr. Hieros. 12: 129 (1963).

Syns. *Medicago polymorpha* var. *ciliaris* L., Sp. Pl., ed. 1, 780 (1753).

Medicago ciliaris (L.) All., Fl. Pedem. 1: 315 (1785).

Annual herb 25-50 cm; stems ascending or decumbent, much-branched, angular, glabrous or sparingly hairy; stipules 0.8-1.5 x 0.4-0.8 cm, deeply dentate to lacinate; petiole 1-2.5 cm, flattened; leaflets 0.5-1.8 x 0.5-1.2 cm, obovate, glabrous on both surfaces or thinly hairy on the lower surface, serrulate; apex acute or rounded; inflorescences 2- to 4(-8)-flowered, axillary; peduncles \pm equalling the petiole; pedicels 2 mm, filiform; calyx 3.5-4 mm, almost glabrous; corolla 4.5-6 mm, mustard-yellow; pod 0.8-1.2(-1.6) cm diam., globular to broadly ovoid, not indurate at maturity; coils 5-10, spinose; coil surface with distinct c. 7 anastomosing veins; spines spreading, densely clothed with multicellular hairs; seeds 4-4.5 x 2 mm, 1-2 in each coil, reniform, blackish-brown, smooth.

N, O, M, S; weed of cultivation, waste ground. Macaronesia, Mediterranean region, Sinai.



Plate 47. LEGUMINOSAE: flowering and fruiting branches, and pod of: *Medicago marina* 1. *Medicago lupulina* 2. *Medicago coronata* 3. *Medicago orbicularis* 4. *Medicago polymorpha* 5. *Medicago littoralis* 6. *Medicago truncatula* 7. *Medicago turbinata* 8. *Medicago laciniata* var. *brachyacantha* 9. *Medicago monspeliaca* 10. *Medicago polyceratia* 11. *Medicago hypogaea* 12. All drawings to the same scale except enlarged parts (scale given).

13. **Medicago minima** (L.) L., Fl. Angl. 21 (1754).

Syns. *Medicago polymorpha* var. *minima* L., Sp. Pl., ed. 1, 780 (1753).

Medicago minima (L.) Bartal., Cat. Piant. Siena 61 (1776).

Medicago hirsuta (L.) All., Fl. Pedem. 1: 315 (1785).

For full synonymy, see Greuter *et al.* Med-Checklist 4: 140 (1989).

Annual herb 5-20 cm, densely appressed-hairy; stems much branched from the base, procumbent or ascending, quadrangular, grooved; stipules 3-5 mm, entire or obscurely denticulate at the base; leaves 1-2.5 cm; petiole 5-1.5 cm; leaflets 4-7 x 2-4.5 mm, cuneate-obovate to oblanceolate, finely denticulate towards the retuse-apiculate apex, the terminal leaflet petiololate and larger than the sessile laterals; peduncles 0.4-1 cm, 3- to 6-flowered; calyx 2-2.5 mm; corolla 3.5-4.5 mm, yellow; pod 3-4 mm thick, 3-5 mm diam. (excluding the spines) shortly cylindrical; coils 3-5, loose, coil surface with 6-8 strongly curved radial veins; spines spreading horizontally, hooked near the apex; seeds 1.5-2 x 1.25 mm, 1-2 in each coil, yellowish brown, smooth.

M, Dw, S; cultivated and arable ground. Mediterranean region, West Asia; adventive elsewhere.

14. **Medicago laciniata** (L.) Mill., Gard. Dict., ed. 8., no. 5 (1768).

Syns. *Medicago polymorpha* L. var. *laciniata* L., Sp. Pl., ed. 1, 781 (1753).

Medicago laciniata (L.) All., Fl. Pedem. 1: 316 (1785).

Annual herb 5-30 cm, glabrous or sparingly hairy; stems many from the base, procumbent or ascending, quadrangular; leaves 1-2.5 cm; stipules 2.5-4.5 mm, coarsely toothed or lacinate; petiole 0.5-2 cm; leaflets 3-8 x 2-5 mm, cuneate-obovate to cuneate-oblong, serrate towards the retuse-apiculate apex, appressed hairy on the lower surface; terminal leaflet petiololate and longer than the lateral leaflets; peduncles 0.5-2 cm, 1- to 2(-3)-flowered; pedicels 1 mm; bracts minute, acuminate; calyx 2-2.5 mm, the teeth shorter than the tube; corolla 4-5 mm, yellow; pod 3-6 mm thick, 2-5-5 mm diam. (excluding the spines), short-cylindrical or subglobose, glabrous, coils 2½-7, spines straight; coil surface with 6-16 prominent S-shaped radial veins, some of them branched; seeds 1-2 in each coil, 2 x 1-1.25 mm, oblong-ovoid, yellowish-brown, smooth.

Two varieties occur in Egypt:

var. **laciniata**

Stipules lacinate; pod subglobose; coils 5-7; peduncles exceeding the petiole.

N, M, D, S; edges of cultivation, alluvial and sandy soils.

var. **brachycantha** Boiss., Diagn. Pl. Orient., ser. 1, 9: 10 (1849).

Syn. *Medicago aschersoniana* Urb., Verh. Bot. Vereins. Prov. Bradenb. 15: 77 (1873).

Stipules dentate; pod cylindrical; coils 2½-5; peduncles shorter than the petiole.

M, D, S; roadsides, sandy wadis and desert plains.

Area of the species: Macaronesia, Mediterranean region, extending eastwards to Pakistan and Afghanistan.

NOTE: In Egypt var. *brachyacantha* is much more widespread than var. *laciniata*, especially in the desert regions.

15. *Medicago sativa* L., Sp. Pl., ed. 1, 778 (1753) subsp. *sativa*

Perennial herb 20-80 cm, glabrous or appressed-hairy; stems much-branched at the base; quadrangular, grooved; leaves 2-5(-6.5) cm; stipules 3-9 mm, lanceolate-acuminate, the lower toothed at the base; petiole 0.5-2 cm; leaflets 0.5-3 x 0.2-1 cm, narrowly oblong-obovate to elliptic, serrulate towards the truncate or retuse-apiculate apex, the terminal leaflet petioliolate and larger than the laterals; peduncles much longer than the subtending leaves; racemes 8- to 25-flowered; pedicels 1-2.5 mm; bracts 1-2 mm, setaceous; calyx 4-6 mm, the teeth equalling the tube; corolla 0.8-1.2 cm, blue, purple or lilac; pod 4-7 mm diam., spiral; coils 3-4, lax, unarmed, appressed-hairy or glabrous, dark brown or blackish when ripe; coil surface reticulate-veined; seeds 1.75-2.25 mm, ovoid-deltoid, yellowish-brown, smooth.

N, O, M, S; escape from cultivation on waste ground, roadsides, edge of cultivated fields. Macaronesia, Europe, Mediterranean region, West Asia; widely cultivated for fodder in many regions of the world, probably native of West Asia.

16. *Medicago monspeliaca* (L.) Trautv., Bull. Sci. Acad. Sci. Pétersb. 8: 272 (1841).

Syns. *Trigonella monspeliaca* L., Sp. Pl., ed. 1, 777 (1753).

Trigonella monspeliaca subsp. *subacaulis* Feinbrun, Beih. Bot. Centralbl. 51(2): 396 (1933).

Annual herb 5-15 cm, appressed-hairy; stems simple or many from the base, prostrate or decumbent; leaves 1.5-3.5 cm; stipules 1.5-2.5 mm, coarsely incised, acuminate; petiole 1-2.5 cm; leaflets 0.4-1.2 x 0.3-0.7 cm, cuneate-obovate, serrate towards the apex; terminal leaflet petiolulate, the petiolule 2-3 mm; flowers 6-15(-20), in capitate racemes; calyx 2-3 mm, the teeth \pm equalling the campanulate tube; corolla 5-7 mm, yellow; pod 0.8-1.5 x 0.15 cm, spreading in stellate clusters, linear, slightly compressed, gently curved or deflexed, the valves with prominent oblique veins; seeds c. 1.5 mm, ovoid, brownish, verrucose.

M, S; cultivated and waste ground. Central and South Europe, Mediterranean region, Sinai, extending northwards to Caucasus and eastwards to Central Asia.

17. *Medicago polyceratia* (L.) Trautv., Bull. Sci. Acad. Sci. Pétersb. 8: 272 (1841).

Syns. *Trigonella polyceratia* L., Sp. Pl., ed. 1, 777 (1753).

Trigonella pinnatifida Cav., Icon. Descr. 1: 26 (1791).

Annual herb 10-25 cm, sparingly hairy, pubescent when young; stems many from the base, branched, prostrate or ascending, angled; leaves 1-1.5 cm; stipules 1.75-2.25 mm, the lower incised at the base, the upper subulate; petiole 2-6 mm; leaflets 3-6 x 2-3 mm, cuneate-obovate, sharply dentate-serrate; terminal leaflet petioliolate, slightly larger than the laterals; peduncles 0.5-1 cm, 1- to 6(-8)-flowered; pedicels 1 mm; bracts minute, subulate; calyx 2.5-3 mm, the teeth \pm equalling the tube; corolla 5-6 mm, yellow; pod 2-4.5 x 0.1-0.15 cm, cylindrical, linear, curved; seeds 1.5 x 1 mm, slightly flattened.

N; edges of cultivation. North Africa, introduced into West Europe.

18. **Medicago hypogaea** E. Small, Taxon 33: 633 (1984).

Syns. *Trigonella aschersoniana* Urb., Verh. Bot. Vereins Prov. Brandenb. 23: 67 (1882), non *Medicago aschersoniana* Urb., Verh. Bot. Vereins Prov. Brandenb. 15: 77 (1873).

Factorovskya aschersoniana (Urb.) Eig, Bull. Inst. Agric. Nat. Hist. (Tel-Aviv) 6: 13 (1927).

Annual herb 5-15 cm, glabrous or thinly appressed-hairy; stems prostrate, much branched from the base, mat-forming; stipules 2-3 mm, lanceolate, dentate to lancinate; petiole of the lower leaves 2-6.5 mm, much shorter on the upper; leaflets 2.5-4.5 mm, obovate-cuneate, sharply dentate, the apex emarginate, mucronate; terminal leaflet petiololate, the petiolule 1-2 mm; peduncles 2.5-8 mm, axillary, 1-flowered, elongating to 1.2-1.5 cm in fruit; pedicels 0.5-1.5 mm; bracts minute; calyx 1.5 mm, appressed-hairy; corolla 2-3.5 mm, yellow, often not opening fully; ovary cylindrical, on a stipe, elongating and directed into the ground where the fruits develop; subterranean pods 6-9 x 3-5 mm, constricted, appressed-hairy, 2-seeded; seeds 3 x 3.5 mm, compressed-ovoid, yellowish, smooth.

M, S; sandy soils. East Mediterranean region, Sinai.

10. **Melilotus** Mill.

Annual or short-lived perennial herbs, often smelling of coumarin especially when dried; leaves pinnately trifoliate, the terminal petiololate; stipules adnate to the petiole; flowers in pedunculate racemes; calyx campanulate, corolla yellow or white, petals caducous; standard often folded longitudinally; wings oblong, obtuse, ± adherent to the keel, with no conjunctival tooth; stamens ± connate, monadelphous or diadelphous; style glabrous; stigma minute; pod 1- to 4-seeded, ovoid or globose, not coiled, unarmed, not or tardily dehiscent, smooth or variously veined; seeds ovoid, the testa smooth or tuberculate. About 20 species, temperate and subtropical regions especially Europe, Asia, Mediterranean region, Ethiopia.

- | | | |
|--|----------------------------|---|
| 1. Flowers white; pod ripening blackish | 1. M. albus | 2 |
| + Flowers yellow; pod ripening greenish-yellow | | |
| 2. Leaflets narrowly linear, deeply serrate; corolla hardly exceeding the calyx | 7. M. serratifolius | |
| + Leaflets lanceolate, obovate, obovate- or oblong-cuneate; corolla distinctly exceeding the calyx | | 3 |
| 3. Pod with concentric ridges | | 4 |
| + Pod with parallel or reticulate ridges | | 6 |
| 4. Pod 6-8 mm, obliquely ovoid, the apex acute | 4. M. messanensis | |
| + Pod 3-4.5 mm, subglobular or ovoid, the apex rounded | | 5 |
| 5. Leaflets oblong-cuneate; racemes 8- to 20-flowered, shorter than the subtending leaf; pod 3-3.5 x 3 mm, subglobular | 2. M. sulcatus | |
| + Leaflets obovate-cuneate; racemes 30(-45)-flowered, dense, much longer | | |

than the subtending leaf; pod 2.5-3 x 2 mm, obovoid

3. *M. segetalis*

6. Flowers 2-2.5 mm; pod with reticulate ridges

6. *M. indicus*

+ Flowers 4-5.5 mm; pod with transverse parallel ridges

5. *M. elegans*

1. *Melilotus albus* Medik., Vorles. Churpfälz. Phys.-Ökon. Ges. 2: 382 (1787).

Syn. *Melilotus argutus* Rchb., Fl. Germ. Excurs. 499 (1832).

Annual or short-lived perennial herb, 0.4-1.2 m, glabrous or sparsely hairy; stems erect, much-branched; stipules 3.5-5 mm, lanceolate, entire; leaflets 1-2.2 x 0.5-1.2 cm, cuneate- to oblong-obovate, denticulate towards the rounded or apiculate apex; petiole 0.5-2 cm; peduncles 1-3 cm, elongating in fruit; racemes many-flowered, elongating and lax in fruit; pedicels 1-2 mm; bracts setaceous, minute; calyx 2 mm; corolla 3.5-4.5 mm, white; pod 3-4.5 mm, globose-ovoid, 1- to 2-seeded, reticulately nerved, brown at maturity; seeds 1.5-2.2 mm, yellowish-brown, smooth.

N, S; weed of cultivation. Europe, Mediterranean region, West and Central Asia; introduced and naturalized elsewhere.

2. *Melilotus sulcatus* Desf., Fl. Atlant. 2: 193 (1799).

Annual herb 15-35 cm, glabrous to sparsely pilose; stems erect or sprawling, much branched, angled; stipules 5-7.5 mm, lanceolate with narrow subulate-filiform lobes; petiole 1-2.5 cm; leaflets 1-2 x 0.2-0.6(-0.8) cm, oblong-cuneate, sharply serrulate-denticulate, the apex rounded; peduncles 0.5-1.5 cm; racemes 1-2 cm, shorter than the subtending leaf, 8- to 20-flowered, elongate in fruit and then equalling or longer than the subtending leaf; pedicels 1-1.5 mm; bracts 1 mm, subulate; calyx 2 mm; corolla 6-8 mm, yellow; pod 3-3.5 x 3 mm, subglobular, with concentric ridges, 1- to 2-seeded; apex rounded, the seeds 2.5 x 2 mm, oblong-subglobose, minutely tuberculate.

O, M, S; weed of cultivation, waste ground. Mediterranean region, Sinai, Atlantic Islands.

3. *Melilotus segetalis* (Brot.) Ser. in DC., Prodr. 2: 187 (1825).

Syns. *Trifolium segetale* Brot., Fl. Lusit. 2: 484 (1804).

Melilotus sulcatus subsp. *segetalis* (Brot.) P. Fourn., Quatre Fl. France 549 (1936).

Annual herb 20-50 cm, glabrous; stems erect or ascending, branched mainly from the base; stipules 4-8 mm, the lower entire, the upper deeply dentate or lacinate; petiole 1-3 cm, flattened; leaflets 0.8-3.2 x 0.6-1.8 cm, obovate-cuneate, sharply serrulate; apex rounded, less commonly truncate or emarginate-apiculate; racemes 2.5-3.5 cm, 30 (-45)-flowered, dense, much longer than the subtending leaf; calyx c. 2 mm; corolla c. 4 mm, yellow; pod 2.5-3 x 2 mm, obovoid, with concentric ridges, yellow when ripe; seeds 2.5 x 1.5 mm, oblong-obovoid, minutely tuberculate.

N; weed of cultivated and waste ground. Mediterranean region, Portugal.

4. *Melilotus messanensis* (L.) All., Fl. Pedem. 1: 309 (1785).

Syns. *Trifolium messanense* L., Mant. Alt. 275 (1771).

Melilotus siculus (Vitman) B. D. Jacks., Index Kew. 3: 199 (1894).

Annual herb 20-60 cm, glabrous; stems erect or ascending, much branched from the base; stipules 0.5-1.2 cm, broadly lanceolate, denticulate or entire; leaflets 1-2.5 x 0.6-1.5 cm, obovate-orbicular to lanceolate-cuneate, sharply serrulate, the apex rounded, or emarginate-apiculate; racemes 6- to 16-flowered, shorter than the subtending leaf; 2-3 mm; corolla 4-5 mm, yellow; pod 6-8 mm, obliquely-ovoid, with concentric ridges; apex acute, yellowish-brown when ripe; seeds 2.5-3.5 x 2-2.5 mm irregularly subglobose, brown, finely reticulate.

N, O, De, S; weed of cultivation, seasonally inundated and moist ground. Mediterranean region, Sinai.

5. *Melilotus elegans* Salzm. ex Ser. in DC., Prodr. 2: 188 (1825).

Annual herb 0.3-1.2 m, glabrous; stems erect, branched, quadrangular; stipules 4-9 mm, mucronate, the lower broader; leaflets 1-2.2 x 0.5-1 cm, obovate- to oblong-cuneate, sharply dentate towards the truncate-apiculate or obtuse apex; flowering racemes 2-3.5 cm, longer than the leaves, lax, 20- to 35-flowered, elongate in fruit to 10 cm; flowers 4-5.5 mm; calyx 1.5 mm; corolla yellow; pod 3.5-4.5 x 3 mm, obovoid to broadly ellipsoid, with transverse parallel ridges, 1(-2)-seeded; seeds 2 x 1.5 mm, subglobose, minutely tuberculate, brown.

M (Lake Mariut region); waste ground. Mediterranean region.

6. *Melilotus indicus* (L.) All., Fl. Pedem. 1: 308 (1785).

Syns. *Trifolium melilotus-indica* L., Sp. Pl., ed. 1, 765 (1753).

Melilotus parviflorus Desf., Fl. Atlant. 2: 192 (1799).

Melilotus bonplandii Ten., Index Sem. Hort. Neapol. 1833: 14 (1833).

Melilotus tommasinii Jord., Mém. Acad. Roy. Sci. Lyon. Sect. Sci., ser. 2, 1: 266 (1851).

Annual herb 15-50 cm, glabrous, hairy when young; stems branched, quadrangular, grooved; stipules 3-6 mm, lanceolate, entire or denticulate, acuminate; leaflets 0.8-2.4 x 0.3-1.2 cm, obovate- to oblong-cuneate, sharply serrate-dentate towards the truncate-apiculate or rounded apex; racemes 1-2.5 cm, 20- to 30-flowered, elongate in fruit to 4-10 cm; calyx 1 mm; corolla 2-2.5 mm, pale yellow; pod 1.5-3 mm, subglobose, with reticulate ridges; seeds 1.5-2 mm, minutely tuberculate.

N, O, M, D, S; weed of cultivation. Mediterranean region, Eurasia; introduced and naturalized elsewhere.

7. *Melilotus serratifolius* Täckh. & Boulos, Publ. Cairo Univ. Herb. 5: 68, f. 10a (1974).

Annual slender herb 15-30 cm; stems branched; stipules laciniate-dentate; leaflets 1.5-2.5 x 0.1-0.3 cm, deeply and sharply serrate; terminal leaflet longer than the lateral leaflets, with 4-5 mm petiole; racemes 2.5-4 cm, lax; flowers minute; corolla slightly exceeding the narrow calyx-lobes, pale yellow; fruit not seen.

O (Dakhla Oasis); weed of cultivation. Endemic.

NOTE: The species is only known from the type collection at Mut, Dakhla Oasis, in fields around the breeding farm. More material is requested, especially plants in fruit for a

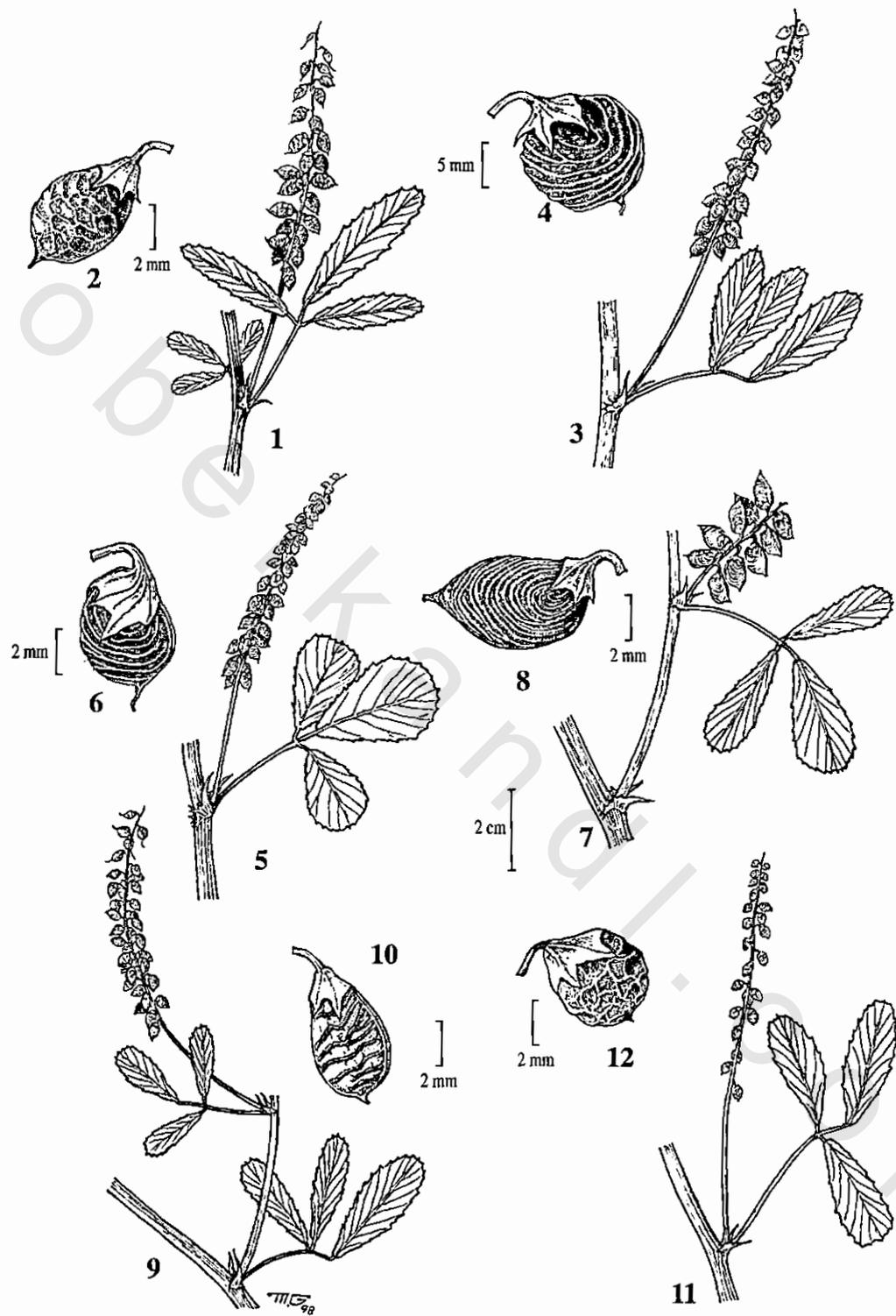


Plate 48. LEGUMINOSAE: *Melilotus albus* 1, fruiting branch; 2, pod. *Melilotus sulcatus* 3, fruiting branch; 4, pod. *Melilotus segetalis* 5, fruiting branch; 6, pod. *Melilotus messanensis* 7, fruiting branch; 8, pod. *Melilotus elegans* 9, fruiting branch; 10, pod. *Melilotus indicus* 11, fruiting branch; 12, pod. All drawings to the same scale except enlarged parts (scale given).

better description and understanding of the species.

11. *Trifolium* L.

Annual or perennial herbs; stems erect, ascending, procumbent or creeping and rooting at the nodes; leaves 3-foliolate (our species), rarely with 5 or 7 leaflets; stipules connate to the petiole at the base; racemes axillary or terminal, capitate, spicate or umbellate, sometimes with a free or connate involucre; flowers pedicellate or sessile, bracteate or not, the inner flowers rarely sterile; calyx 5-, 10-, or 20-nerved, rarely 30- to 36-nerved, the calyx-tube sometimes inflated in fruit; corolla persistent or caducous, white, yellow, purple, pink, flesh-coloured, lilac or violet; standard free or connate at the base with the wings and keel; stamens diadelphous, mostly adnate to the wings and keel, all or 5 of the filaments dilated at the apex; ovary sessile or stipitate, 2- to 8-ovulate; pod indehiscent, mostly 1- to 2-seeded, rarely more, enclosed in the persistent calyx, rarely exerted, usually membranous, rarely leathery; seeds globose to ovoid, oblong or reniform, About 240 species, temperate Eurasia, Mediterranean region, Africa and the Americas.

- | | |
|--|---|
| 1. Fruiting calyx conspicuously inflated | 2 |
| + Fruiting calyx not inflated (slightly inflated in <i>T. argutum</i>) | 4 |
| 2. Perennial with creeping stems rooting at the nodes | 1. <i>T. fragiferum</i> |
| + Annual | 3 |
| 3. Fruiting head villous, stellary-lobed; fruiting calyx c. 8 mm | 2. <i>T. resupinatum</i> |
| + Fruiting head with hidden calyx teeth, fruiting calyx 3-6 mm | 3. <i>T. tomentosum</i> |
| 4. Stipules dentate all along their margins, not subulate or cuspidate at the apex | 5 |
| + Stipules entire, subulate, acuminate or cuspidate at the apex | 6 |
| 5. Leaflets oblong, oblong-linear or narrowly elliptic;
calyx glabrous | 4. <i>T. glanduliferum</i> var. <i>nervulosum</i> |
| + Leaflets obovate or obcordate; calyx densely villous | 15. <i>T. stellatum</i> |
| 6. Inflorescence sessile or shortly pedunculate | 7 |
| + Inflorescence distinctly pedunculate | 8 |
| 7. Calyx 3-4.5 mm, white, c. 36-nerved | 8. <i>T. argutum</i> |
| + Calyx 5-7 mm, 10-nerved, the tube leathery to ligneous | 13. <i>T. scabrum</i> |
| 8. Perennial with creeping stems rooting at the nodes; peduncles to 30 cm | 10. <i>T. repens</i> |
| + Annual, peduncles much shorter | 9 |
| 9. Corolla yellow | 10 |
| + Corolla white, cream, pink, lilac, red or purple | 11 |
| 10. Terminal leaflets sessile or subsessile; peduncles to 5 times as long as the lax
10- to 20-flowered heads | 5. <i>T. patens</i> |
| + Terminal leaflets with 1.5-3 mm petiole; peduncles 1-2 times
as long as the compact many-flowered heads | 6. <i>T. campestre</i> |
| 11. Calyx 2.5-3 mm; standard 2-3(-4) times as long as the calyx | 7. <i>T. philistaeum</i> |

- + Calyx 0.4-1.6 cm; standard equalling or less than twice the length of the calyx 12
- 12. Calyx 1.4-1.6 cm, the teeth 2-2¹/₂ times as long as the tube 16. **T. dasyurum**
- + Calyx 0.4-1 cm, the teeth shorter, equalling or slightly longer than the tube 13
- 13. Calyx tube 20-nerved 12. **T. lappaceum**
- + Calyx tube 5-10-nerved 14
- 14. Corolla 6-8 mm; calyx 3.5-4.5 mm 9. **T. nigrescens**
- + Corolla 1-2 cm; calyx 0.5-1.3 cm 15
- 15. Corolla cream 11. **T. alexandrinum**
- + Corolla pink, lilac, red or purple 16
- 16. Leaflets 2-4 mm diam., narrowly linear-lanceolate 17. **T. angustifolium**
- + Leaflets 0.4-1.5 cm diam., broadly ovate, oblong-lanceolate or elliptic 17
- 17. Corolla ± equalling the calyx 14. **T. incarnatum** var. **incarnatum**
- + Corolla c. 1¹/₂ times as long as the calyx 18
- 18. Flowers purple at and after anthesis; stems appressed-hairy 19. **T. purpureum**
- + Flowers pale pink at anthesis, turning pale purple or dark lilac; stems with spreading hairs 18. **T. dichroanthum**

1. **Trifolium fragiferum** L., Sp. Pl., ed. 1, 772 (1753).

Syns. *Trifolium neglectum* C. A. Mey., Index Sem. Hort. Petrop. 9, Suppl. 21 (1843).

Trifolium fragiferum L. subsp. *bonanii* (C. Presl) Soják, Novit. Bot.

Delect. Seminum Horti Bot. Univ. Carol. Prag. 1963: 50 (1963).

Perennial herb 10-35 cm, glabrous or sparsely hairy; stems creeping, rooting at the nodes; stipules 1.2-2 cm, lanceolate, the free parts subulate; petiole to 10 cm; leaflets 0.6-1.8 x 0.4-1.2 cm, obovate to elliptic, the veins prominent, the margins spinulose-dentate; apex obtuse, retuse or rounded; peduncles to 18 cm, axillary; heads 1-1.2 cm, many-flowered; involucre 3-5 mm, dissected into oblong-linear lobes; bracts exceeding the calyx-tube; pedicels short; calyx tube 2 mm, obscurely 10-nerved, densely hairy, the teeth unequal; corolla 4-5 mm, whitish, later becoming pink; calyx in fruit inflated, reticulately-veined, hairy; pod 1.5 mm, 2-seeded; seeds 1 mm, reniform, brownish.

M (Alexandria); marshy and moist ground. Mediterranean region, Europe, West Asia, Ethiopia.

2. **Trifolium resupinatum** L., Sp. Pl., ed. 1, 771 (1753).

Syn. *Trifolium suaveolens* Willd., Hort. Berol., t. 108 (1812).

Annual herb 10-50 cm, glabrous or glabrescent; stems ascending, erect or procumbent, branched from the base, hollow; stipules 1-1.5 cm, oblong, caudate, distinctly veined in the basal part; petiole of lower leaves to 10 cm; leaflets 1-2.2 x 0.4-1.5 cm, obovate to elliptic, finely serrulate, the apex rounded, emarginate or truncate; peduncles usually exceeding the leaves; heads 1-1.4 cm diam., many-flowered; pedicels 0.4-mm; calyx c. 3

mm; calyx-tube 1 mm, c. 12-veined; corolla 4-7.5 mm, resupinate, pink to purple, fragrant; fruiting heads villous, stellate-lobed, fruiting calyx c. 8 mm, ovoid, inflated, papery, reticulate, the 2 terminal teeth lengthening and upcurved; pod c. 2 x 1.5 mm, usually 1-seeded; seeds 1.5 x 1.2 mm, ovoid, brown.

Two varieties occur in Egypt:

var. **resupinatum**

Corolla 5.5-7.5 mm, bright pink to purple; peduncle generally much longer than the subtending petiole.

var. **minus** Boiss., Fl. Orient. 2: 137 (1872).

Syns. *Trifolium bicornis* Forssk., Fl. Aegypt.-Arab. 139 (1775).

Trifolium clusii Gren. & Godr., Fl. Fr. 1: 414 (1849).

Trifolium resupinatum L. var. *clusii* (Gren. & Godr.) Dinsm. in Post, Fl. Syr. Pal. Sinai, ed. 2, 1: 245 (1932).

Corolla 4-5 mm, pale pinkish-violet; peduncle usually shorter than the subtending petiole.

Area of the species: N, O, M, D; moist ground, fields, orchards, roadsides. Mediterranean region, West and Central Asia; adventive elsewhere.

NOTE: Both varieties are known from the entire area of species in Egypt, but var. *minus* is less widespread and usually grows in drier habitats.

3. **Trifolium tomentosum** L., Sp. Pl., ed. 1, 771 (1753).

Annual herb 10-25 cm, glabrous or sparingly hairy; stems ascending or procumbent, many from the base; stipules 0.6-1.2 cm, lanceolate, petiole to 5 cm; leaflets 0.3-1.4 x 0.3-0.8 cm, obovate or elliptical, distinctly veined, sharply serrulate, the apex rounded or truncate; peduncles usually shorter than the petiole; flowering heads 6-8 mm diam., many-flowered; bracts cup-shaped; pedicels minute; calyx 2-2.5 mm, distinctly bilabiate; calyx-tube 1.25 mm, membranous, c. 12-veined; corolla pink; fruiting calyx 6-8 mm, inflated, papery, reticulate-veined, hidden within the head; pod 1.5-2 mm, enclosed within the calyx, 1-seeded; seeds 1 mm, smooth.

Four varieties occur the Egypt:

var. **tomentosum**

Fruiting heads pilose or glabrescent, allowing the reticulate calyx to be clearly visible.

M, D, S; sandy desert plains, edges of cultivation.

var. **chthonocephalum** Bornm., Beih. Bot. Centralbl. 31, 2: 204 (1914).

Fruiting heads crowded and overtopped by the projecting long-petioled leaves.

M, Dw (Tahrir); fields, roadsides.

var. **orientale** Bornm., Verh. Zool.-Bot. Ges. Wien 48: 581 (1898).

All heads sessile, the upper often in pairs.

M, S; roadsides, edges of fields.

var. **curvisepalum** (Täckh.) Thiéb., Fl. Lib.-Syr. 2: 28 (1940).

Syn. *Trifolium curvisepalum* Täckh., Svensk Bot. Tidskr. 26: 373 (1932).

Upper calyx teeth of the fruiting head setaceous, strongly recurved, borne on a narrow neck-like projection from the head.

S; sandy desert plains.

Area of the species: Mediterranean region, West Asia, Atlantic Islands.

4. **Trifolium glanduliferum** Boiss., Diagn. Pl. Orient., ser. 1, 2: 30 (1843) var.

nervulosum (Boiss. & Heldr.) Zohary, Fl. Palaest. 2: 175 (1972).

Syns. *Trifolium nervulosum* Boiss. & Heldr. in Boiss., Diagn. Pl. Orient., ser. 1, 9: 25 (1849).

Trifolium galilaeum Boiss., Diagn. Pl. Orient., ser. 1, 9: 26 (1849).

Trifolium nervulosum Boiss. & Heldr. var. *galilaeum* (Boiss.) Boiss., Fl. Orient. 2: 142 (1872).

Trifolium glanduliferum Boiss. subsp. *nervulosum* (Boiss. & Heldr.)
Ponert, Feddes Repert. 83: 637 (1973).

Annual herb 10-25 cm, glabrous or slightly hairy; stems erect or ascending, branched; stipules 3-8 mm, adnate to the petiole to more than half of their length, broadly ovate, scarious, parallel-nerved, the margins green and sharply dentate, the apex obtuse; leaflets 0.8-1.6 x 0.3-0.5 cm, oblong, oblong-linear or narrowly elliptic, conspicuously nerved, sharply dentate, obtuse, mucronate, sometimes with sessile or stipitate glands on or between the teeth; peduncles axillary, to 5 cm; heads c. 1 cm, globose, many-flowered; involucre absent; bracts minute; flowers sessile; calyx c. 4 mm; calyx tube white, glabrous, prominently 10-nerved; calyx-teeth unequal, ± equalling the tube, spine-tipped; corolla c. 1 cm, pink to purple; pod 2.5-3 mm, exserted from calyx-tube, with long style, 2-seeded; seeds 1-1.5 x 1 mm, ovoid, yellowish-brown.

S; sandy plains. East Mediterranean region, Sinai.

5. **Trifolium patens** Schreb. in Sturm, Deutschl. Fl. Abth. 1, 16: fol. 18 (1804).

Annual herb 10-35 cm, glabrous or sparsely hairy; stems erect or ascending, branched mainly from the base; stipules 0.8-1.4 cm, ovate, entire or obscurely serrate, rounded at the base, the apex acute; petiole 0.5-1.8 cm; leaflets 0.5-1.5 x 0.3-0.6 cm, narrowly obovate to oblong or elliptic, entire or serrulate towards the rounded or emarginate apex, the terminal leaflet subsessile or sessile; peduncles 3-5 cm, much longer than the leaves; heads c. 0.8 cm, ± globose, 10- to 20-flowered; pedicels c. 2 mm; flowers lax, subsessile; calyx c. 3 mm, 5-nerved; corolla 5-6 mm, yellow.

M; orchards, fields. Egypt, Syria, Central and South Europe.

6. **Trifolium campestre** Schreb. in Sturm, *Deutschl. Fl. Abth.* 1, 16: fol. 13-14 (1804).

Syns. *Trifolium procumbens* L., *Fl. Suec.*, ed. 2, 261 (1755) pro parte, nom. ambig. non *Sp. Pl.*, ed. 1, 722 (1753).

Trifolium spadiceum Thuill., *Fl. Par.*, ed. 2, 385 (1799), non L. (1755).

Trifolium ciliatum Poir., *Encycl.* 8: 28 (1808).

Trifolium glaucescens Hausskn., *Mitt. Thür. Bot. Ver. N. F.* 5: 79 (1893).

Trifolium pumilum Hossain, *Not. Roy. Bot. Gard. Edinb.* 23: 479 (1961).

Annual herb 5-25 cm, appressed hairy; stems branched, especially from the base; stipules 3-7 mm, ovate to oblong, acuminate; petiole of lower leaves to 1.5 cm, those of the upper shorter; leaflets 0.4-1.2 x 0.3-0.8 cm, cuneate-obovate to obcordate, denticulate towards the truncate or retuse apex, the terminal leaflet with a slender 1.5-3 mm petioliole; peduncle 1-2.5 cm, generally exceeding the subtending leaf; heads c. 1 cm, globose, many-flowered, compact; pedicels c. 1 mm, shorter than the calyx, deflexed after anthesis; bracts reduced to a row of red glands; calyx 2 mm; tube short, 5-nerved, teeth unequal, 1½-2 times as long as the tube; corolla 5-6 mm, yellow, drying brownish; pod 1-seeded; seeds c. 1 mm, ovoid, brownish, smooth.

M, S; sandy plains, edges of cultivation. Mediterranean region, West Asia, Europe, naturalized in many temperate regions.

7. **Trifolium philistaeum** Zohary, *Israel J. Bot.* 19: 296 (1970) var. **philistaeum**

Syn. *Trifolium stenophyllum* Boiss., *Diagn. Pl. Orient.* 9: 30 (1849), non Nutt., *J. Acad. Nat. Sci. Philadelphia*, ser. 2, 1: 151 (1848).

Annual herb 10-25 cm, glabrous or sparsely hairy; stems branched; stipules 1-1.4 cm, oblong-ovate, many-nerved, entire, the upper free part lanceolate; leaflets 1-2.4 x 0.2-0.4 cm, oblong, narrowly elliptic to narrowly linear, coarsely dentate to entire, terminal leaflet long-petioliolate; peduncles to 8 cm; heads many-flowered, ovoid, elongate in fruit to 4 cm; pedicels 1-1.5 mm, deflexed in fruit; calyx 2.5-3 mm, membranous, 2-lipped; corolla c. 1 cm, white to pinkish; standard 2-3(-4) times as long as the calyx, longer than the wings; pod stipitate, 1-seeded; seeds c. 1.5 mm, ovoid, yellowish-brown.

S; sandy coastal plains. Sinai, Palestine

8. **Trifolium argutum** Banks & Sol. in Russel, *Nat. Hist. Aleppo*, ed. 2, 2: 260 (1794).

Syns. *Trifolium xerocephalum* Fenzl, *Pug. Pl. Nov. Syr.* 5 (1842).

Trifolium moriferum Boiss., *Diagn. Pl. Orient.*, ser. 1, 9: 28 (1849).

Annual herb 15-30 cm, glabrous or sparsely hairy; stems branched mainly from the base; stipules 5-8 mm, oblong-ovate, the basal part membranous with prominent parallel veins, the upper free part lanceolate; petiole 1-4 cm; leaflets 0.5-1.4 x 0.3-0.8 cm, obovate-cuneate to broadly-elliptic, sharply denticulate, the apex rounded and mucronate; flowering heads c. 1 cm, elongate in fruit, sessile or short-pedunculate, subtended by an involucre of upper leaves, many-flowered; bracts equalling or longer than the calyx tube, scarious, obovate to oblong, mucronate; calyx 3-4.5 mm, white; tube c. 36-nerved, villose slightly inflated in fruit; calyx-teeth shorter than the tube, subulate, spreading; corolla 5-7 mm, white, or pink; pod 1-seeded, with a beak c. 3 times as long as the pod; seeds c. 1 mm, ovoid, brown.

M; edges of cultivation, roadsides. East Mediterranean region.

9. **Trifolium nigrescens** Viv., Fl. Ital. Fragm. 12, t. 13 (1808) subsp. **petrisavii** (Clem.) Holmboe, Veg. Cypr., 106 (1914).

Annual herb 10-25 cm, glabrous; stems erect, ascending or sprawling, branched especially from the base; stipules 1-1.4 x 0.3-0.4 cm, narrowly oblong, the basal part membranous and distinctly veined, the apical part subulate; petiole of lower leaves to 8 cm or more, upper leaves with progressively shorter petiole; leaflets 0.4-2 x 0.3-1.5 cm, broadly obovate-cuneate, distinctly veined, sharply denticulate, the apex rounded, truncate or emarginate; peduncles 1.5-4 cm; heads 1-1.5 cm; bracts 1 mm; pedicels 1.5-2.5 mm; calyx 3.5-4.5 mm; the tube 2 mm, white-membranous, 10-nerved; calyx teeth subulate, green; corolla 6-8 mm, white or pinkish; pod c. 3 mm, oblong, 1- to 2-seeded, constricted between the seeds; seeds c. 1 mm, suborbicular, to ovoid, brownish.

M; orchards and roadsides. East Mediterranean region to Iraq.

10. **Trifolium repens** L., Sp. Pl., ed. 1, 767 (1753).

Perennial herb 10-40 cm, glabrous; stems creeping, branched, rooting at the nodes; stipules 0.6-1.2 x 0.4-0.6 cm, the basal part ovate-oblong, scarious, free, upper part subulate; petiole to 18 cm; leaflets 1-2.4 x 0.8-1.6 cm, broadly obovate to orbicular, sharply denticulate-serrulate, the apex rounded, truncate or apiculate; peduncles to 30 cm; heads 1.8-3 cm, subglobose, 30-40-flowered; bracts shorter than the pedicels, membranous; pedicels 3-4 mm, deflexed in fruit; calyx c. 4 mm, 10-nerved; corolla 0.8-1.2 cm, white or tinted pink, fragrant; pod 3-4.5 mm, 3-4-seeded, oblong, constricted between the seeds; seeds c. 1.25 mm, ovoid, brownish.

N (Cairo), M (Alexandria). Mediterranean region, Europe, West and Central Asia; cultivated for fodder and naturalized in many temperate regions.

11. **Trifolium alexandrinum** L., Cent. Pl. 1: 25 (1755).

Annual herb 20-60 cm, appressed-hairy or glabrescent; stems much-branched; stipules 1-3 cm, the lower part oblong, green-veined, the upper free part subulate; petiole of lower leaves to 7 cm, those of the upper leaves shorter; leaflets 1.5-4.5 x 0.5-1.8 cm, oblong-elliptic, obscurely dentate-serrate, the apex rounded or mucronate; peduncles 1-5 cm; heads terminal, 3 x 1 cm, ovate-oblong, dense; flowers sessile; bracts absent; calyx 5-6 mm, 10-veined, appressed hairy; corolla 1-1.2 cm, cream; pod 2-2.5 mm, ovate, 1-seeded; seeds 2 mm, yellow.

N, O, M, D, S; naturalized and escape from cultivation. East Mediterranean region, Sinai, Iraq; introduced and cultivated elsewhere.

12. **Trifolium lappaceum** L., Sp. Pl., ed. 1, 768 (1753).

Annual herb 10-25 cm, sparingly hirsute; stems few from the base, branched above, decumbent; stipules 0.7-1.2 cm, membranous between the prominent greenish-violet veins, the upper free part subulate; leaflets 0.5-1.5 x 0.3-0.8 cm, ovate to obovate-cuneate, denticulate towards the rounded or truncate apex; peduncles 0.5-2.5 cm, elongate in fruit; heads 1-1.5 cm, ± globose; flowers sessile; bracts absent; calyx 7-9 mm,

20-nerved; calyx teeth *c.* 1½ times as long as the tube, subulate from a broad 3 (-4)-veined base, rapidly narrowed to a filiform apex; corolla shorter than the calyx, white or pink; pod ovate, included in the calyx tube; seeds 1.5 mm, subspherical, brownish, smooth.

S (El-Arish); sandy soils. Mediterranean region to Central Asia; introduced to some temperate regions.

13. *Trifolium scabrum* L., Sp. Pl., ed. 1, 770 (1753).

Annual herb 5-20 cm, appressed-hairy; stems ascending or procumbent, few, branched mainly from the base, wiry; stipules 5-8 mm, lanceolate-acuminate, membranous with prominent green veins, the upper free part triangular with acuminate tip; leaflets 0.4-1.2 x 0.3-0.8 cm, cuneate-obovate, the nerves prominent and recurved at the denticulate margins, the apex rounded or truncate; terminal leaflet subsessile; heads 0.8-1 cm, mainly axillary, sessile, few- to many-flowered; stipules of the subtending leaves frequently broad and involucrate below the head; flowers sessile; bracts absent; calyx 5-7 mm; tube cylindrical, 10-nerved, leathery to ligneous, appressed-hairy; teeth unequal, lanceolate, rigid, becoming spiny in fruit, prominently 1-nerved; corolla white or pink, equalling the calyx; fruiting head prickly, separating as one unit from the plant; pod ovoid, membranous, included in the calyx tube, 1-seeded; seeds *c.* 1.5 mm, oblong-ovoid, brown, smooth.

M; rocky coastal ridges. Mediterranean region, West Asia.

14. *Trifolium incarnatum* L., Sp. Pl., ed. 1, 769 (1753) var. *incarnatum*

Annual herb 15-50 cm, hairy; stems erect, stout, few or branched from the base; stipules 1.4-2 cm; upper free part ovate, dentate towards the rounded apex; leaflets 1-2.5 x 0.5-1.5 cm, broadly obovate, denticulate, the apex mostly rounded; heads to 5 x 1.5 cm, terminal oblong, pedunculate, calyx-tube 10-nerved, densely appressed-hairy; calyx-teeth equal, acute; corolla 1-1.5 cm, ± equalling the calyx, blood red, rarely white.

N (Cairo); escape from cultivation. British Isles, Portugal, Spain, Italy, Balkan Peninsula, Turkey.

NOTE: Widely cultivated for fodder throughout Europe and often naturalized or escape.

15. *Trifolium stellatum* L., Sp. Pl., ed. 1, 769 (1753).

Annual herb 10-25 cm, densely hairy; stems erect or ascending, branched at the base; stipules 0.6-1.2 x 0.4-0.8 cm, obovate, dentate throughout their margins, apex rounded or subacute; petiole 1-5 cm; leaflets 0.4-1.2 x 0.3-1.2 cm, obovate or obcordate, villose on both surfaces, denticulate, the apex truncate or emarginate; peduncles 3-5 cm; heads 2-3 cm, subglobose, terminal; calyx 1.2-1.4 cm densely villous; calyx-tube 3-5 mm, 10-veined; calyx-teeth 6-8 mm, subequal, spreading in fruit; petals shorter than to almost equalling the calyx, white or pink; pod included in the calyx-tube, 1-seeded; seeds *c.* 1.8 x 1.5 mm, ovoid, yellowish-brown.

M; sandy soils, edges of cultivation. West Europe, Mediterranean region extending westwards to Iran.



Plate 49. LEGUMINOSAE: *Trifolium fragiferum* 1, habit and fruiting head; 2, calyx in fruit. *Trifolium resupinatum* 3, flowering and fruiting branch; 4, flower; 5, calyx in fruit. *Trifolium tomentosum* 6, flowering and fruiting branch; 7, calyx in fruit. *Trifolium campestre* 8, flowering and fruiting branch. *Trifolium alexandrinum* 9, flowering branch and fruiting head; 10, flower; 11, calyx in fruit. *Trifolium lappaceum* 12, flowering and fruiting branch; 13, calyx in fruit. *Trifolium scabrum* 14, flowering and fruiting branch; 15, calyx in fruit. *Trifolium stellatum* 16, flowering branch; 17, calyx in fruit. *Trifolium dasyurum* 18, flowering branch; 19, flower; 20, calyx in fruit. *Trifolium angustifolium* 21, flowering branch; 22, flower; 23, calyx in fruit. *Trifolium purpureum* 24, flowering branch; 25, flower; 26, calyx in fruit. *Trifolium dichroanthum* 27, flowering branch; 28, flower; 29, calyx in fruit. All drawings to the same scale except enlarged parts (scale given).

16. **Trifolium dasyurum** C. Presl, Symb. Bot. 1: 53 (1831).

Syns. *Trifolium formosum* d'Urv., Mém. Soc. Linn. Paris 1: 350 (1822), non Savi, Observ. Trifol. Sp. 102 (1810).

Trifolium velivolium Paine, Palest. Explor. Soc., Third Stat. 103 (1875).

Annual herb 10-30 cm, densely hairy; stems few, erect, simple or dichotomously branched above, ending with a flower-head at the end of each branch; stipules 2-3.5 cm, oblong, membranous between the prominent green veins, the apical free part subulate or cuspidate; petiole 1-5 cm; leaflets 1-3.5 x 0.2-0.6 cm, oblong-elliptic, entire, the apex acute; peduncles 2.5-6 cm, densely villous; heads 1.5-3.5 cm, terminal many-flowered, oblong-ovoid; calyx 1.4-1.6 cm, densely villous, the tube 10-veined; teeth 2-2½ times as long as the tube, equal, subulate; corolla ± as long as the calyx, reddish-purple; calyx in fruit with spreading teeth; pod included in the calyx and concealed by the closed calyx throat; seeds 2-2.5 mm, oblong, brownish-yellow, smooth.

M; orchards and barley fields. East Mediterranean region, extending eastwards to Iran.

17. **Trifolium angustifolium** L., Sp. Pl., ed. 1, 769 (1753).

Annual herb 10-30 cm, appressed-hairy; stems simple or with a few from the base, erect or ascending; stipules 1.4-2 cm, narrowly oblong, conspicuously nerved, the upper free part lanceolate-subulate; leaflets 2-4.5 x 0.2-0.4 cm, narrowly linear-lanceolate; petiole 1-4 cm; peduncles 1-3 cm; heads 1.5-4 cm, ovoid-cylindrical, elongate in fruit; calyx c. 1 cm, densely covered with spreading stiff hairs, 10-nerved, teeth slightly longer than the tube, subequal, subulate, stiff and spiny-tipped in fruit; corolla shorter than or equalling the calyx, pink to purple; pod concealed within the calyx, 1-seeded; seeds 2 x 1.5 mm, ovoid-oblong, brownish-yellow, smooth.

M; orchards and barley fields. Mediterranean region, Atlantic Islands, extending eastwards to Iran.

18. **Trifolium dichroanthum** Boiss., Diagn. Pl. Orient. 9: 20 (1849).

Annual herb 10-40 cm, hairy; stems with a few branches from the base, erect or ascending, patent hairy; stipules 1.2-1.8 cm, oblong-ovate, membranous between the prominent green nerves, upper free part subulate; leaflets 1-3 x 0.4-0.8 cm, oblong-elliptic, entire, apex obtuse or mucronate; peduncles 1-5 cm; heads 2-4.5 x 1.5 cm, ovoid-cylindrical; calyx 8-9 mm, densely appressed-hairy; teeth unequal, longer than the tube, spreading in fruit; corolla 1.6-1.8 cm, pale pink at anthesis, turning pale purple or dark lilac; pod included in the calyx tube, 1-seeded, ovoid, membranous; seeds 1.5-2 mm, ovoid, brownish, smooth.

S; sandy plains. Sinai, Palestine, Lebanon.

19. **Trifolium purpureum** Loisel., Fl. Gall. 484 (1807).

Annual herb 15-40 cm, hairy; stems branched, erect or ascending, appressed-hairy; stipules 1.5-2.5 cm, oblong-lanceolate, membranous between the green nerves, the upper free part subulate; leaflets 2-4.5 x 0.4-1.5 cm, oblong-lanceolate or -elliptic, entire, the apex acute, mucronate; peduncles 2-6 cm; heads 1.5-6 cm, ovoid in flower, cylindrical in

fruit; flowers 1.5-2 cm; calyx 0.8-1 cm, adpressed-hairy, the tube 3-4 mm; teeth subulate, the lower tooth longer than the others; corolla more than 1½ times as long as the calyx, intensely purple at and after anthesis; calyx-tube conspicuously nerved in fruit, teeth plumose with golden-yellow bristles; pod ovoid, included in the calyx tube, 1-seeded; seeds 1.2 mm, ovoid, brownish.

Two varieties occur in Egypt:

var. **purpureum**

Flowering heads 3-4 cm long, fruiting heads 3-6 cm long, flowers very numerous.

M; barley fields, orchards.

var. **desvauxii** (Boiss. & Blanche) Post, Fl. Syr. Pal. Sinai 236 (1896).

Syn. *Trifolium desvauxii* Boiss. & Blanche in Boiss., Diagn., ser. 2, 2: 12 (1856).

Flowering heads 1.5-2 cm long, fruiting heads 2-2.5 cm long, flowers less numerous.

S (El-Arish, Rafah); orchards, coastal sandy plains.

Area of the species: Mediterranean region, West Asia.

12. **Anthyllis** L.

Syn. *Physanthyllis* Boiss.

Herbs (our species) or shrubs; leaves imparipinnate, rarely 1-3-foliolate; stipules small, caducous; flowers in dense heads, rarely in clusters or solitary in the bract axils; calyx 5-toothed; corolla variously coloured; stamens monadelphous; pod included in the persistent usually inflated calyx, ± indehiscent; seeds 1-numerous. 35 species, West Europe, Macaronesia, East Mediterranean region, extending to Sahara and Ethiopia.

1. Flowers many, in terminal heads; calyx teeth unequal; calyx-tube with oblique mouth; pod not constricted 1. **A. vulneraria**
+ Flowers few in axillary clusters; calyx teeth ± equal; calyx-tube straight; pod constricted between the seeds 2. **A. tetraphylla**

1. **Anthyllis vulneraria** L., Sp. Pl., ed. 1, 719 (1753) subsp. **maura** (Beck) Maire, Bull. Soc. Hist. Nat. Afr. Nord 20: 20 (1929).
Syn. *Anthyllis maura* Beck, Ann. K. K. Naturhist. Hofmus. 11: 64 (1896).

Annual or short-lived perennial, 15-50 cm, appressed-hairy; stems branched from the base, erect or ascending; leaves imparipinnate, leaflets 4-6 pairs, the terminal leaflet longer than the lateral leaflets, the lower leaves reduced to a terminal leaflet; leaflets 1-3.5 x 0.2-0.8 cm, sessile, lanceolate, narrowly elliptic to linear, densely appressed-hairy beneath, glabrous on the upper surface, entire, acute; heads many-flowered, terminal, subtended by 2 unequal palmatisect bracts; calyx 1.4-1.8 cm, slightly inflated at anthesis; calyx-teeth unequal; calyx tube with oblique mouth; corolla c. 2 cm, red; pod c. 4 mm, not constricted, 1(-2)-seeded; seeds 2 x 1 mm, ovoid.

M; limestone ridges. West Mediterranean region, North Africa.

NOTE: Cullen in Davis, Fl. Turkey 3: 534 (1970) describes this species as very polymorphic which may be divided into about 30 subspecies distributed throughout Europe, North Africa, Caucasia and extending to Ethiopia. Greuter *et al.*, Med-Checklist 4: 8-13 (1989) enumerate 35 subspecies known from the Mediterranean region.

2. **Anthyllis tetraphylla** L., Sp. Pl., ed 1, 719 (1753).

Syns. *Physanthyllis tetraphylla* (L.) Boiss., Voy. Bot. Espagne 2: 162 (1840).

Tripodion tetraphyllum (L.) Fourr., Ann. Soc. Linn. Lyon, ser. 2, 16: 359 (1868).

Annual herb 10-25 cm, hairy; stems prostrate, erect or ascending, branched at the base, with spreading hairs; leaflets 1-2 pairs, 1-3 x 0.5-2.5 cm, terminal leaflet much larger than the basal leaves often with 1 leaflet, obovate, adpressed-pilose on both surfaces, entire, the apex rounded-apiculate, base tapering to a flattened rhachis 1-1.5 x 0.3-0.5 cm; flowers 3-6, in axillary clusters; calyx 1.2-1.4 x 0.3-0.5 cm, slightly inflated, membranous, densely appressed pilose, more inflated and to 2 x 1 cm after anthesis, calyx teeth \pm equal, calyx tube straight; corolla 1.6-2 cm, standard yellow, keel red-tipped; pod 6-8 x 3-4 mm, oblong, 2-seeded, constricted, between the seeds, included within the calyx; seeds c. 2.5 mm, compressed, suborbicular, tubercled.

M (Mersa Matruh). Mediterranean region.

NOTE: This species is treated under the genus *Physanthyllis* by Meikle, Fl. Cyprus 1: 471 (1977) and under the genus *Tripodion* by Greuter *et al.*, Med-Checklist 4: 197 (1989).

13. **Hymenocarpos** Savi, nom. conserv.

Annual herbs; leaves imparipinnate, exstipulate but with basal leaflets resembling stipules; flowers in pedunculate axillary clusters; calyx with 5 subequal teeth; corolla yellow to orange, free from the staminal tube; stamens diadelphous; ovary sessile, 2-ovulate, the style upcurved; pod flattened, circinate, 2-locular, indehiscent; seeds smooth. 1 species, Mediterranean region, Sinai.

1. **Hymenocarpos circinnatus** (L.) Savi, Fl. Pis. 2: 205 (1798).

Syns. *Medicago circinnata* L., Sp. Pl., ed. 1, 778 (1753).

Hymenocarpos nummularis (DC.) G. Don, Gen. Hist. 2: 173 (1832).

Annual herb 15-45 cm, densely hairy; stems ascending or procumbent, branched from the base; lower leaves 2-5 cm, simple, spatulate, entire; upper leaves with 2-4 pairs of leaflets, the terminal leaflet much larger; leaflets 1-2.5 x 0.3-0.6 cm, oblong-elliptic, entire, acute; flowers 2-4, on peduncles shorter than or equalling the subtending leaves; calyx-teeth much longer than the tube, clothed with golden-yellow bristles; corolla 6-8 mm, yellow to orange; pod 1.5-1.8 cm diam., \pm orbicular, reticulate, the margins denticulate-spinulose, wings broader than the pod, 2-seeded.

M, S; barley fields, roadsides. Mediterranean region, Sinai.

14. Lotus L.

Annual or perennial herbs or subshrubs; leaves (3-)5-foliolate; stipules minute or 0, basal pair of leaflets subsessile, stipule-like, upper 3 leaflets crowded at the apex of the rachis; inflorescences axillary, pedunculate, capitate or umbellate, rarely 1-flowered; bracts foliaceous; bracteoles usually 0; calyx-teeth subequal; corolla conspicuous, yellow, orange, red, pink, rarely white, free from the staminal sheath; stamens diadelphous; ovary sessile or short-stipitate; ovules numerous; style upcurved, the stigma terminal or oblique; pod linear to oblong, 2-valved, terete, compressed or torulose, often septate; seeds globose or compressed. About 100 species, north temperate regions especially the Mediterranean region and West Asia.

- | | |
|--|-------------------------------|
| 1. Flowers yellow, sometimes flushed with red | 2 |
| + Flowers white, pink, red, purple or crimson | 12 |
| 2. Pod inflated, 5-7 mm diam., with a deep longitudinal ventral suture | 1. <i>L. edulis</i> |
| + Pod not inflated, 1-4 mm diam., with a shallow longitudinal ventral suture | 3 |
| 3. Leaves crowded, mostly 3-foliolate | 4. <i>L. polyphyllus</i> |
| + Leaves spaced, mostly 5-foliolate | 4 |
| 4. Pod flattened, strongly torulose | 5. <i>L. ornithopodioides</i> |
| + Pod terete or slightly compressed | 5 |
| 5. Annuals; inflorescence 1- to 2(-4)-flowered | 6 |
| + Perennials, woody at the base; inflorescence 2- to 8(-12)-flowered, umbellate, long- pedunculate | 8 |
| 6. Plant densely pilose; flowers 5-7 mm | 10 <i>L. angustissimus</i> |
| + Plant appressed-hairy, sometimes stems thinly pilose; flowers 0.8-1.2 cm | 7 |
| 7. Leaflets 1-1.5 x 0.5-1 cm; peduncles usually shorter than the subtending leaf, stout; pod straight, 10- to 18-seeded, slightly torulose | 7. <i>L. peregrinus</i> |
| + Leaflets 0.2-1(-1.5) x 0.15-0.5 cm; peduncles equalling or exceeding the subtending leaf, slender; pod slightly curved, 18- to 30-seeded, torulose | 6. <i>L. halophilus</i> |
| 8. Plants with appressed silky hairs; calyx teeth unequal | 9 |
| + Plants glabrous, glabrescent or pilose; calyx-teeth equal or subequal | 10 |
| 9. Lateral calyx-teeth acute, slightly shorter than the upper; keel with a long straight beak | 2. <i>L. creticus</i> |
| + Lateral calyx-teeth obtuse, much shorter than the upper; keel with a short curved beak, often purple-tipped | 3. <i>L. cytisoides</i> |
| 10. Calyx and stems greyish-white pilose | 11. <i>L. palustris</i> |
| + Calyx and stems glabrous or sparsely pilose | 11 |
| 11. Stems solid; rootstock not stoloniferous; leaflets without conspicuous lateral veins | 9. <i>L. glaber</i> |
| + Stems hollow; rootstock stoloniferous; leaflets with conspicuous lateral veins | 8. <i>L. pedunculatus</i> |

12. Pod 5-8 mm diam., the margins bordered by 4 conspicuous undulate wings 18. *L. tetragonolobus* 13
 + Pod 1-2.5 mm diam., the margins unwinged
13. Plants densely greyish-villous 12. *L. lanuginosus* 14
 + Plants glabrous, glabrescent or appressed hairy
14. Pod 5-6 mm, 3-4-seeded 17. *L. nubicus* 15
 + Pod longer, more than 4-seeded
15. Peduncles much shorter than the subtending leaf; style 2 mm 16. *L. glinoides* 16
 + Peduncles equalling or longer than the subtending leaf; style 3.5-5.5 mm
16. Umbels up to 7-flowered (all plants with some umbels more than 3-flowered) 15. *L. lalambensis* 17
 + Umbels 1- to 3-flowered, rarely to 5-flowered
17. Plant pubescent or pilose; pod 1.5-2.8 x 0.3-0.35 cm; annual of Nile banks and wetlands 13. *L. arabicus*
 + Plant glabrous; pod 3.5-4 x 0.25 cm; desert shrublet, sometimes flowering in the first year 14. *L. hebranicus*

1. *Lotus edulis* L., Sp. Pl., ed. 1, 774 (1753).

Annual herb 10-25 cm, thinly pilose; stems erect or ascending, branched mainly from the base; leaves 1.3-3 cm, 5-foliolate, the leaflets 1-2 x 0.6-1.2 cm, obovate-cuneate, truncate or emarginate; peduncles 4-7 cm; racemes 1- to 3-flowered; bracts ± equalling the calyx; calyx 0.8-1 cm, the teeth longer than the tube; corolla 1.2-1.4 cm, yellow; standard red-veined; pod 3-4 x 0.5-0.7 cm, inflated, arcuate; apex hooked, strongly impressed, with a deep longitudinal ventral suture; seeds 2.5-3 x 2-2.5 mm, reniform, dark brown, tuberculate.

M; barley fields, roadsides. Mediterranean region.

2. *Lotus creticus* L., Sp. Pl., ed. 1, 775 (1753).

Syns. *Lotus commutatus* Guss. Fl. Sicul. Prodr. 2: 545 (1828-1832).

Lotus salzmännii Boiss. & Reut., Pugill. Pl. Afr. Bor. Hispan. 37 (1852).

Perennial silvery herb, 20-60 cm, woody at the base, with dense appressed silky-hairy; stems many from the base, richly branched, ascending or procumbent; leaves 0.8-2.5 cm, 5-foliolate; leaflets 0.5-1.2 x 0.2-0.4 cm; obovate-cuneate to oblong-cuneate; peduncles 2-5 cm, much longer than the subtending leaf; inflorescence umbellate, 2- to 5-(-7)-flowered; bracts 3, shorter than the calyx; calyx 6-8 mm, densely appressed-hairy; calyx teeth unequal, acute; the lateral teeth shorter than the upper; corolla 1.2-1.6 cm, bright yellow, the keel with a long straight beak; pod 2.5-4 x 0.2 cm, cylindrical, glabrous; seeds 1.5 mm, globose, dark brown, smooth.

M, D, S; coastal sandy plains and calcareous ridges. Mediterranean region, Sinai.

3. *Lotus cytisoides* L., Sp. Pl., ed. 1, 776 (1753).

Syns. *Lotus prostratus* Desf., Fl. Atlant. 2: 206 (1799), non L., Syst. Nat., ed. 10.

1179 (1759).

Lotus allionii Desv., J. Bot. Agric. 3: 77 (1814).

Lotus patens C. Presl in J. Presl & C. Presl, Delic. Prag. 48 (1822).

Perennial herb 20-50 cm, woody at the base, with appressed silky-hairy, greenish-grey; stems many arising from the base, prostrate, branched; leaves 0.7-1.8 cm, 5-foliolate; upper 3 leaflets ovate, lanceolate to obovate, apiculate; lower pair smaller; peduncles 2-6.5 cm, much longer than the subtending leaf; inflorescence umbellate, 3- to 5-flowered; bracts 3, shorter than the calyx; calyx 7-9 mm, thinly appressed-hairy to glabrescent, calyx teeth unequal, the lateral teeth much shorter than the upper, obtuse; corolla 1.2-1.5 cm, yellow; the keel shorter than the wings, short-beaked, strongly curved, often purple-tipped; pod 3-4 x 0.2 cm, terete, straight; seeds 1.5 mm, globose or slightly compressed, brown.

M; oolitic coastal sand dunes and limestone ridges. Mediterranean region.

NOTE: The more widespread *Lotus cytisoides* may be confused with the less common *L. creticus* in the Mediterranean coastal strip. They may be separated by the pronounced silvery indumentum of *L. creticus* compared with the greenish-grey aspect of *L. cytisoides*. The keel is strongly curved in *L. cytisoides* while it has a long straight beak in *L. creticus*.

4. **Lotus polyphyllus** E. D. Clarke, Travels 2(2): 41 (1814).

Syn. *Lotus argenteus* Webb & Berthel., Phyt. Canar. 3(2, 2): 87 (1842), non Salisb., Prodr. 333 (1796), nom. illeg.

Subshrub 30-60 cm, all parts (except the corolla and pods) densely silvery-white pubescent; stems many, richly branched; leaves 0.5-1.2 cm, crowded and usually covering the stems, mostly 3-foliolate, sessile; leaflets 2-5(-8) x 1-2.5(-4) mm, ovate-lanceolate, acute; peduncles 0.5-1.5 cm, axillary, 1- to 4-flowered; flowers 7-9 mm; calyx 5.5-7 mm, the teeth unequal; corolla slightly longer than the calyx, yellow, turning brownish when dry; pod 5-7 x 2.5-3 mm, subcylindrical, with a persistent deflexed style, 2-seeded; seeds 1.5 mm, ovoid.

M; coastal sand dunes. North Africa.

5. **Lotus ornithopodioides** L., Sp. Pl., ed. 1, 775 (1753).

Annual herb 15-40 cm, appressed-hairy or villous; stems branched from the base; leaves 5-foliolate, villous; upper leaflets 0.6-1.8 x 0.3-0.8 cm, obovate to rhombic; lower leaflets ovate, smaller; peduncles 2-5 cm; inflorescence umbellate 2-5-flowered; bracts 3, longer than the calyx, leaf-like; flowers 0.8-1.1 cm; calyx 2-lipped, the teeth unequal; corolla exceeding the calyx, yellow; pod 2.5-4 x 0.25 cm, 10- to 16-seeded, flattened, slightly curved, strongly torulose; seeds 1.5-2 mm, orbicular, smooth, dark brown.

M, S; borders of cultivation, roadsides. Mediterranean region, Sinai, Atlantic Islands.

6. **Lotus halophilus** Boiss. & Spruner in Boiss., Diagn. Pl. Orient., ser. 1, 2: 37 (1843).

Syns. *Lotus villosus* Forssk., Fl. Aegypt-Arab. LXXI (1775), non Burm. f., Fl. Cap. Prodr. 23 (1768).

Lotus pusillus Viv., Fl. Libyc. Spec. 47 (1824), non Medicus, Bot. Beob. 1783: 226 (1784).



Plate 50. LEGUMINOSAE: *Anthyllis vulneraria* 1, flowering branch. *Anthyllis tetraphylla* 2, flowering branch; 3, fruiting cluster. *Hymenocarpus circinnatus* 4, flowering and fruiting branch. *Lotus cytisoides* 5, flowering and fruiting branch. *Lotus polyphyllos* 6, flowering and fruiting branch; 7, fruit. *Lotus ornithopodioides* 8, fruiting branch and mature fruits. *Lotus halophilus* 9, flowering and fruiting branch. *Lotus peregrinus* 10, flowering and fruiting branch. All drawings to the same scale except enlarged part (scale given).

Annual slender herb 5-25 cm, appressed-hairy; stems few or many from the base, procumbent or ascending, branched; leaflets 0.2-1(-1.5) x 0.15-0.5 cm, ovate, obovate or broadly elliptic, acute; peduncles equalling or exceeding the subtending leaf, slender; racemes 1-4-flowered; bracts 3; calyx 4-6.5 mm, 2-lipped, the teeth shorter than the tube; corolla 0.8-1.1 cm, pale yellow; pod 1.5-3.5 x 0.15 cm, cylindrical, torulose, slightly curved, 18- to 30-seeded; seeds 1 mm, subglobose, yellowish brown, smooth.

N, O, M, D, S; sandy deserts, alluvial silty plains, calcareous ridges, edges of cultivation. Mediterranean region, West Asia.

NOTE: One of the most widespread annuals in desert regions, highly palatable to sheep and goats.

7. **Lotus peregrinus** L., Sp. Pl., ed. 1, 774 (1753).

Syn. *Lotus carmeli* Boiss., Diagn. Pl. Orient. 9: 34 (1849).

Annual herb 10-35 cm, appressed-hairy; stems erect or ascending, branched pilose; leaflets 1-1.5 x 0.5-1 cm, obovate, obovate-cuneate or rhombic, the apex obtuse or rounded, sometimes apiculate; peduncles 0.5-1.5 cm, usually shorter than the subtending leaf, thick; racemes 2- to 3-flowered; bracts 3, equalling or exceeding the calyx; calyx shorter than the corolla, 2-lipped; corolla 0.8-1.2 cm, yellow; pod 2-3.5 x 0.2-0.3 cm, terete, straight, slightly torulose, 10- to 18-seeded; seeds 1.5 mm, globose, yellowish-brown, smooth.

N, O, M; edges of cultivation. East Mediterranean region.

8. **Lotus pedunculatus** Cav., Icon. 2: 52 (1793).

Syns. *Lotus uliginosus* Schkuhr, Bot. Handb. 2: 412 (1796).

Lotus decumbens Poir. in Lam., Encycl. Suppl. 3: 508 (1814).

Perennial stoloniferous herb 15-50 cm, glabrous or sparsely pilose; stems erect or ascending, hollow; leaflets broadly obovate, with conspicuous lateral veins; apex mostly rounded; peduncles to 8 cm, with 5-12 umbellate flowers; calyx-teeth \pm equal; corolla 1-1.2 cm, golden yellow; pod 1.5-3 x 0.15-0.25 cm, straight, terete; seeds 2 mm, globose, brownish-yellow, smooth.

M (Damietta); moist ground. North Africa, Europe.

9. **Lotus glaber** Mill., Gard. Dict., ed. 8, no. 3 (1768).

Syns. *Lotus tenuis* Willd., Enum. Pl. Hort. Berol. 797 (1809).

Lotus tenuifolius Rchb., Fl. Germ. Excurs., 506 (1832), non Burm. f., Fl.

Cap. Prodr. 22 (1768), nom. illeg.

Lotus corniculatus L. subsp. *tenuis* (Willd.) Berher in Louis, Dép. Vosges 2: 72 (1887).

Lotus corniculatus L., subsp. *tenuifolius* (L.) E. Fourn., Quatre Fl. France 564 (1935).

Like *Lotus pedunculatus* but entire plant glabrous; stem solid; rootstock not stoloniferous; leaflets narrowly oblong or oblanceolate, acute or acuminate; peduncles with 1-3(-5) flowers; corolla 0.8-1 cm.

N, O, M; moist and cultivated ground, canal banks, lawns. Mediterranean region, Europe, West and Central Asia.

10. **Lotus angustissimus** L., Sp. Pl., ed 1, 774 (1753).

Annual herb 10-30 cm, all parts except the corolla and mature pods thinly to densely yellow-pilose; stems erect or ascending, richly branched from the base, slender; leaves 0.5-1.5 cm; leaflets 2-8 x 1-3 mm, ovate-lanceolate to elliptic, apiculate; peduncles 1.5-3.5 cm, usually much exceeding the subtending leaf, slender; inflorescence umbellate, 1- to 3-flowered; bracts 2-7 mm, usually 3, very variable in size on the same plant; calyx-teeth longer than the tube, filiform, unequal; corolla 5-7 mm, yellow, longer than the calyx; pod 1.8-2.2 x 0.1-0.15 cm, terete, slightly curved towards the apex, 18- to 25-seeded; seeds 1 mm, subglobose, brownish, smooth.

N; cultivated ground. North Africa, Europe, West Asia.

11. **Lotus palustris** Willd., Sp. Pl., ed. 4, 3: 1394 (1802).

Syns. *Lotus lamprocarpus* Boiss., Diagn. Pl. Orient. 9: 33 (1849).

Lotus palustris Willd. var. *glaberrimus* (Asch. & Schweinf.) Täckh. & Boulos, Stud. Fl. Egypt, ed. 2, 248 (1974), nom. nud.

Perennial herb 30-60 cm, greyish-white pilose; stems erect or trailing, richly branched from the base, glabrous when young; leaflets 1.2-2.2 x 0.5-1.2 cm, ovate-lanceolate to obovate, apiculate; peduncles 2-3 times as long as the subtending leaves; inflorescence umbellate, 2- to 4-flowered; bracts equalling or slightly longer than the calyx; calyx 4-5 mm, the teeth twice as long as the tube; corolla 7-9 mm, yellow; pod 1.6-2.2 x 0.2 cm, cylindrical, straight; seeds 1 mm, globose.

O, M; moist ground. North Africa, East Mediterranean region.

12. **Lotus lanuginosus** Vent., Jard. Malmaison, t. 92 (1805).

Perennial herb 20-40 cm, densely greyish-villous; stems ascending, richly branched from the base; leaves short-petiolate; leaflets 3-8 x 2-5 mm, all similar to each other in shape and size, obovate-cuneate, the apex obtuse, truncate or rounded, apiculate, peduncles 1.5-3 cm; 3-5 times as long as the subtending leaf; inflorescence umbellate, 2- to 4-flowered; bracts 3, much shorter than the calyx; calyx c. 8 mm, densely villous; tube c. 4 mm, conspicuously 10-veined; teeth \pm equalling the tube, subulate; corolla 1.2-1.4 cm, purple; pod 1.8-3 x 0.2-0.3 cm, cylindrical, straight, torulose, beaked; seeds 2 mm, globose, brown, smooth.

S; desert wadis and plains. Sinai, Palestine, Syrian Desert, Arabia.

13. **Lotus arabicus** L., Mant. 104 (1767).

Syns. *Lotus roseus* Forssk., Fl. Aegypt.-Arab. 140 (1775).

Lotus mossamedensis Baker, Fl. Trop. Afr. 2: 62 (1871).

Annual herb 20-60 cm, pubescent or pilose; stems richly branched from the base and above; leaf rhachis flattened; leaflets 1-2.5 x 0.4-1 cm, petiololate, obovate-cuneate, obtuse, rounded or apiculate, the basal pair similar to the others; peduncle 1-4(-8) cm,

1-3(-5)-flowered; bracts usually 1, sometimes 3, similar to the leaflets; pedicels 1.5-2.5 mm; calyx pubescent, the tube 3-3.5 mm; the teeth 1½-2 times as long as the tube, narrowly triangular; corolla pink, the standard about as long as the wings; style 3.5(-4) mm; pod 1.5-2.8 x 0.3-0.35 cm, slightly torulose, 16- to 20-seeded; seeds 2 mm, globose, yellowish-brown mottled with dark brown.

N, O; Nile banks and wetlands. Egypt, tropical Africa.

NOTE: The type specimen of this species was grown from seed collected from Egypt and sent by Forsskål to Linnaeus. The lectotype, designated by Lassen, No. 931.10 is deposited in LINN. (Taxon 46: 474, 1997). *Lotus arabicus* in Egypt is restricted to the Nile banks and some wetlands in the Oases. Throughout its range of distribution in tropical Africa it is known from sandbanks and mudbanks in rivers where the rain fall is 800-1000 mm (Gillett, Polhill & Verdcourt in Milne-Redhead & Polhill, Fl. Trop. East Africa, Leguminosae 3: 1084, 1971). Records of *L. arabicus* from desert regions in Egypt or elsewhere may be considered doubtful.

14. **Lotus hebranicus** Hochst. ex Brand, Bot. Jahrb. Syst. 25: 176, 221 (1898).

Syns. *Lotus arabicus* L. var. *glabrescens* Schweinf., Bull. Herb. Boiss. 4, App. 2: 234 (1896).

Lotus deserti Täckh. & Boulos, Publ. Cairo Univ. Herb. 5: 71, f. 10b (1974).

Like *Lotus arabicus* but desert shrublet to 80 cm, sometimes flowering in first year, very richly branched; entire plant glabrous; leaflets smaller and thicker; calyx teeth equalling or slightly longer than the tube; style 4.5-5 mm; pod 3-4 x 0.25 cm, c. 25-seeded; seeds 1.5 mm, globose-reniform.

De, S; desert wadis. Egypt, Eritrea.

NOTE: *Lotus hebranicus* is named after Wadi Hebran, El-Tor region, Sinai where the type material was collected by W. Schimper, No. 214, 3 Apr. 1835 (lectotype K!). *Lotus deserti* was described from the Eastern Desert of Egypt: Wadi El-Faraied, Red Sea coastal region, 12 Feb. 1961, collected by Täckholm, Kassas *et al.* (holotype, CAI!). It is a rather widespread species in the Eastern Desert. The type specimen of *L. hebranicus* from Sinai is similar in every respect to the Eastern Desert specimens, and therefore the earlier name *Lotus hebranicus* is applied here to this species and *Lotus deserti* is listed as a synonym.

15. **Lotus lalambensis** Schweinf., Bull. Herb. Boiss. 4, App. 2: 235 (1896).

Annual or short-lived perennial herb, 20-40 cm; all parts except the corolla and pods adpressed grey-pubescent; stems erect, branched from the base, wiry; leaves 1-2 cm, rachis 1-2 mm; leaflets 0.5-1.5 x 0.15-0.4 cm, narrowly lanceolate, acute to obtuse; peduncles 1.5-3 cm, up to 3 times as long as the subtending leaf; umbels with up to 7-flowers, (all plants with some umbels more than 3-flowered); calyx 5-6 mm, the tube constricted at the base; teeth ± equalling the tube, subulate; corolla 1-1.2 cm, pink; style 4.5-5.5 mm; pod 1.8-2.5 cm, to 30-seeded, torulose; seeds c. 1.5 mm, globose, brown.

S; desert wadis. Egypt, Arabia, Eritrea, Ethiopia.

16. **Lotus glinoides** Delile, Ann. Sci. Nat. Bot., ser. 2, 7: 286 (1837).

Syns. *Lotus trigonelloides* Webb in Webb & Berthel., Hist. Nat. Canar. 3, Phytog., t. 65 (1837).

Lotus schimperi Steud. ex Boiss., Fl. Orient. 2: 170 (1872).

Lotus ehrenbergii Schweinf. ex Vierh., Beitr. Kenntniss. Flor. Sud-Arab., Sokotra, Semba & Abdel Kuri 42 (1907).

Annual herb 10-25 cm, grey-pubescent, with dense to few bulbous-based hairs; stems ascending to procumbent; leaves 0.6-1.8 cm; upper leaflets 5-8 x 1.5-3 mm, obovate-lanceolate, the apex obtuse or rounded; lower pair of leaflets much smaller; peduncles 1-3 mm or inconspicuous, shorter than the subtending leaf; umbels 1-2(-3)-flowered; bracts 1-3, resembling the leaflets; calyx 3.5-4.5 mm, the teeth \pm equalling the tube, subulate; corolla 5-7 mm, pink to purple; style 2 mm; pod (0.8-)1.5-2.2 x 0.15 cm, cylindrical, torulose, often curved towards the apex, 6- to 15-seeded; seeds 1.2 mm, globose, brown.

N, De, R, GE, S; sandy plains, desert wadis, edges of cultivation. Sinai, Palestine, North Africa, Central Sahara, Sudan, Socotra.

NOTE: A much variable species probably due to the diverse habitats where it grows. Some authors, e.g. Gillett (Kew Bull. 3: 361-381, 1958), recognises two species here: *Lotus glinoides* (pod 1.4-2.5 cm, c. 15-seeded) and *L. schimperi* (pod 0.7-1.1 cm, 6- to 9-seeded). However, he cites intermediate variants and suggests that hybridization occurs between the two species. The present treatment recognizes only one species, *Lotus glinoides*, and plants with small pods and fewer seeds are considered as extreme variants of the same species.

17. **Lotus nubicus** Baker in Oliv., Fl. Trop. Afr. 2: 61 (1871).

Annual herb 10-20 cm, all parts except the corolla and pod densely appressed-hairy, the hairs with small bulbous base; stems many from the base, procumbent; leaves 0.6-1.2 cm, leaf rhachis 1-2 mm; leaflets petioliolate, the upper leaflets 3-8 x 1.5-3.5 mm, obovate-cuneate; apex rounded, obtuse or truncate; lower pair of leaflets smaller; peduncles 1-3 mm or inconspicuous, much shorter than the subtending leaf; calyx densely hirsute; calyx-tube slightly shorter or equalling the teeth; corolla 5-7 mm, pink, slightly longer than the calyx; style 2.5 mm; pod 5-6 x 2 mm, 3- to 4-seeded; seeds 1.5 mm, subglobose, brown, smooth.

R, GE; sandy plains. Egypt, Sudan.

NOTE: In Egypt this species is restricted to the Gebel Elba region and the southern Red Sea coastal region c. 21°-22° N where it grows on sandy plains. In Sudan it is known from the desert sandy plains of Mount Musa in the White Nile region c. 14°50' N, where the type was collected (Kotschy 311, 10 Jan. 1841, K!).

18. **Lotus tetragonolobus** L., Sp. Pl., ed. 1, 773 (1753).

Syns. *Tetragonolobus purpureus* Moench, Meth. 164 (1794).

Lotus palaestinus Boiss., Diagn. Pl. Orient., ser. 2, 2: 20 (1856).

Tetragonolobus pseudopurpureus Uechtr., Österr. Bot. Z. 24: 133 (1874).



Plate 51. LEGUMINOSAE: *Lotus glaber* 1, flowering and fruiting branch. *Lotus angustissimus* 2, flowering and fruiting branches. *Lotus palustris* 3, flowering and fruiting branches. *Lotus lanuginosus* 4, flowering and fruiting branches. *Lotus arabicus* 5, flowering and fruiting branch. *Lotus hebranicus* 6, flowering and fruiting branches. *Lotus lalambensis* 7, flowering and fruiting branch. *Lotus glinoides* 8, flowering and fruiting branch. *Lotus nubicus* 9, flowering and fruiting branch. *Lotus tetragonolobus* 10, flowering and fruiting branches. All drawings to the same scale.

Lotus purpureus Moench var. *palaestinus* (Boiss.) Post, Fl. Syria, Palest., Sinai 251 (1896).

Annual herb 10-25 cm, densely hairy; stems procumbent or ascending, branched mainly from the base, with long spreading hairs; rachis 5-8 mm; upper leaflets 1-2.5 x 0.5-1.8 cm, ovate-cuneate to broadly elliptic, the apex rounded or acute; basal leaflets smaller; peduncle 1-4 cm, 1- to 2-flowered; bracts 1.5-2 x 1 cm, 3, resembling the leaflets; calyx 1-1.2 cm, pilose; the teeth longer than the tube, narrowly lanceolate; corolla twice as long as the calyx, crimson; pod 2-4.5 x 0.4-0.6 mm, subterete, the sutures bordered by 4 conspicuous undulate wings; seeds c. 4 mm, subglobose, smooth, brown.

M, S; cultivated fields, waste ground and roadsides. Mediterranean region, Sinai.

NOTE: This species is treated by some authors under the genus *Tetragonolobus* Moench.

15. *Scorpiurus* L.

Annual herbs, stems decumbent; leaves simple, entire; stipules elongate, adnate to the petiole, conspicuous; inflorescence umbellate, axillary, long-pedunculate; bracts small, bracteoles absent; flowers yellow to reddish; calyx deeply 5-fid, campanulate; standard suborbicular, wings oblong to ovate, keel oblong, incurved; stamens diadelphous, alternate, filaments dilated above, anthers uniform; style incurved; stigma capitate; pod subterete, circinate-convolute, ribbed; ribs smooth, tuberculate or muricate, indehiscent; seeds reniform to ovoid-cylindrical. 2 species, Mediterranean region, West Asia, Northeast tropical Africa, Atlantic Islands.

1. *Scorpiurus muricatus* L., Sp. Pl., ed. 1, 745 (1753).

Syns. *Scorpiurus sulcatus* L., Sp. Pl., ed. 1, 745 (1753).

Scorpiurus subvillosus L., Sp. Pl., ed. 1, 745 (1753).

Scorpiurus laevigatus Sm., Fl. Graec. Prodr. 2: 81 (1813).

Scorpiurus acutifolius Viv., Fl. Libyc. Spec. 43 (1824).

Scorpiurus muricatus subsp. *laevigatus* (Sm.) Thell., Mém. Soc. Sci. Nat. Cherbourg 38: 333 (1912).

Scorpiurus muricatus subsp. *subvillosus* (L.) Thell., Mém. Soc. Sci. Nat. Cherbourg 38: 339 (1912).

Scorpiurus muricatus subsp. *sulcatus* (L.) Thell., Mém. Soc. Sci. Nat. Cherbourg 38: 339 (1912).

Annual herb 10-35 cm, appressed-hairy; stems branched from the base and above; stipules 1.5-2.5 cm, lanceolate-subulate, entire, membranous except the green midrib; leaves 5-15 x 1-2 cm, oblanceolate, with 3-5 main veins, pseudopetiolate, acute; peduncles 5-18 cm; inflorescence umbellate 1- to 3(-5)-flowered; bracts small, scarious; calyx 4 mm, the teeth equalling or slightly shorter than the tube; corolla yellow or reddish; pod 3-5 cm, circinate or coarcted, with conspicuous longitudinal ribs, the sutures undulate, constricted between the seeds; seeds c. 3.5 x 2 mm, reniform to falcate, dark brown to blackish, rugulose.

N, O, M, D, S; cultivated ground. East and South Mediterranean region, Sinai, Arabia, Iraq, Iran.

16. *Coronilla* L.

Annual (our species) or perennial herbs or shrubs; stems and branches terete; leaves imparipinnate, thick; leaflets regularly paired, sometimes 3-foliolate or with a single large leaflet, short petiololate or sessile; bracts connate into an inconspicuous involucre; stipules connate, stipules and involucre without dark markings or "glands"; peduncle terete; flowers umbellate; calyx campanulate; corolla yellow (our species), rarely white or pink, petals clawed; stamens diadelphous; style bent at 90° and papillose below the small capitate stigma; ovary many-ovulate; fruit a loment, the segments 1-seeded; seeds oblong-linear. 9 species, Mediterranean region, Europe, Atlantic Islands.

1. Leaflets 1-3, the terminal leaflet several times longer than the others
+ Leaflets 3-7, the terminal leaflet longer than or almost equalling the others
1. ***C. scorpioides***
2. ***C. repanda***

1. ***Coronilla scorpioides*** (L.) Koch, Syn. Fl. Germ. Helv. 188 (1853).
Syn. *Ornithopus scorpioides* L., Sp. Pl., ed. 1, 744 (1753).

Annual herb 10-35 cm, glabrous, glaucous; stems erect or ascending, simple or branched mainly from the base; stipules 1.5-2.5 mm, membranous, fused at the base or almost to the apex; leaves 1.5-4.5 cm, 3-foliolate; terminal leaflet 1.5-3 x 1-2 cm, broadly ovate, short-petiololate; lateral leaflets 3-8 mm, suborbicular, sessile; peduncles 1.5-4 cm; umbels 2-4-flowered, pedicels 1-1.5 mm; bracts minute, caducous; calyx 2 mm, tube campanulate, teeth broadly triangular; corolla 2½ times as long as the calyx, yellow; pod 2-4.5 x 0.15-0.2 cm, falcate or coiled, with a 2-3 mm beak, breaking up into about 8 segments; seeds 2-3 x 0.5 mm, cylindrical, brown, smooth.

M, De, S; sandy soils. Mediterranean region, Sinai, extending eastwards to Iraq and Iran.

2. ***Coronilla repanda*** (Poir.) Guss., Fl. Sicul. Syn. 2: 305 (1844) subsp. **repanda**
Syn. *Ornithopus repandus* Poir., Voy. Barb. 2: 215 (1789).

Annual herb 5-25 cm, glabrous, glaucous; stems simple or branched from the base; stipules 2 mm, connate, membranous; leaves 1-3 cm; lower leaves 3-foliolate or simple; upper leaves with 2-3 pairs of leaflets; leaflets 0.6-2 x 0.3-0.6 cm, elliptic or oblong-elliptic, lower almost orbicular; peduncles usually exceeding the leaves; umbels 2- to 4-flowered; bracts minute, caducous; pedicels 1 mm; calyx 2 mm; teeth very short, triangular; corolla 5-7 mm, yellow; pod 2.5-4.5 cm, narrowly linear, strongly arcuate to coiled into a ring at maturity, about 8-segmented; seeds 2-2.5 x 0.5 mm, sausage-shaped, brown.

S; coastal sandy plains. Mediterranean region, Sinai.

17. *Securigera* DC., nom. conserv.

Like *Coronilla* but stems and branches angular to sulcate; leaves thin, with distinct petiole, often longer than the lamina; stipules free, always with dark markings "glands" at the apex, caused by an aggregation of tannin cells, more conspicuous on dried specimens; bracts free, linear, with dark tannin-markings at the apex like the stipules, their number equalling that of flowers, inserted at the base of each pedicel; corolla

yellow, white or pink to purple; style smoothly curved and tapering along its whole length, totally without papillae below the large oblique stigma; fruit a loment, although in *Securigera securidaca* (our species) fragmentation is suppressed. 12 species. Mediterranean region to Somalia.

1. **Securigera securidaca** (L.) Degen & Dörfl., Denkschr. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl. 64: 718 (1897).
 Syns. *Coronilla securidaca* L., Sp. Pl., ed. 1, 743 (1753).
Securigera coronilla DC. in Lam. & DC., Fl. Fr., ed. 3, 4: 609 (1805), nom. illeg.

Annual herb 30-50 cm, glabrous or pubescent; stems erect or ascending, branched, angled and sulcate; stipules 2 mm, free, with dark markings at the apex; leaves 5-12 cm, imparipinnate; upper leaves with 4-6 pairs of leaflets, lower with 2-3 pairs; petioles 1 mm; leaflets 0.6-1.8 x 0.4-0.8 cm, obovate-cuneate, the apex truncate-apiculate; peduncles axillary, exceeding the subtending leaf, elongate in fruit; umbels 3- to 8-flowered; bracts minute, free, membranous, deflexed, with black markings at the tip; calyx 2 mm; teeth equalling the tube, triangular, acute; corolla 0.8-1.1 cm, yellow; standard with reddish veins and 2 mm claw; pod 6-8.5 x 0.3-0.5 cm, compressed, dehiscent, with a 2-3 cm hooked beak, sutures incrassate and the upper caniculate, 6- to 10-seeded; seeds 3.5 x 2 mm, oblong, brownish, smooth.

M; cultivated ground, naturalized. North and East Mediterranean region, eastwards to Iran.

18. **Hippocrepis** L.

Annual (our species) or perennial herbs or shrubs; stems angular; leaves imparipinnate, petiolate; stipules often united for a short distance with the petiole, usually with dark spots "glands" at the base; peduncles well-developed, rarely the inflorescence sessile or sessile; inflorescence umbellate; bracts equalling the number of flowers, membranous, 2-lobed, encircling the base of the umbel and separated by the dark "glands"; calyx-tube ± cylindrical; corolla yellow, standard with a tooth emerging from claw; stamens diadelphous; ovary many-ovular, sessile; style papillose below the small stigma; pod much compressed (our species), rarely terete, divided into 1-seeded horseshoe-shaped jointed segments, each with a deep rounded sinus above the seed; seeds curved or horseshoe shaped. 21 species, Mediterranean region, West Asia.

- | | | |
|---|---------------------------|---|
| 1. Pod coiled into 2 or more rings, margins of sinuses extended into projecting horns | 3. H. areolata | 2 |
| + Pod straight, slightly curved or rounded; margins of sinuses without projecting horns | | |
| 2. Flowers and pods 1-2, sessile in the leaf axis | 1. H. unisiliquosa | 3 |
| + Flowers and pods 2-8, umbellate, on distinct peduncles | | |
| 3. Margin of the elevated seed-chamber not reaching the pod margin at the base | 5. H. cyclocarpa | 4 |
| + Margin of the elevated seed-chamber reaching the pod margin at the base | | |
| 4. Pod straight to slightly curved; leaflets up to 5 pairs | 2. H. constricta | |

+ Pod rounded or strongly curved; leaflets up to 8 pairs

4. *H. multisiliquosa*

1. *Hippocrepis unisiliquosa* L., Sp. Pl., ed. 1, 744 (1753).

Annual herb 10-35 cm, glabrous or sparingly hairy when young; stems many from the base, often branched above, angular; stipules 2.5-4 mm, lanceolate, scarious, with 2 dark spots at the base; leaves 2-8 cm, petiolate, with 3-7 pairs of leaflets; leaflets 0.6-1.4 x 0.15-0.35 cm, linear-oblong to -cuneate, the apex truncate-mucronate; flowers 1-2, very rarely 3, axillary, sessile; pedicels 1 mm, hairy; calyx 2.5-3.5 mm, the teeth equalling the tube; corolla twice as long as the calyx, yellow, standard sometimes pink-veined; pod 2.5-5 x 0.2-0.55 cm, compressed, straight or curved, linear, papillate-hairy, of 5-10 segments; sinus open or closed; seeds 3-3.5 mm, curved to semicircular, brown, smooth.

Two subspecies occur in Egypt:

subsp. *unisiliquosa*

Syns. *Hippocrepis biflora* Spreng., Pl. Min. Cog. Pugill. 2: 73 (1815).

Hippocrepis unisiliquosa L. subsp. *biflora* (Spreng.) O. Bolòs & Vigo, Fl. Països Catalans 1: 642 (1984).

Flowers 1, rarely 2 or 3; pod 4-5.5 mm wide, straight or slightly curved; sinus of segment open.

S; sandy soils. East Mediterranean region, Sinai.

subsp. *bisiliqua* (Forssk.) Bornm., Notizbl. Bot. Gart. Berlin-Dahlem 10: 438 (1928).

Syn. *Hippocrepis bisiliqua* Forssk., F. Aegypt.-Arab. LXXI (1775).

Flowers 2-3, rarely 1; pod 2-3 mm wide, strongly curved; sinus of segments closed, often with overlapping edges.

M, De, S; edges of cultivation, sandy soils. Egypt, Palestine, Syria, Arabia, Iraq, Southwest Iran.

NOTE: Some authors treat *Hippocrepis biflora* Spreng. as a good species, others treat it as a subspecies of *H. unisiliquosa* L. or as a variety of subsp. *bisiliqua* (Forssk.) Bornm. In this treatment it is reduced to the synonymy of *H. unisiliquosa* subsp. *unisiliquosa*, (cf. Chamberlain in Davis, Fl. Turkey 3: 546, 1970).

2. *Hippocrepis constricta* Kunze, Pug. Prim. Pl. 12 (1842).

Annual herb 10-40 cm, glabrous or sparsely hairy; stems angular, many from the base; ascending or procumbent, wiry, usually with long internodes; stipules 1-2 mm, broadly lanceolate, scarious; leaves with 2-5 pairs of leaflets; leaflets 0.3-1.5 x 0.2-0.4 cm, oblong-elliptic, the apex obtuse, emarginate or truncate; peduncle 1.5-3 cm; umbels 2- to 4-flowered; bracts 1.5 mm, triangular, membranous; ciliate; pedicels 0.5-1 mm; calyx 2.5-3 mm, the teeth about as long as the tube; corolla 5-6 mm, pale yellow with pink veins; pod 2-3 x 0.2-0.3 cm, linear, straight or slightly curved, papillose-pubescent, the apex with a curved mucro to 2 mm; sinuses 5-9; margin of the elevate seed-chamber reaching the pod margin at the base; seeds 2 mm, C-shaped, brownish.

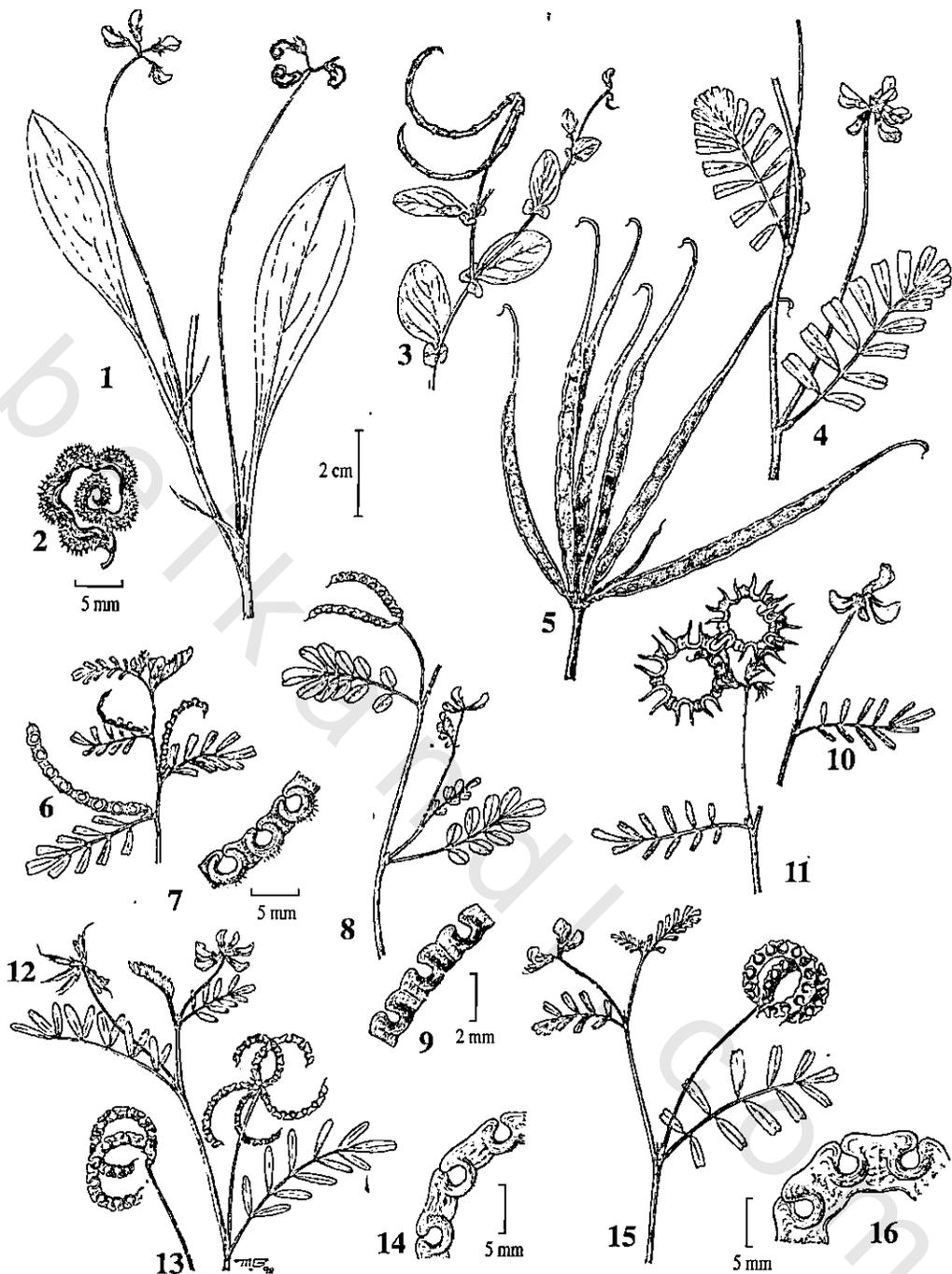


Plate 52. LEGUMINOSAE: *Scorpiurus muricatus* 1, flowering and fruiting branch; 2, pod. *Coronilla scorpioides* 3, flowering and fruiting branch. *Securigera securidaca* 4, flowering branch; 5, fruiting branch. *Hippocrepis unisiliquosa* 6, flowering and fruiting branch; 7, portion of the pod. *Hippocrepis constricta* 8, flowering and fruiting branch; 9, portion of the pod. *Hippocrepis areolata* 10, flowering branch; 11, fruiting branch. *Hippocrepis multisiliquosa* 12, flowering and fruiting branch; 13, pods; 14, portion of the pod. *Hippocrepis cyclocarpa* 15, flowering and fruiting branch; 16 portion of the pod. All drawings to the same scale except enlarged parts (scale given).

N, De, R, S; sandy plains, limestone hills, edges of cultivation. Egypt, Palestine, Arabia, Iran, Pakistan.

3. **Hippocrepis areolata** Desv., Mém. Soc. Linn. Paris 4: 329 (1826).

Syns. *Hippocrepis bicontorta* Loisel., Mém. Soc. Linn. Paris 6: 424 (1827).

Hippocrepis cornigera Boiss., Diagn., ser. 1, 2: 102 (1843).

Annual herb 10-30 cm, glabrous or sparsely hairy; stems angular, many from the base, procumbent or ascending; stipules 1-2 mm, narrowly lanceolate, scarious, with 2 dark spots at the base; leaves with 2-6 pairs of leaflets; leaflets 0.5-1.2 x 0.1-0.25 cm, subopposite, oblong to linear, the apex obtuse, truncate or emarginate; peduncles usually longer than the subtending leaf; umbels 2- to 5 flowers; bracts minute, scarious, with 2 black spots at the base; pedicels 1 mm; calyx 3-4 mm, glabrous, the teeth shorter than the tube; corolla 6-8 mm, yellow; standard purple-veined, keel strongly incurved; pod 3-4 cm, compressed, coiled into 2 or more rings; margins of sinuses extended into projecting horns; seeds 3 x 0.5 mm, crescent-shaped, brownish, smooth.

M, De, S; sandy desert wadis and calcareous hills. South France, North Africa, East Mediterranean region, Sinai, Arabia, Iraq, South Iran.

4. **Hippocrepis multisiliquosa** L., Sp. Pl., ed. 1, 744 (1753).

Annual herb 10-35 cm, glabrous; stems angular, erect to procumbent, branched from the base and above; stipules 2-3 mm, triangular, acute, scarious, with dark spots at the base; leaves 3-8 cm, petiolate, with 3-8 pairs of leaflets; leaflets 0.4-1.2 x 0.2-0.4 cm, oblong-linear to narrowly obovate-cuneate, the apex obtuse or truncate-mucronate; peduncles equalling or exceeding the subtending leaf; umbels 3- to 8-flowered; bracts 1-1.5 mm, 2-fid, with 2 prominent black glands at the base; pedicel 1.5 mm; calyx 3-3.5 mm, the teeth equalling or slightly shorter than the tube; corolla 6-7.5 mm, yellow, the keel curved; pod 4-5 x 0.3-0.4 cm, linear in outline, compressed, rounded or strongly curved, sinus almost closed, margin of the elevated seed-chamber reaching the pod margin at the base; seeds cylindrical, arcuate, brown, smooth.

S; edges of cultivation, sandy soils. Mediterranean region, Sinai.

5. **Hippocrepis cyclocarpa** Murb., Acta Univ. Lund. 33(12): 30 (1897).

Like *Hippocrepis multisiliquosa*, but the flowers smaller, 5.5-6.5 mm; pod completely rounded, the segments 5-6 mm broad, margin of the elevated seed-chamber not reaching the pod margin at the base.

M; cultivated ground. Egypt, Libya, Tunisia.

19. **Cullen** Medik.

Shrubs or herbs; leaves 1-3-foliolate, rarely 5-foliolate; leaflets ovate, lanceolate or elliptic, coarsely dentate to undulate, glabrous to densely pubescent; stipules linear-subulate, free and adhering to the base of leaf-rhachis, persistent; flowers scarcely exceeding the calyx, purple, rarely pale-coloured, sessile, in clusters into long axillary pedunculate spikes, each triplet of flowers subtended by a single ovate bract; calyx campanulate; standard obovate; wings longer than the keel; ovary substipitate; style

upcurved, the stigma minute or capitate; fruit erect, conspicuously glandular-warty, indehiscent; pericarp thin, adherent to the seed; seeds obliquely reniform. 35 species, Old World tropics.

1. **Cullen plicata** (Delile) C. H. Stirt., *Bothalia* 13: 317 (1981).

Syns. *Psoralea plicata* Delile, *Descr. Egypte, Hist. Nat.* 252 (1814).

Psoralea odorata Blatt. & Halb., *J. Bombay Nat. Hist. Soc.* 26: 238 (1918).

Small shrub 30-60 cm; stems pubescent, glandular-punctate; leaves 3-foliolate, petiolate; terminal leaflet 1-2.5 x 0.3-0.8 cm, oblong to oblong-ovate, the lateral smaller, pubescent and gland-dotted on both surfaces; sinuate-plicate; inflorescence racemose, axillary; flowers in clusters of 1-3; pedicel 1-2 mm; bracts 1-2 mm; calyx 3-4.5 mm, pubescent, the teeth shorter than the tube; corolla slightly longer than the calyx; pod 4-5 mm, ellipsoid, pubescent, enclosed in the accrescent calyx; seed 4 mm.

N, D; sandy plains and edges of cultivation. North Africa, Arabia, extending eastwards to Pakistan and India, and southwards to Sudan and Somalia.

NOTE: This species is treated under the genus *Psoralea* by some authors.

20. **Bituminaria** Heist. ex Fabr.

Perennial herbs; leaves 3-foliolate, gland-dotted, pubescent; stipules linear-subulate, persistent; flowers sessile or subsessile, aggregated in clusters of 5-16 flowers into long pedunculate axillary, capitate or umbellate inflorescences; each cluster subtended by a single 3-5-cleft bract; calyx with long setaceous teeth, corolla hardly exceeding the calyx, pink, blue, violet or creamy-white; standard narrowly obovate; wings longer than the keel; ovary substipitate, pubescent; stigma slightly flattened; fruit indehiscent, with a long sword-shaped beak; pericarp adnate to the seed or free; seeds dark brown, oblong or obliquely reniform. 2 species, Mediterranean region, Sinai.

1. Terminal leaflet of lower leaves 2.5-4.5 cm; heads
10-25-flowered

+ Terminal leaflet of lower leaves 0.5-1.5 cm; heads 3-8-flowered

1. **B. bituminosa**

2. **B. flaccida**

1. **Bituminaria bituminosa** (L.) C. H. Stirt., *Bothalia* 13: 318 (1981).

Syns. *Psoralea bituminosa* L., *Sp. Pl.*, ed. 1, 763 (1753).

Psoralea palaestina Gouan, *Ill. Observ. Bot.* 51 (1773).

Perennial herb, 0.4-1.2 m, appressed-hirsute; stems erect, striate; stipules 0.6-1.2 cm, narrowly lanceolate; leaves long-petiolate, 3-foliolate; leaflets of lower leaves 2.5-4.5 x 2-4 cm, ovate-elliptic to orbicular; leaflets of upper leaves 4-7 x 0.6-1.6 cm, elliptic, lanceolate, acute; terminal leaflet longer than the 2 lateral, petiololate; peduncles to 12 cm, exceeding the subtending leaf; heads 10-25-flowered; bracts 3-5 mm, triangular, 2-3-toothed; flowers 1.8-2.5 cm; calyx 1.2-1.4 cm, hirsute, the teeth longer than the tube, unequal, subulate; corolla blue to violet, longer than the calyx, the standard longer than the wings and keel; pod 1.5-2.5 cm including the beak, seed bearing part ovoid, shorter than the beak; beak sword-like, hairy.

S; cultivated and waste ground. Mediterranean region, West Asia.

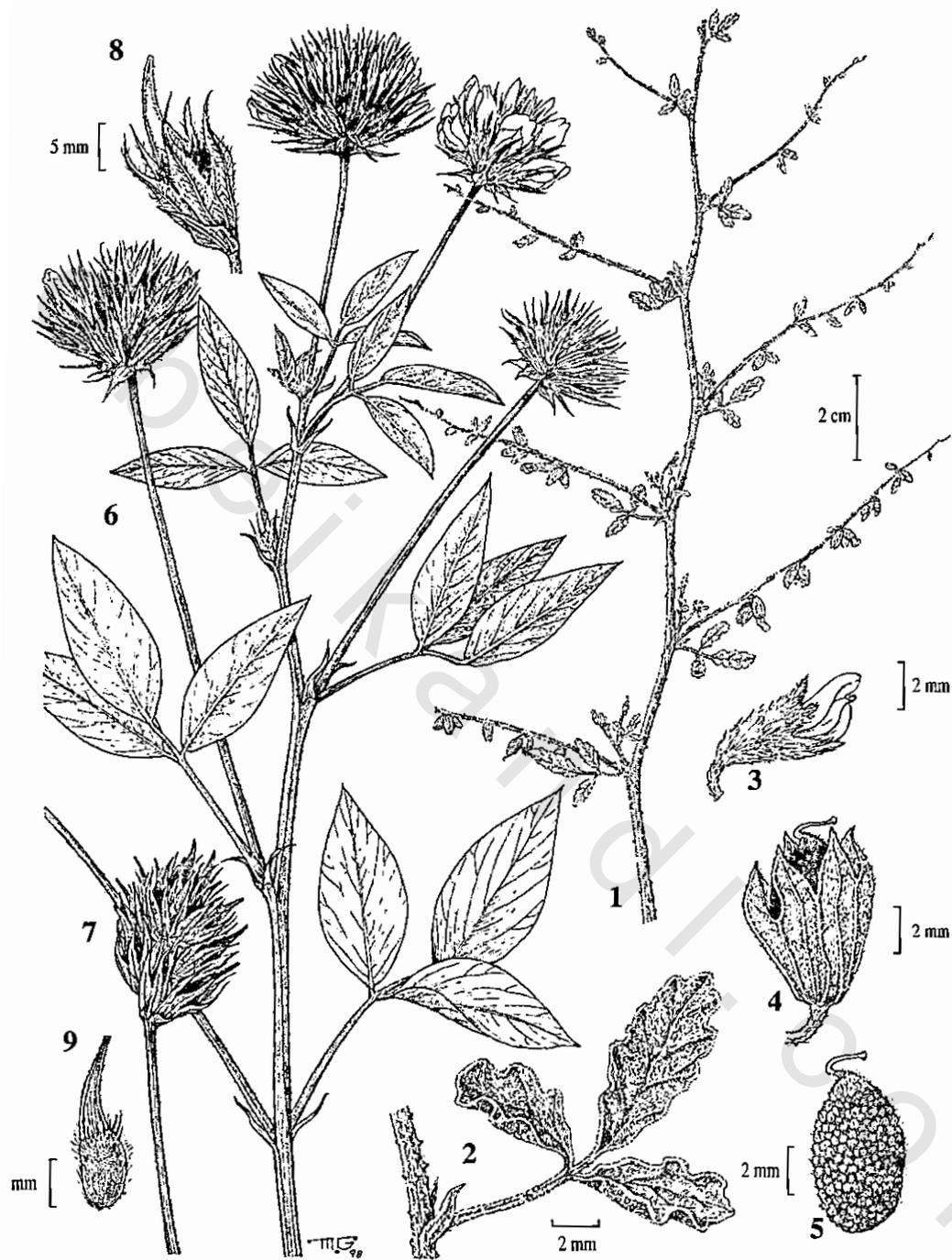


Plate 53. LEGUMINOSAE: *Cullen plicata* 1, flowering and fruiting branch; 2, leafy branch; 3, flower; 4, pod enclosed in the calyx; 5, pod exposed. *Bituminaria bituminosa* 6, flowering and fruiting branch; 7, fruiting head; 8, pod enclosed in the calyx; 9, pod exposed. All drawings to the same scale except enlarged parts (scale given).

2. **Bituminaria flaccida** (Nábelek.) Greuter, Willdenowia 16: 108 (1986).
 Syn. *Psoralea flaccida* Nábelek, Spisy Prír. Fak. Masarykovy Univ. 35: 74 (1923).

Like *Bituminaria bituminosa*, but the terminal leaflet of lower leaves 0.5-1.5 cm; heads 3-8-flowered. However, it could be an extreme variant of *B. bituminosa*.

21. **Indigofera** L.

Shrubs, perennial or annual herbs, hairs biramous, simple trichomes sometimes present; stipules subulate, linear-attenuate to lanceolate or ovate; leaves pinnately 1-23-foliolate or simple; leaflets opposite, sometimes alternate, entire; stipels often present; inflorescences usually axillary racemes, less often panicles or with flowers in axillary clusters; corolla orange, carmine, crimson, pink or white; standard hairy on the dorsal surface, tapering into a short claw; keel bearded distally, the upper margin with a fringe of hairs, lateral spurs present; filaments free distally for less than 1 mm, ovary long with a short style, or short and few-seeded with a long style; stigma capitate; pod 1- to many-seeded, strigose, hirsute, sericeous or glabrous. About 750 species, tropical and warm regions of the world, especially Africa.

- | | |
|---|---------------------------|
| 1. Spiny shrub; inflorescence spinescent | 2 |
| + Unarmed herb or shrub; inflorescence not spinescent | 3 |
| 2. Inflorescence 2-4-flowered; pod appressed-strigose, not torulose | 6. I. spinosa |
| + Inflorescence (5-)10-20-flowered; pod appressed-silvery, torulose | 10. I. spiniflora |
| 3. Leaves simple | 4. I. cordifolia |
| + Leaves compound | 4 |
| 4. Pod subglobose, 1-seeded; inflorescence condensed, subcapitate; the bracts passing gradually into foliage leaves | 3. I. lotononoides |
| + Pod terete or flattened, 2- to many-seeded; inflorescence of axillary racemes; bracts distinct from leaves | 5 |
| 5. Pod flattened | 6 |
| + Pod terete | 7 |
| 6. Annual; pod 1.5-2.5 cm, strongly curved, 5-9-seeded | 1. I. hochstetteri |
| + Perennial; pod 0.5-1 cm, almost straight, 2-4-seeded | 2. I. arabica |
| 7. Flowers and pods in axillary clusters, not pedunculate | 5. I. sessiliflora |
| + Flowers and pods in pedunculate racemes | 8 |
| 8. Multicellular glandular hairs present | 9 |
| + Multicellular glandular hairs absent | 10 |
| 9. Stems and leaves sparsely greenish-yellow canescent, densely glandular-hairy; the glandular hairs to 1.5 mm; pod to 2.2 cm, not or inconspicuously torulose, 8-12-seeded | 7. I. colutea |
| + Stems and leaves densely silvery-canescens, sparsely glandular-hairy; the glandular hairs to 0.5 mm; pod to 1.2 cm, torulose, 3-5-seeded | 8. I. argentea |

10. Leaflets alternate 9. *I. oblongifolia*
+ Leaflets opposite 11

11. All leaves 3-foliolate; pod 2.5-4 x 0.15 cm, not or inconspicuously
torulose, 8-12-seeded 11. *I. trita* subsp. *subulata* var. *nubica*

+ At least some leaves 5-9-foliolate; pod 0.7-1.2 x 0.3-0.4 cm,
conspicuously torulose, 2-4(-5)-seeded 12

12. Leaflets 3-5, silvery-strigose on both surfaces; pod strongly torulose,
the segments globular 12. *I. articulata*

+ Leaflets (5)-7-9, glabrous above; pod less torulose, the segments
cylindrical-ovoid 13. *I. coerulea*

1. *Indigofera hochstetteri* Baker in Oliv., Fl. Trop. Afr. 2: 101 (1871).

Syns. *Indigofera arenaria* A. Rich., Tent. Fl. Abyss. 183 (1847), non E. Mey.,
Comm. Pl. Afr. Austr. 107 (1836).

Indigofera ornithopodioides Jaub. & Spach, Ill. Pl. Orient. 5: 90 (1856),
non Schumach., Beskr. Guin. Pl. 372 (1827).

Indigofera anabaptista Baker in Hook. f., Fl. Brit. Ind. 2: 102 (1876), nom.
illeg.

Indigofera semhaënsis Vierh., Denkschr. Kaiserl. Akad. Wiss.
Math.-Naturwiss. Kl. 71: 362 (1907).

Annual herb 15-40 cm, strigose; stems spreading; stipules 2-3 mm, filiform; petiole 0.5-1.5 cm; leaves 3-5(-7)-foliolate; leaflets 0.5-2.5 x 0.2-0.7 cm, oblong-lanceolate, with rounded, retuse or truncate, mucronate apex, strigose on the lower surface, slightly strigose on the upper; peduncles 0.3-1.2 cm; racemes many-flowered, shorter than or equalling the subtending leaf; calyx 2-2.5 mm; teeth 1.5-2 mm, subulate-filiform; tube very short; corolla ± equalling the calyx, caducous; pod 1.5-2.5 cm, flattened, strongly curved, the style base persistent on the obtuse apex, 5-9-seeded; seeds 2 x 1.2 mm, flattened, kidney-shaped, smooth.

N, O, GE; edges of cultivation, sandy soils. Egypt, tropical East Africa to Congo and Mali, Arabia to Pakistan and India.

2. *Indigofera arabica* Jaub. & Spach, Ill. Pl. Orient. 5: 89 (1856).

Perennial herb woody at the base, 15-30 cm, silvery-strigose; stems branched, especially at the base; stipules 2-2.5 mm, subulate; petiole 0.5-1 cm; leaves 3-5-foliolate; leaflets 0.5-1.5 x 0.2-0.6 cm, opposite, obovate or oblanceolate, downcurved at the rounded, truncate or retuse apex; peduncle 0 or very short; racemes shorter than the subtending leaf, 5-12-flowered, dense; calyx 3-3.5 mm, strigose, deeply divided into subulate teeth; standard strigose on the dorsal surface; pod 0.5-1.1 x 0.3 cm, flattened, silvery-strigose, the style base persistent on the obtuse-upcurved apex, 2-5-seeded; seeds 1.5 x 1.5 mm, rounded-rectangular, with thick margins.

S; stony wadis. Sinai, Arabia, Somalia, Ethiopia.

3. *Indigofera lotononoides* Baker f., J. Bot. (London) 41: 187 (1903).

Perennial herb 10-20 cm, woody at the base, pubescent; leaves 3-foliolate; inflorescence

condensed, subcapitate, white-hairy, the bracts passing gradually into foliage leaves calyx *c.* 3 mm, slightly shorter than the pod; pod subglobose, 1-seeded.

O (Uweinat); sandy plains, Egypt, Libya, Sudan.

4. ***Indigofera cordifolia*** Roth, Nov. Pl. Sp. 357 (1821).

Annual herb 10-20 cm, pubescent; stems prostrate; leaves 0.6-1.2 x 0.4-0.8 cm pubescent on both surfaces, simple, subsessile, ovate, cordate, with a prominent midrib on the lower surface, mucronate; flowers 3-7, in axillary clusters; calyx *c.* 3 mm, the teeth much longer than the tube, subulate; corolla bright red, slightly shorter than the calyx; pod 3-4 x 1.5 mm, terete; style persistent, (1-)2-seeded, torulose when 2-seeded. seeds 1 mm, pitted.

Dw (Giza Pyramids); sandy plains. Egypt, Mauritania, Cape Verde Islands, Sudan Ethiopia, Eritrea, Socotra, Pakistan, Afghanistan, India, Indonesia, North Australia.

5. ***Indigofera sessiliflora*** DC., Prodr. 2: 228 (1825).

Syns. *Indigofera tribuloides* Boiss., Fl. Orient. 2: 189 (1872).

Indigofera arabica, sensu Baker, Fl. Trop. Afr. 2: 103 (1871).

Indigofera trigonelloides, sensu Baker, Fl. Brit. Ind. 2: 94 (1876), non Jaub. & Spach.

Annual herb 15-30 cm; stems ascending, much-branched; leaves 2-3.5 cm, the petiole 0.5-1 cm, the rhachis 1.5-2.5 cm, with 6-11 leaflets; leaflets 3-7 mm, silvery-pubescent; flowers 7-12 in dense sessile, axillary clusters; calyx 2.5-3 mm, the teeth much longer than the tube, setaceous, densely silvery-hairy; corolla \pm equalling the calyx, pubescent on the dorsal surface; pod 0.9-1.3 x 1.5 mm, torulose, pubescent, 3-6-seeded; seeds not pitted.

O (Uweinat), GE; sandy plains. Egypt, Sudan, Ethiopia, India, extending westwards to Senegal.

6. ***Indigofera spinosa*** Forssk., Fl. Aegypt.-Arab. 137 (1775).

Small spiny shrub, 30-60 cm; stems much-branched, intricate, appressed white-hairy; stipules 1.5-2.5 mm, subulate; petiole 1-3 mm, the rhachis very short, with 3(-7) leaflets; leaflets 2-6 x 2-3 mm, densely strigose, elliptic to obovate-cuneate, mucronate; axis of the inflorescence 0.8-2.5 cm, spiny and glabrescent at the tip, 2-4-flowered; bracts minute, caducous; flowers subsessile: calyx *c.* 2 mm, the teeth *c.* 1 mm; corolla *c.* 5 mm, pink to purple, the standard pubescent on the dorsal surface; pod 1-2 x 0.2 cm, straight, appressed- strigose, not torulose, 6-9-seeded.

De, R, GE; hillsides and rocky ground. Egypt, tropical East Africa, Arabia.

7. ***Indigofera colutea*** (Burm. f.) Merr., Philipp. J. Sci. 19: 355 (1921).

Syns. *Galega colutea* Burm. f., Fl. Ind. 172 (1768).

Indigofera viscosa Lam., Encycl. 3: 247 (1789).

Indigofera multifoliolata De Wild., Pl. Beq. 2: 539 (1924).

Annual herb (in Egypt), 20-40(-60) cm, stems and leaves sparsely greenish-yellow

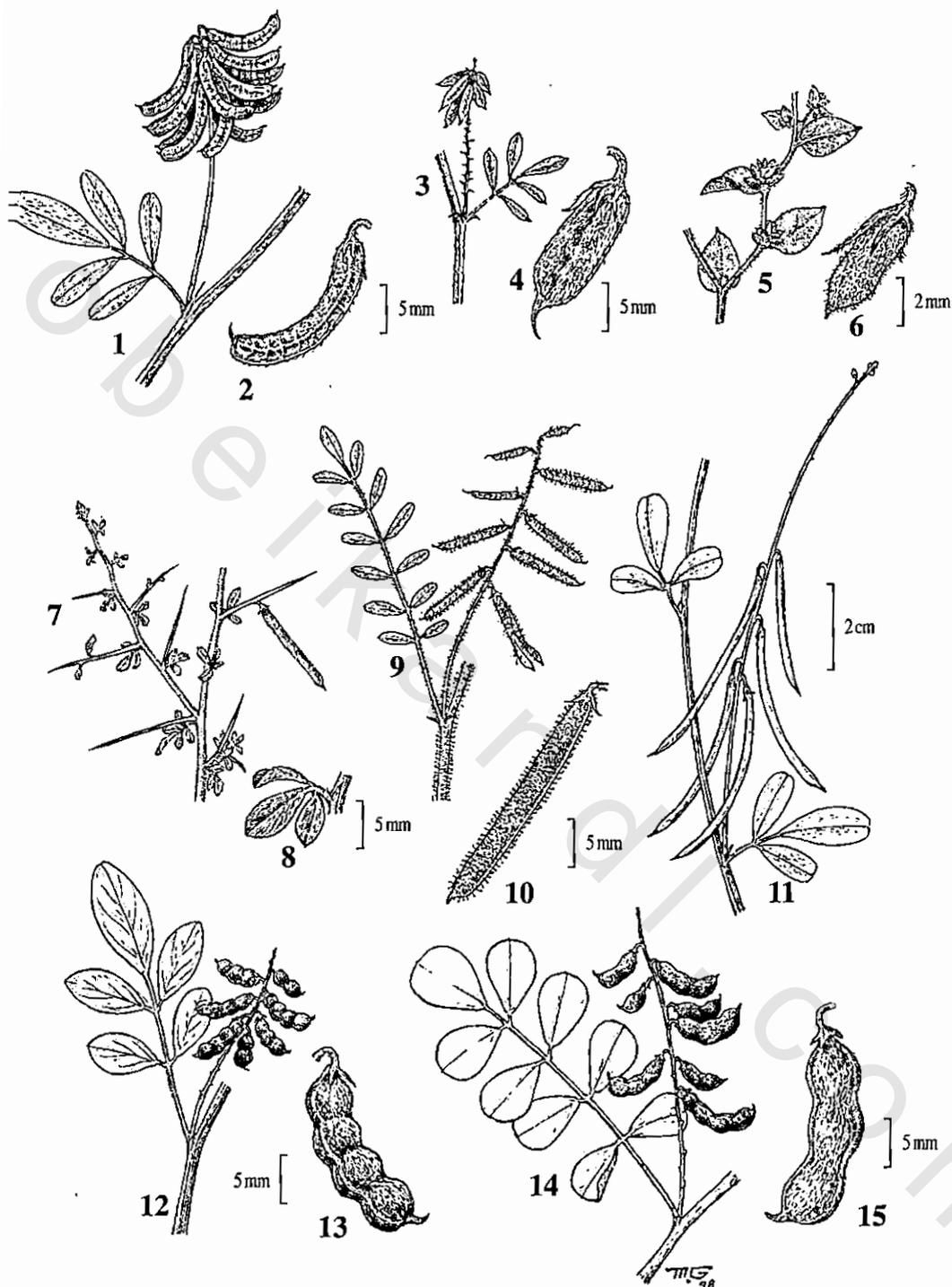


Plate 54. LEGUMINOSAE: *Indigofera hochstetteri* 1, fruiting branch; 2, pod. *Indigofera arabica* 3, fruiting branch; 4, pod. *Indigofera cordifolia* 5, fruiting branch; 6, fruit. *Indigofera spinosa* 7, flowering and fruiting branch; 8, leaf. *Indigofera colutea* 9, fruiting branch; 10, pod. *Indigofera trita* subsp. *subulata* var. *nubica* 11, fruiting branch. *Indigofera articulata* 12, fruiting branch; 13, pod. *Indigofera coerulea* var. *coerulea* 14, fruiting branch; 15, pod. All drawings to the same scale except enlarged parts (scale given).

canescent and densely covered with multicellular glandular hairs especially on the stems, leaf rhachis and pods; glandular hairs to 1.5 mm; stems erect or spreading, branched from the base and above; stipules 2-3 mm; leaflets 9-15, 0.5-1.2 x 0.2-0.3 cm, oblong-elliptic; peduncles 0.6-1.2 cm, racemes 8-18-flowered, longer than the subtending leaf; calyx 2-3 mm, deeply divided; corolla 6-7 mm, dull purple, pubescent on the dorsal side; pod 1.5-2.2 x 0.2 cm, straight, densely covered with glandular hairs, 8-12-seeded; seeds spotted.

R; sandy plains. Southeast Egypt, tropical East and South Africa, Arabia, India, Australia.

8. **Indigofera argentea** Burm. f., Fl. Ind. 171 (1768), non L. (1771).

Syns. *Indigofera semitrijuga* Forssk. var. *tetrasperma* DC., Prodr. 2, 230 (1825).

Indigofera arenaria A. Rich. var. *strigosa* N. Terrac., Ann. Ist. Rom. 5: 109 (1893).

Small shrub 20-50 cm, densely silvery-canescens, sparsely glandular-hairy, the glandular hairs to 0.5 mm; stems ascending; petiole 0.5-1 cm, the rhachis 0.5-1 cm, with 5-7 leaflets; leaflets 2.5-6 x 2-3 mm, opposite, obovate-cuneate, silvery on both surfaces; racemes 4-10-flowered, lax, longer than the subtending leaf; calyx 2 mm, densely pubescent; corolla 4-5 mm, bright red, the standard hairy on the dorsal surface; pod 1-1.2 cm, glandular-hairy, straight, torulose, 3-5-seeded.

N, D, R, GE; sandy plains. Egypt, Sudan, Somalia, Ethiopia, Mauritania, South Arabia, India.

9. **Indigofera oblongifolia** Forssk., Fl. Aegypt.-Arab. 137 (1775).

Syns. *Indigofera lotoides* Lam., Encycl. 3: 247 (1789), excl. syn.

Indigofera paucifolia Delile, Descr. Egypte, Hist. Nat. 107, t. 37, f. 2, 2 (1814).

Indigofera desodioides Baker, Kew Bull. 1894: 331 (1894), non J. Linn. Soc. 22: 463 (1887).

Shrub 1-1.5 m, silvery-pubescent; stems many, branched; petiole 0.5-1 cm, the leaf rhachis 1-2 cm, with (1-)2-7 leaflets; leaflets 1.5-3.5 x 0.4-0.8 cm, oblong, alternate, strigose on both surfaces; racemes axillary, many-flowered; calyx 2-3 mm; teeth ± equalling the tube, triangular; corolla 4-5 mm, purple; standard silvery-hairy on the dorsal surface; pod 1.2-1.8 x 0.2 cm, curved, torulose, white-strigose, 5-8-seeded.

N, D, GE; sandy plains and rocky wadis. Egypt, Sudan, Djibouti, Ethiopia, Somalia, Arabia, Socotra, eastwards to Java and westwards to Angola and Senegal.

10. **Indigofera spiniflora** Boiss., Fl. Orient. 2: 190 (1872).

Syn. *Indigofera spinosa* Forssk. var. *spiniflora* (Boiss.) Schweinf., Bull. Herb. Boiss., 4, App. 2: 237 (1896).

Small shrub 20-50 cm, appressed silvery-hairy; stems ascending to sprawling; leaves 3-foliolate; petiole 2-8 mm, the rhachis c. 1 mm; leaflets 0.4-1.2 x 0.2-0.4 cm, appressed silvery-hairy on both surfaces, obovate-cuneate to oblong-elliptic, with a prominent midrib beneath; apex rounded; inflorescence 2-4 cm, ending in a weak spine; raceme (5-)10-20-flowered; pedicels 1 mm, downcurved; calyx c. 2 mm; teeth longer than the

tube; corolla red, the standard hairy on the dorsal surface; pod 1-1.2 x 0.2 cm, reflexed, torulose, appressed silvery-hairy, 4-6-seeded; stigma persistent.

R, GE; sandy plains. South Egypt, Sudan, Somalia, Ethiopia, Yemen.

11. *Indigofera trita* L. f., Suppl. Pl. 335 (1781) subsp. *subulata* (Vahl ex Poir.) Ali

var. *nubica* (J. B. Gillett) Boulos & Schrire, comb. nov.

Basionym: *Indigofera subulata* Vahl ex Poir. in Lam., Encycl., Suppl. 3: 150

(1813) var. *nubica* J. B. Gillett, Kew Bull., Add. Ser. 1: 100 (1958).

Small shrub 0.4-1.2 m, strigose; stems erect, much-branched; all leaves 3-foliolate; petiole 0.5-1 cm, the rhachis 2-5 mm; leaflets 0.6-1.5 x 0.3-0.7 cm, obovate-cuneate to elliptic, obtuse, truncate or emarginate, strigose and with a prominent midrib on the lower surface, glabrous on the upper; peduncles 2-5 cm, racemes axillary, much longer than the subtending leaf, many-flowered; calyx c. 2 mm, strigose; teeth ± equalling the tube, subulate; corolla c. 5 mm; pod 2.5-4 x 0.15 cm, slightly curved, thinly strigose, not or inconspicuously torulose, 8-12-seeded.

GE; rocky slopes; Southeast Egypt, Northeast Sudan, Somalia.

NOTE: The type material of *Indigofera trita* subsp. *subulata* var. *nubica* was collected 5 March 1865 by G. Schweinfurth, No. 1812 (K, holotype!, BM isotype) from Gebel Shallal, near Gebel Elba at 22°N, the frontier region between Egypt and Sudan. It was recollected 25 January 1933 by J. R. Shabatai, No. F. 1893, Wadi Kansisrob, Gebel Elba, Egypt (K!). Another specimen was collected from Gebel Elba, 22 February 1933 by B. K. Cooke No. 138 (K!) but without a detailed locality within the Gebel Elba region. A fourth specimen from Sudan, about 21°N, Red Sea Hills, alt. 3,000-4,000 ft, was collected by J. Th. Bent in 1896. The four specimens from Egypt and Sudan were collected within or near Gebel Elba, Red Sea Hills, between 21°N and 22°N. The only available specimen from Somalia (without any detailed locality) was collected in 1897 by E. L. Phillips (K!).

12. *Indigofera articulata* Gouan., Ill. Observ. Bot. 49 (1773).

Syns. *Indigofera tinctoria*, sensu Forssk., Fl., Aegypt.-Arab. 138 (1775).

Indigofera glauca Lam., Encycl. 3: 246 (1789).

Shrub 0.5-1.2 m, densely silvery-strigose throughout; stems branched; leaves 3-5-foliolate; leaflets 1-2.5 x 1-1.8 cm, silvery-strigose on both surfaces, opposite, obovate, the apex rounded; racemes sessile, shorter than the subtending leaf, many-flowered; calyx 1.5 mm; teeth triangular, equalling the tube; corolla c. 4 mm, soon deciduous; standard brownish, strigose on the dorsal surface; pod 0.7-1.2 x 0.3-0.4 cm, conspicuously torulose, the segments globular, indehiscent, 2-4-seeded.

N, O, D, R, GE; edges of cultivation, sandy plains. Egypt, Sudan, Djibouti, Ethiopia, Somalia, Arabia.

13. *Indigofera coerulea* Roxb., Hort. Beng. 57 (1814) var. *coerulea*

Like *Indigofera articulata* but leaflets (5-)7-9, glabrous on the upper surface; pod less torulose and the segments cylindrical-ovate.

De (north and west of Gebel Elba), GE; stony wadis. Southeast Egypt, Northeast Sudan, North Ethiopia, Somalia, Arabia, eastwards to India and Sri Lanka.

22. *Microcharis* Benth.

Annual or perennial herbs; leaves 1-9(-13)-foliolate or simple; stipels absent; racemes axillary or terminal, laxly 3-15(-30)-flowered; bracts persistent; pedicels stiffly spreading; corolla pink, glabrous; standard narrow at the base, tapering to the claw; keel with lateral pouches, spurs absent; stamens curved upwards; vexillary stamen mostly sterile; anthers at least of the shorter stamens with hyaline scales at the base; style short, thick, widened and laterally compressed at the point of flexure; stigma discoid, oblique; pod patent to erect, (5-)10-30-seeded, laterally compressed, linear, straight or curved; seeds quadrate, crowded, separated by thin septa. About 35 species, tropical Africa and Madagascar.

1. *Microcharis tritoides* (Baker) Schrire, *Bothalia* 22: 167 (1992) subsp. **tritoides**
 Syns. *Indigofera tritoides* Baker, *Kew Bull.* 1895: 214 (1895).
Indigofera leptocarpa Hochst. & Steud. ex Balf. f., *Roy. Soc. Edinb.* 11:
 510, 14 (1882), p. p., non Eckl. & Zeyh. (1836).
Indigofera tenuisiliqua Schweinf., *Bull. Herb. Boiss.* 4, App. 2: 241 (1896).

Perennial herb 30-50 cm, woody at the base, densely appressed silvery-pubescent; stems erect or ascending; leaves 3-foliolate, some simple; petiole 0.5-1 cm; leaflets 1-3.5 x 0.5-2.5 cm, obovate to oblanceolate, silvery-pubescent on both surfaces; racemes 15-30-flowered, much exceeding the subtending leaf; peduncles 0.5-2.5 cm; calyx 3-3.5 mm, teeth triangular; corolla pink, glabrous; pod 2.5-4 x 0.2 cm, straight or curved near the apex, silvery, 15-25-seeded.

GE; stony wadis. Southeast Egypt, Northeast Sudan, Ethiopia, Djibouti, Somalia, Arabia.

23. *Tephrosia* Pers., nom. conserv.

Annual or perennial herbs or shrubs, hairs basifixed; leaves usually imparipinnate, less often simple or 1-foliolate, rarely palmate; lateral nerves of leaflets usually closely parallel; flowers in the axils of upper leaves or in pseudo-racemes; calyx 5-lobed, the upper 2 teeth often \pm united; corolla usually reddish-purple, the standard pubescent on the dorsal surface, with a well-defined claw; vexillary filament slightly attached to the others or less often free; disc usually present between stamens and ovary; pod linear-oblong, \pm flattened, thinly leathery, dehiscent, often explosively, the separated valves twisting; seeds 1-many. 400 species, tropical and warm temperate regions especially Africa.

- | | |
|--|--------------------------|
| 1. Pod ovoid, 1-seeded | 1. T. nubica |
| + Pod linear, many-seeded | 2 |
| 2. Flowers 1-3, axillary, not pedunculate | 3 |
| + Flowers numerous, racemose | 4 |
| 3. Leaflets obovate or obcordate, appressed-hairy on both surfaces | 2. T. quartiniana |
| + Leaflets oblanceolate, elliptic or narrowly obovate, glabrous on the upper surface | 3. T. uniflora |

4. Leaves simple
+ Leaves imparipinnate

6. *T. kassasii*
5

5. Calyx and pod densely brown-villous
+ Calyx and pod appressed-hairy

4. *T. villosa* subsp. *ehrenbergiana*
5. *T. purpurea*

1. ***Tephrosia nubica*** (Boiss.) Baker in Oliv., Fl. Trop. Afr. 2: 125 (1871) subsp. *nubica*
Syns. *Pogonostigma nubicum* Boiss., Diagn. Pl. Orient. 2: 40 (1843).
Pogonostigma abyssinicum Jaub. & Spach, Ill. Pl. Orient. 5: 88 (1856).
Tephrosia nubica (Boiss.) Baker var. *abyssinica* (Jaub. & Spach)
Schweinf., Bull. Herb. Boiss. 4, App. 2: 247 (1896).

Perennial herb 40-80 cm, woody at the base, grey-tomentose throughout; stems erect, much-branched; stipules 2.5-4 mm, subulate; petiole 0.5-1.5 cm, the rhachis 1.5-5 cm, with 5-9 leaflets; leaflets 1.5-4 x 0.3-0.8 cm, oblanceolate, densely tomentose on the lower surface, appressed hairy on the upper; flowers in terminal and axillary pseudo-racemes; calyx c. 1.2 cm, deeply lobed, densely villous, calyx-lobes c. 1 cm, subulate; petals purplish, the standard c. 1.2 cm, densely villous; pod 1-1.2 x 0.6 cm, ovoid, densely villous, with a 5-mm stipe, 1-seeded; seeds 4-5 x 3 mm.

De (north of GE), GE; stony and sandy wadis. Egypt, Sudan, Chad, Kenya, Djibouti, Ethiopia, westwards to Mauritania and Niger.

2. ***Tephrosia quartiniana*** Cuf. ex Greuter & Burdet, Willdenowia 16: 446 (1987).
Syn. *Tephrosia vicioides* A. Rich., Tent. Fl. Abyss. 1: 188 (1847), non Schlecht.,
Linnaea 12: 297 (1838).

Annual or short-lived perennial herb, 20-50 cm, pubescent; stems spreading to ascending, branched mainly from the base; stipules 3-5 mm, narrowly lanceolate, acuminate, 3-nerved; petiole 0.5-1.5 cm, the rhachis (1-)2-5 cm, villose, with (3-)-5-9 leaflets; leaflets 0.5-1.2 x 0.4-0.8 cm, obovate or obcordate, densely pubescent on the lower surface, less pubescent on the upper, with rounded or emarginate, mucronate apex; flowers 1-3, axillary, not pedunculate; calyx c. 3 mm, deeply lobed; lobes subulate, densely villose; standard 5-6 mm, greenish-pink, wings pink; pod 2.5-3.5 x 0.3-0.4 cm, villose, linear, with a 2 mm stipe, 6-9-seeded.

De (north of GE), GE; stony wadis. Southeast Egypt, North Sudan, Arabia, Eritrea, Ethiopia, Mali, Niger.

3. ***Tephrosia uniflora*** Pers., Syn. Pl. 2: 329 (1807) subsp. *petrosa* (Blatt. & Hallb.) J. B. Gillett & Ali, Kew Bull. 13: 114 (1958).
Syn. *Tephrosia petrosa* Blatt. & Hallb., J. Bombay Nat. Hist. Soc. 26: 239 (1818).

Perennial herb 20-50 cm, appressed silvery-hairy; stems erect, or ascending, branched mainly from the base; stipules 4-5 mm, subulate, stiff; petiole 3-6 mm; the rhachis 1-2.5 cm, with 3-7 leaflets; leaflets 1-2.5 x 0.4-1 cm, oblanceolate, elliptic or narrowly obovate, silvery with a prominent nerve on the lower surface, glabrous on the upper, with obtuse, rounded or emarginate apex; flowers 1-3, axillary, not pedunculate; calyx 4-6 mm, pilose, the lobes slightly longer than or equalling the tube; standard 7-9 mm, purplish-brown, pubescent on the dorsal surface; pod 3.5-4.5 x 0.4 cm, pubescent, curved towards the tip, with a 2-3 mm stipe, 8-10-seeded.

GE; rocky slopes and wadi beds. Southeast Egypt, Northeast Sudan, Ethiopia, Somalia, Arabia, India, Pakistan.

NOTE: *Tephrosia uniflora* and *T. quartiniana* are treated as conspecific by Thulin in Flora of Ethiopia 3: 112 (1989) as well as in Flora of Somalia 1: 399-400 (1993) on two grounds. First, that intermediates occur in both of the flora regions (Ethiopia and Somalia) and second, that the name *Tephrosia quartiniana* is invalid. As a matter of fact, the two species are quite distinct in our flora region, something which Thulin, *l. c.*, admits. On the other hand, the name *T. quartiniana* has been validated in Willdenowia 16: 446 (1987) by Greuter and Burdet.

4. ***Tephrosia villosa*** (L.) Pers., Syn. Pl. 2: 329 (1807) subsp. ***ehrenbergiana*** (Schweinf.) Brummitt, Bol. Soc. Brot., sér. 2, 41: 225 (1968).
Syns. *Tephrosia ehrenbergiana* Schweinf., Beitr. Fl. Aethiop. 18 (1867).
Tephrosia incana, sensu Baker, Fl. Trop. Afr. 2: 123 (1871), non (Roxb.) Wight
Tephrosia villosa var. *incana*, sensu Taub., Pfl. Ost-Afr., C: 212 (1895), non (Roxb.) Baker.

Annual or short-lived perennial herb, 30-80 cm, villous or tomentose throughout; stems erect, villous; stipules 5-8 mm, narrowly-triangular, acute, 3-nerved; petiole 0.5-1 cm, villous, the rhachis 3-8 cm, villous, with 9-13 leaflets; leaflets 1-3 x 0.6-1 cm, oblong-cuneate to elliptic, densely appressed-tomentose on the lower surface, less tomentose on the upper; flowers in terminal pseudo-racemes; pedicels 2-3 mm, densely villous; calyx 1-1.2 cm, densely tomentose, tube 2 mm; lobes 0.8-1 cm, acuminate; corolla 1.2-1.4 cm, pink; standard tomentose on the dorsal surface; pod 3.5-5 x 0.5-0.6 cm, strongly curved, densely tomentose, the hairs brownish-yellow, 7-10-seeded.

O (Kharga); edges of cultivation. Egypt, tropical East, South and West Africa, Madagascar, southern Arabia.

5. ***Tephrosia purpurea*** (L.) Pers., Syn. Pl. 2: 329 (1807).
Syns. *Cracca purpurea* L., Sp. Pl., ed. 1, 752 (1753).

Annual or short-lived perennial herb, pubescent; stems erect, procumbent or ascending, much-branched; stipules 0.4-1.2 cm, narrowly triangular, acuminate; leaves silky-appressed or spreading-pubescent; petiole 0.5-4 cm, the rhachis 1.5-8 cm, with (5-)7-11 (-13) leaflets; leaflets 1-4 x 0.6-1.8 cm, oblong-elliptic; main nerves 6-9 on each side; apex obtuse, rounded or retuse, mucronate; flowers in lax, leaf-opposed or axillary pseudo-racemes; bracts 3-5 mm, subulate; pedicels 2-4 mm, strigose or spreading pubescent; calyx 3-4 mm, deeply lobed, teeth subulate, strigose or spreading-pubescent; corolla reddish-purple, the standard white, pubescent on the dorsal surface; pod 3.5-5.5 x 0.4-0.5 cm, slightly upcurved towards the tip, strigose or spreading-pubescent, 5-9-seeded; seeds 2.5-3 mm, subcylindrical, mottled.

Two subspecies occur in Egypt:

- subsp. ***leptostachya*** (DC.) Brummitt, Bol. Soc. Brot., sér. 2, 41: 245 (1968) var. ***pubescens*** Baker, Fl. Trop. Afr. 2: 125 (1871).
Syn. *Tephrosia leptostachya* DC., Prodr. 2: 251 (1825).



Plate 55. LEGUMINOSAE: *Tephrosia nubica* 1, flowering and fruiting branch. *Tephrosia quartiniana* 2, flowering and fruiting branch. *Tephrosia villosa* 3, flowering and fruiting branch. *Tephrosia purpurea* subsp. *leptostachya* 4, fruiting branch. *Sesbania sesban* 5, flowering branch; 6, pods. *Colutea istria* 7, flowering branch; 8, fruiting branch. All drawings to the same scale.

Stems, leaves and pods spreading-pubescent.

O (Dakhla & Kharga), S; moist and waste ground. Tropical Africa, Sinai.

subsp. **apollinea** (Delile) Hosni & El-Karemy, Sendtnera 1: 248 (1993).

Syns. *Galega apollinea* Delile, Descr. Egypte, Hist. Nat. 288 (1814).

Tephrosia apollinea (Delile) Link, Enum. Hort. Berol. Alt. 2: 252 (1822).

Stems, leaves and pods strigose, the lower surface of leaflets silvery-strigose.

N, De, R, GE; Nile banks, desert wadis, especially Wadi Allaqi (Nubia), Gebel Elba and adjacent regions. Southern Egypt, Sudan.

NOTE: Gillett in Milne-Redhead & Polhill, Flora Trop. East Africa, Papilionoideae 1: 186-188 (1971) recognizes three subspecies of *Tephrosia purpurea* in the flora region: subsp. *purpurea*, subsp. *leptostachya* (DC.) Brummitt and subsp. *dunensis* Brummitt. Hosni & El-Karemy, in Sendtnera 1: 245-257 (1993) recognise three subspecies in Egypt: subsp. *purpurea*, subsp. *dunensis* and subsp. *apollinea* (Delile) Hosni & El-Karemy; the latter being reduced by them to a subspecies of *T. purpurea*. Studying the available material from Egypt, Arabia and tropical East Africa, I came to the conclusion that neither subsp. *purpurea* (introduced to Tropical Africa, according to Gillett, *l. c.*) nor subsp. *dunensis* (restricted to Kenya, Tanzania, Somalia, Malawi, Mozambique and Madagascar, according to Gillett, *l. c.*) are represented in the Egyptian material. On the other hand subsp. *leptostachya*, which was not listed by Hosni & El-Karemy, *l. c.*, is represented in Egypt by var. *pubescens* Baker. It was also observed that the only reliable difference between the two subspecies known from Egypt is the type of indumentum: subsp. *leptostachya* var. *pubescens* with spreading-pubescent plants, mainly known from Kharga and Dakhla oases, and rarely from Sinai, while subsp. *apollinea* with silvery-strigose leaflets (lower surface) is known from the Nile region, Eastern Desert in Wadi Allaqi and Gebel Elba regions. In the meantime, I have not seen any authentic specimens of *Tephrosia desertorum* Scheele, Linnaea 17: 383 (1843) from Egypt; its occurrence in Egypt may be considered doubtful, and its identity as a good species is questionable. The specimens I have seen from Arabia of *T. desertorum* seem to be better accommodated under *T. purpurea* subsp. *leptostachya* var. *leptostachya* and it is proposed here to list *Tephrosia desertorum* Scheele as a synonym of *T. purpurea* subsp. *leptostachya* (DC.) Brummitt var. *leptostachya*, a variety not known from Egypt.

6. *Tephrosia kassasii* Boulos, Feddes Repert. 73: 205 (1966).

Perennial herb 30-60 cm, woody at the base; stems many, branched at the base; leaves simple, 2-4 x 0.5-1.2 cm, broadly elliptical, appressed-hairy on both surfaces, apex retuse; petiole 1.2-2.5 cm; flowers in axillary pseudo-racemes, the pedicels c. 5 mm; calyx c. 3 mm; corolla 0.8-1 cm, violet; pod 3-5 x 0.5 cm, flattened, appressed hairy, 5-8-seeded; seeds brown, smooth.

N (Nubia); sandy soil near the Nile banks. Endemic.

24. *Sesbania* Scop., nom. conserv.

Annual or short-lived perennial herbs, softly woody shrubs or small trees; stipules present; leaves paripinnate; flowers in axillary racemes; bracts and bracteoles present but

often caducous; calyx campanulate, truncate or shortly 5-lobed, sparsely woolly at the margin; corolla glabrous (our species), yellow, the standard almost always streaked and spotted with purple and having 2 variously shaped appendages on its claw; vexillary stamen free; pod long, dehiscent, beaked, 8-50-seeded. About 50 species, warm and usually wet regions of the world.

1. Shrub or small tree, glabrous or glabrescent; appendages of standard with acute free tips 1. *S. sesban*
+ Annual or short-lived perennial, pubescent throughout; appendages of standard without free tips 2. *S. sericea*

1. *Sesbania sesban* (L.) Merr., Philipp. J. Sci. (Bot.) 7: 235 (1912).
Syns. *Aeschynomene sesban* L., Sp. Pl., ed. 1, 714 (1753).
Sesbania aegyptiaca Poir. in Lam., Encycl. 7: 128 (1806).

Shrub or small tree 1.5-5 m, glabrous or glabrescent; petiole 0.5-1.5 cm, rhachis 4-14 cm; leaflets 16-48, 1-2.2 x 0.5 cm, oblong-linear, glabrous, the apex obtuse or rounded; peduncles 2-4 cm; racemes 2-10 cm, 2-12(-18)-flowered; calyx 4-5 mm, the lobes 0.5-1 mm, broadly triangular, acute; standard 1.2-1.4 x 2 cm, the appendages with acute free tips 2-5 mm; pod 10-20(-25) x 0.4 cm, straight, 15-40-seeded; seeds 3-3.5 x 2 mm, ± cylindrical, mottled with dark violet.

N, M, O, S, (El-Arish - Rafah); Nile and canal banks, edges of cultivation, often cultivated as a shade or ornamental plant, also as a hedge between fields, naturalized. Old World tropics, introduced elsewhere.

2. *Sesbania sericea* (Willd.) Link, Enum. Hort. Berol. Alt. 2: 244 (1822).
Syns. *Coronilla sericea* Willd., Enum. Pl. Hort. Reg. Bot. Berol. 773 (1809).
Sesbania pubescens DC., Prodr. 2: 265 (1825).

Annual or short-lived perennial, 1-2 m, slightly woody; pubescent throughout except the flower and fruit; petiole 1-3 cm, the leaf rhachis 8-15 cm; leaflets 30-50, 1-2 x 0.3-0.5 cm; racemes 2-8-flowered; calyx 3-4 mm, glabrous, the lobes 1 mm, broadly triangular; standard 6-9 mm, claw 2 mm, appendages very narrow, without free tips; pod 10-16 x 0.4-0.5 cm, straight or slightly curved, 12-32-seeded; seeds 3-3.5 x 2 mm, spotted.

N; casual in cultivated ground and along canal banks. Tropical Africa, Arabia, Sri Lanka, West Indies, South America.

25. *Colutea* L.

Shrubs; leaves imparipinnate; stipules minute, free, membranous; leaflets opposite or alternate, entire; racemes axillary, few- or many-flowered; flowers conspicuous; pedicels long; calyx campanulate or tubular, corolla yellow or purple; standard ± orbicular, base with 2 protubences; wings oblong; keel curved; vexillary stamen free; pod stipitate, membranous, much inflated, indehiscent; seeds reniform. 28 species, Mediterranean to China, Northeast and East Africa, mostly in dry mountains.

1. *Colutea istria* Mill., Gard. Dict., ed. 8, no. 2 (1768).
Syn. *Colutea halepica* Lam., Encycl. 1: 353 (1785).

Shrub 0.5-2.5 m, sparingly white appressed-hairy; young stems with white scaly bark, old branches reddish; leaves 3-10 cm; leaflets 8-12, 0.5-1.2 x 0.3-0.6 cm, broadly elliptic to obovate, short-petiololate, the apex rounded or obtuse; peduncles usually exceeding the subtending leaf; racemes few-flowered, the bracts minute; pedicels 1-2 cm; flowers 1.5-2 cm; calyx *c.* 6 mm, campanulate; calyx-teeth 1.5 mm, broadly triangular; corolla yellow, standard with a horseshoe-shaped basal protruberance; pod 4-5 x 2-3 cm, much inflated, long-stipitate, glabrous, indehiscent; seeds 4-5 mm.

S; rocky slopes on high altitudes. Sinai. Palestine, Syria, Turkey.

26. *Astragalus* L.

Annuals, herbaceous perennials or shrubs; leaves pari- or imparipinnate; stipules conspicuous, free or adnate to the petiole, herbaceous or glumaceous; inflorescence a sessile or pedunculate spike or raceme, or flowers sessile in upper leaf axils, rarely solitary; calyx campanulate to tubular or deeply lobed; glabrous or hairy; hairs simple or biarmous; corolla white, pink, purple or yellow; wings and keel usually shorter than the standard; stamens diadelphous; fruit a variously shaped legume; seeds compressed, globular or ovoid. About 1750 species, mainly north temperate regions and tropical African mountains.

1. Annuals	2
+ Herbaceous perennials with woody base, unarmed or spiny shrubs	19
2. Flowers and pods umbellate	3
+ Flowers and pods in racemes	6
3. Peduncle 0-0.5(-1) cm	4
+ Peduncle (1.5-)3-6 cm	5
4. Pod 0.5-1.2 cm, not beaked, appressed-hairy	2. <i>A. tribuloides</i>
+ Pod 1.2-1.5 cm, attenuate into a beak, with dimorphous short-appressed and long-spreading hairs	3. <i>A. sinaicus</i>
5. Corolla 0.6-1 cm, yellow, mauve-purple or whitish-blue; pod 1-1.6 cm	4. <i>A. asterias</i>
+ Corolla 1.2-1.5 cm, pale mauve; pod 1.5-2(-2.5) cm	5. <i>A. schimperi</i>
6. Pod 0.6-1 cm	18. <i>A. vogelii</i>
+ Pod 1.5-6 cm	7
7. Pod densely-villous or long pilose-hairy	8
+ Pod glabrous or appressed-hairy	10
8. Pod 4-5 cm; calyx with white and black hairs	13. <i>A. peregrinus</i>
+ Pod 1.5-2.5 cm; calyx with white hairs only	9
9. Pod 1.2-2 x 0.4-0.7 cm, 2-4 times as long as broad, ovoid-oblong, slightly curved	14. <i>A. bombycinus</i>
+ Pod 1.5-2.5 x 0.25-0.3 cm, 8-10 times as long as broad, linear, strongly falcate	10. <i>A. eremophilus</i>

- 10. Pod 4-8(-10) mm broad, oblong-prismatic and straight or ovoid-oblong to oblong-lanceolate and slightly curved 11
 + Pod 1.5-4 mm broad, strongly curved to semicircular or fishhook-shaped 12
11. Corolla 1-1.2 cm, whitish to cream; pod oblong-prismatic and straight 1. **A. boeticus**
 + Corolla 1.6-1.8 cm, bright violet; pod ovoid-oblong to oblong-lanceolate, slightly curved 15. **A. palaestinus**
12. Pod with conspicuous red spots 12. **A. annularis**
 + Pod without red spots 13
13. Leaflets 2-4 pairs 7. **A. hauarensis**
 + Leaflets 5-12 pairs 14
14. Pod strongly reticulately-wrinkled transversely 6. **A. corrugatus**
 + Pod not wrinkled 15
15. Pod 2.5-3.5(-4) mm broad, deeply caniculate dorsally 16
 + Pod 1.5-2.5(-3) mm broad, not deeply caniculate dorsally 17
16. Corolla white; pod fishhook-shaped or semicircular, triquetrous, slightly appressed-hairy 16. **A. trimestris**
 + Corolla purple, drying yellowish; pod dorsally compressed, falcate, strigose 8. **A. intercedens**
17. Corolla 1.2-1.4 cm; calyx densely covered with white and black hairs, teeth $1/4$ - $1/3$ as long as the tube 11. **A. hispidulus**
 + Corolla 0.8-1 cm; calyx with white hairs only, teeth equalling or longer than the tube 18
18. Raceme (6-)8-12-flowered; corolla yellowish-white; pod 4-7 cm, fish-hook-shaped 17. **A. hamosus**
 + Raceme 3-4-flowered; corolla pale violet; pod 2-3 cm, semicircular 9. **A. mareoticus**
19. Spiny shrub, spines consisting of persistent indurated leaf petiole 20
 + Unarmed shrub or perennial with woody base 23
20. Calyx in fruit 1-1.5 cm broad, inflated, membranous, concealing the pod 31. **A. spinosus**
 + Calyx in fruit not inflated; pod exposed 21
21. Pod (5-)6-8.5 cm 28. **A. dactylocarpus** subsp. **acinaciferus**
 + Pod 1.8-4.5(-5) cm 22
22. Leaflets 5-7 pairs; pod 1.8-2 cm 30. **A. trigonus**
 + Leaflets 20-25 pairs; pod 3-4.5(-5) cm 29. **A. sieberi**
23. Calyx in fruit inflated 24
 + Calyx in fruit not inflated 25

24. Corolla yellow; calyx in fruit 2-2.5 cm, inflated, with spreading white-hairs; pod 0.8-1 cm, concealed in the calyx, glabrous, transversely wrinkled 24. *A. kahiricus* =
 + Corolla violet with white margins; calyx in fruit c. 1.3 cm broad, white- and black-hairy, splitting to expose the pod; pod 0.8-1.5 cm, with dense white fleece as thick as the diameter of the pod 32. *A. amalecitanus* =
25. Pod 3(-4) cm broad 25. *A. macrocarpus* =
 + Pod 0.7-2 cm broad 26
26. Corolla yellow 27
 + Corolla red, pink, purple or violet 30
27. Leaflets 3-4 distant pairs 21. *A. camelorum* =
 + Leaflets 10-30 pairs 28
28. Plant stemless, pod 1-2.5 cm 23. *A. caprinus*
 + Plant with well-developed stems, pod 3-6 cm 29
29. Leaflets 10-15 pairs, ovate-oblong; calyx-teeth $1/3-1/2$ as long as the tube; pod 3-4.5 x 0.7-0.8 cm 26. *A. sparsus*
 + Leaflets 20-30 pairs, broadly ovate to orbicular-obcordate, retuse; calyx teeth equalling the tube; pod 4.5-6.5 x 1-1.5 cm 27. *A. fruticosus* =
30. Plant with many distinct stems; leaflets 4-8 pairs 20. *A. sanctus*
 + Plant stemless; leaflets 12-30 pairs 31
31. Leaflets 12-15 pairs 22. *A. fresenii*
 + Leaflets 20-30 pairs 19. *A. cretaceus*

1. *Astragalus boeticus* L., Sp. Pl., ed. 1, 758 (1753).

Annual 10-40 cm, sparingly hairy; stems erect or prostrate; stipules 6-8 mm, triangular; leaves 3-10 cm; leaflets 12-24, 0.6-1.5 x 0.2-0.6 cm, ovate-oblong, retuse; flowers in dense racemes; bracts 2-3 mm; calyx 6-8 mm, with black and white appressed hairs, the teeth 2-3 mm; corolla 1-1.2 cm, whitish to cream; pod 2.5-3.5 x 0.6-0.8 cm, oblong-prismatic, straight, the valves keeled; beak 2-3 mm, hooked.

M, S; coastal cultivated and waste ground. Mediterranean region, Sinai, Macaronesia, Iran.

NOTE: The unripe green fruits are edible.

2. *Astragalus tribuloides* Delile, Descr. Egypte, Hist. Nat. 70 (1814).

Annual 5-15 cm, appressed-hirsute; stems prostrate, many from the base; leaves 4-8 cm; stipules 2 mm, free for most of their length, lanceolate, hirsute; leaflets 10-26, 0.3-1.2 x 0.1-0.4 cm, oblong-elliptic, elliptic or linear; flowers on very short peduncles or sessile in groups of 3-6; bracts 1-2 mm, lanceolate, acuminate; calyx 3-5 mm, white-hirsute or the tube glabrous, the teeth shorter than the tube; corolla 0.5-1.4 cm, creamy-white, purple-

flushed to purple; pod 0.5-1.2 x 0.2-0.35 cm, oblong-lanceolate, 2-gibbous at the base, glabrous to densely appressed-hairy; seeds 1.5 mm, yellow, smooth.

Five varieties occur in Egypt:

- | | |
|-----------------------------------|--------------------------|
| 1. Pod 5-7 mm | 2 |
| + Pod 0.6-1.2 cm | 3 |
| 2. Pod appressed-hirsute | var. minutus |
| + Pod glabrous | var. leiocarpus |
| 3. Peduncle 3-5 mm | var. mareoticus |
| + Peduncle less than 3 mm, or 0 | 4 |
| 4. Corolla 1 cm; pod glabrous | var. elarishensis |
| + Corolla 1.2-1.4 cm; pod hirsute | var. tribuloides |

var. **tribuloides**

O; M, D, S., edges of cultivation, sandy desert plains.

var. **minutus** (Boiss.) Boiss., Fl. Orient. 2: 225 (1872).

Syn. *Astragalus minutus* Boiss., Diagn. Pl. Orient. 9: 58 (1849).

M, De, S; desert wadis and plains.

var. **mareoticus** Sirj., Feddes Repert. 53: 227 (1944).

M (Lake Mariut region); waste ground.

var. **leiocarpus** Boiss., Fl. Orient. 2: 225 (1872).

D, S; desert wadis.

var. **elarishensis** Eig, Bull. Zionist Org. Inst. Agric. Nat. Hist. 6: 29 (1927).

S; sandy plains.

Area of the species: Macaronesia, North Africa, Sinai, West and Central Asia.

3. **Astragalus sinaicus** Boiss., Diagn. Pl. Orient. 9: 57 (1849).

Like *Astragalus tribuloides*, but pod 1.2-1.5 cm, attenuate into a beak, covered with dimorphous short-appressed and long-spreading hairs.

S; desert wadis. North Africa, Sinai, Greece, Aegean Islands, Crimea, Turkey.

4. **Astragalus asterias** Steven, Bull. Soc. Nat. Moscou 4: 267 (1832).

Syn. *Astragalus cruciatus*, sensu Zohary, Fl. Palaest. 2: 59 (1972).

Annual 20-40 cm, appressed-hairy; stems erect, ascending or prostrate, branched from

the base; stipules 3-5 mm, linear-lanceolate; leaflets 11-23, 0.4-1.2 x 0.15-0.4 cm, elliptic to oblong-elliptic or linear, obtuse, appressed-hairy; peduncles 1.5-4.5 cm, 4-9-flowered; flowers sessile; calyx 3-6 mm, densely black- and white-hairy, the teeth \pm equalling the tube, subulate; corolla 0.6-1 cm, yellow, mauve-purple or whitish-blue; pods 1-1.7 x 0.3 cm, stellately spreading, linear-lanceolate, 2-gibbous, appressed-pubescent with long (few) and short (many) white simple hairs; seeds 2-2.5 x 1.5 mm, \pm oblong, compressed.

Two subspecies occur in Egypt:

subsp. **asterias**

Peduncles to 4.5 cm; calyx 3-4 mm; corolla mauve-purple or whitish-blue; pod 1-1.4 cm, 2-gibbous.

M, D, S; sandy plains, edges of cultivation, roadsides. North Africa, West and Central Asia.

subsp. **radiatus** (Batt.) Greuter, Willdenowia 15: 427 (1986).

Syns. *Astragalus radiatus* Bunge, Mém. Acad. Sci. Pétersb. 11 (16): 11 (1868), non Steven, Bull. Soc. Nat. Moscou 4: 267 (1832).

Astragalus cruciatus Link subsp. *radiatus* Batt. in Batt. & Trab., Fl. Algérie 1: 255 (1889)

Astragalus stella, sensu Täckh., Stud. Fl. Egypt, ed. 2, 264 (1974).

Peduncles 1-3 cm; calyx 5-6 mm; corolla yellow; pod 1.3-1.7 cm, slightly gibbous.

M, De, S; arable fields, waste ground. Mediterranean region, Sinai, Arabia.

5. ***Astragalus schimperi*** Boiss., Diagr. Pl. Orient., ser. 1, 2: 53 (1843).

Annual 10-25 cm, densely white-hairy throughout; stems ascending or prostrate, several from the base; stipules 2-4 mm, linear-lanceolate; petiole 0.5-1.5 cm; leaflets 8-16, 3-8 x 1.5-3 mm, elliptic to oblong, obtuse, appressed and densely white-hairy on both surfaces; peduncles 0.2-3 cm; flowers capitate, in 2-6-flowered clusters; bracts 1.5-2 mm; calyx 5-6 mm, appressed white-hairy, the teeth shorter than the tube; corolla 1-1.5 cm, pale mauve; pods 1.5-2 x 0.3-0.4 cm, stellately spreading, slightly 2-gibbous, straight or slightly arcuate, clothed with short appressed hairs and long spreading white hairs with tuberculate base; seeds 1 mm, \pm spherical, smooth.

Two varieties occur in Egypt:

var. **schimperi**

Peduncles 1.5-3 cm, always well developed.

De, S; sandy desert wadis and plains.

var. **subsessilis** Eig, Syst. Stud. Astrag. Near East 13 (1955).

Peduncles 2-5 mm.

—D, S; sandy desert wadis and plains.

—Area of the species: Egypt, Palestine, Syria, Arabia.

—**Astragalus corrugatus** Bertol., Rar. Ital. Pl. Dec. 3: 33 (1810).

Syn. *Astragalus cruciatus* Link, Enum. Hort. Berol. Alt. 2: 256 (1822).

—Annual 10-30 cm, sparsely hairy; stems ascending or procumbent, branched from the base; stipules 2-4 mm, lanceolate, acuminate; petiole 0.5-1.5 cm; leaflets 10-16, 0.4-1.2 x 0.2-0.3 cm, linear-cuneate, retuse; peduncles to 6 cm; flowers 1-6, subsessile, in lax racemes; bracts 1-1.5 mm, deltoid, membranous; calyx 4-5 mm, the teeth shorter than the tube; corolla 7-9 mm, pinkish or white; pod 3-4 x 0.2-0.3 cm, subcylindrical, semicircular or arcuate, glabrous, strongly reticulately-wrinkled transversely, hooked or with a short mucro at the tip, dorsal suture convex, ventral suture furrowed; seeds 2 mm, quadrate, smooth.

Two subspecies occur in Egypt.

subsp. **corrugatus**

Pod semicircular, hooked at the tip, transversely reticulate-wrinkled on all surfaces.

O, S; edges of cultivation, roadsides.

subsp. **tenuirugis** (Boiss.) Eig, Syst. Stud. Astrag. Near East 16 (1955).

Syn. *Astragalus tenuirugis* Boiss., Diagn. Pl. Orient. 9: 61 (1849).

Pod arcuate, ending in a short curved mucro, reticulate-wrinkled on ventral surface only.

S; sandy plains and desert wadis.

Area of the species: North Africa, East Mediterranean region, Sinai, Arabia to Central Asia.

7. **Astragalus hauarensis** Boiss., Diagn. Pl. Orient. 9: 63 (1849).

Syn. *Astragalus gyzensis* Bunge, Mém. Acad. Sci. Pétersb. 11 (16): 14 (1868).

Annual 10-30 cm, grey-canescens; stems ascending or prostrate; stipules 2-3 mm, triangular; petiole 2-5 cm; leaves imparipinnate; leaflets 5-9, remote, often sub-opposite, 0.6-1.2 x 0.3-0.7 cm, elliptic-oblong or broadly elliptic, appressed white-hairy on both surfaces; peduncles 0.5-2.5 cm; racemes loosely 3-5-flowered; bracts minute; calyx 5-7 mm, appressed-hirsute, the teeth shorter than the tube; corolla 1-1.4 cm, pale mauve to whitish-pink; pod 2-3 x 0.4 cm, slightly compressed, semicircular, ending in a short mucro, clothed with short appressed hairs and long spreading hairs with bulbous base, dorsal suture furrowed; seeds 1.5 mm, rhomboid, compressed, smooth.

M, D, S; sandy wadis and plains. Egypt, Palestine, Arabia, Iraq, Iran, Afghanistan.

8. **Astragalus intercedens** Sam. ex Rech. f., Ark. Bot., ser. 2, 1, 5: 308 (1949).

Syn. *Astragalus maris-mortui* Eig, Syst. Stud. Astrag. Near East 21 (1955).

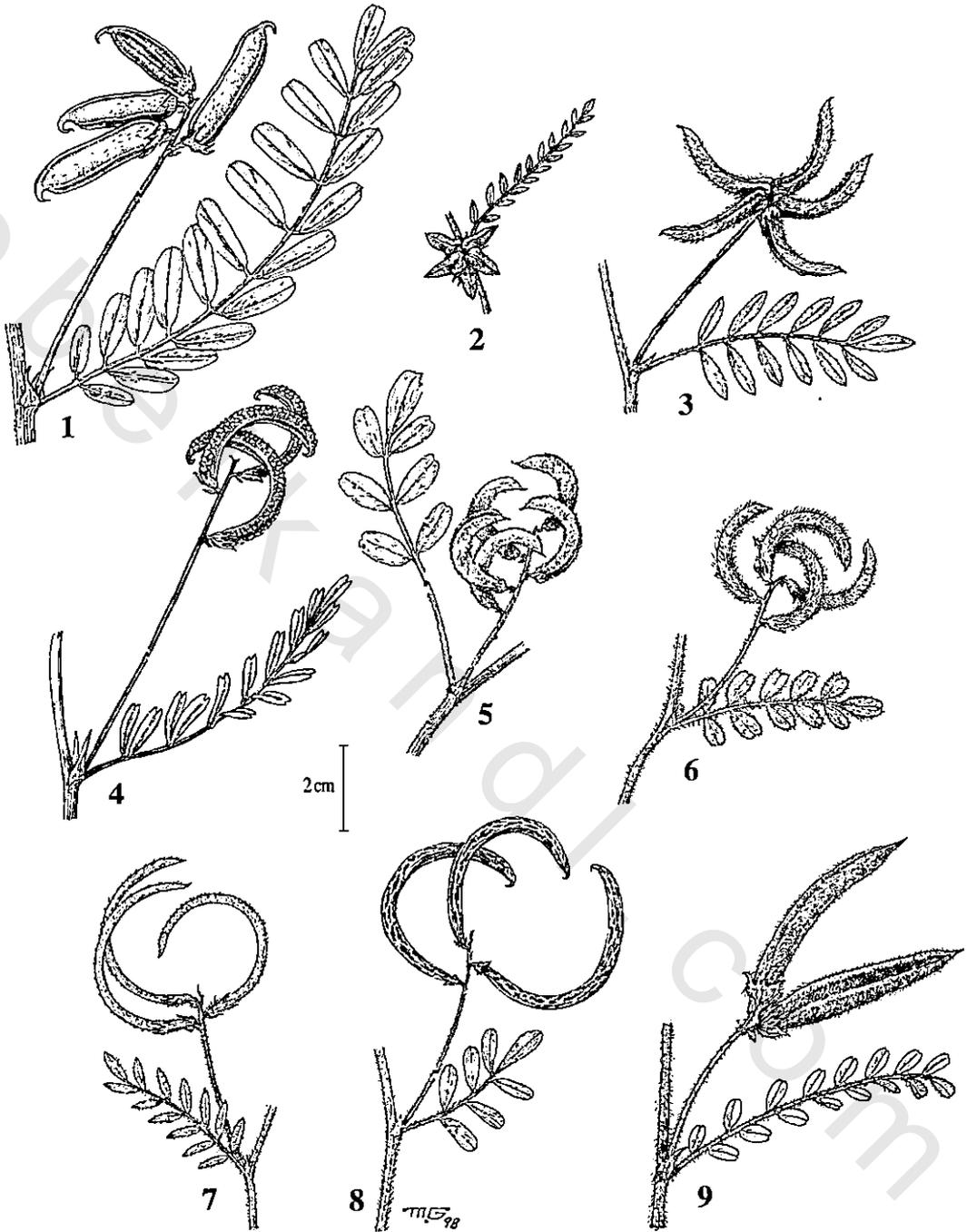


Plate 56. LEGUMINOSAE: fruiting branches of: *Astragalus boeticus* 1. *Astragalus tribuloides* 2. *Astragalus schimperii* 3. *Astragalus corrugatus* 4. *Astragalus hauarensis* 5. *Astragalus eremophilus* 6. *Astragalus hispidulus* 7. *Astragalus annularis* 8. *Astragalus peregrinus* 9. All drawings to the same scale.

Annual 10-20 cm, clothed with appressed and spreading white hairs; stems few from the base, ascending, branched; stipules 2-4 mm, narrowly triangular; leaflets 8-16, 4-8 x 1-2 mm, oblong-elliptic, hairy on both surfaces; peduncles usually longer than the subtending leaf; racemes 1-4-flowered; bracts 1.5-2 mm; calyx 7-8 mm, black- and white-hirsute, the teeth 1.5-2 mm, subulate; corolla 1-1.4 cm, purple, drying yellowish; pod 3-4 x 0.3 cm, dorsally compressed, falcate, strigose, deeply grooved on the dorsal surface, separating at maturity into 2 valves, each closed by a septal lamella.

S; desert wadis. Sinai, Palestine, Libya.

9. **Astragalus mareoticus** Delile, Descr. Egypte, Hist. Nat. 257 (1814).

Annual 10-20 cm, appressed white-hairy or villous; stems prostrate, branched from the base; stipules 3 mm, broadly triangular, ciliate along the margins; leaves 2.5 cm; leaflets 12-18, short-petiololate, 3-7 x 1-3 mm, oblong-elliptic; apex retuse or obtuse, the upper surface glabrous, lower white-hispid; peduncles 1-3 cm; racemes 3-4-flowered; calyx 3-4 mm, white hairy; teeth \pm equalling the tube, triangular; corolla 5-7 mm, pale violet; pod 2-3 x 0.3 cm, semicircular, sparsely strigose to almost glabrous, slightly grooved on the dorsal surface; seeds 2-2.5 mm, subquadrangular.

M, De; sandy deserts. Egypt, Libya, Algeria, Morocco.

10. **Astragalus eremophilus** Boiss., Diagn. Pl. Orient. 2: 54 (1843).

Syn. *Astragalus falcinellus* Boiss., Diagn. Pl. Orient. 9: 63 (1849).

Annual 15-25 cm, white-villous throughout; stems ascending or prostrate, branched from the base; stipules 2-3 mm, triangular; leaves 2.5-4 cm; leaflets 6-12, short-petiololate, 0.4-1.2 x 0.2-0.5 cm, broadly elliptic to obovate, obtuse, truncate or retuse at the apex, white-villous on both surfaces; peduncles 1-4 cm; racemes 1-5-flowered; bracts 1.5-2 mm; calyx 3-5 mm, white-villous, the teeth longer than the tube; corolla 5-6 mm, pale yellow; pod 1.5-2.5 x 0.25-0.3 cm, 8-10 times as long as broad, strongly falcate, linear in outline, attenuate towards the apex, white-villose.

O, D, R, GE, S; sandy wadis and desert plains. North Africa, Sinai, Palestine, Arabia, Iran, Pakistan.

11. **Astragalus hispidulus** DC., Astragalogia 132 (1802).

Annual 15-25 cm, white- and black-hispid; stems many from the base, ascending or prostrate; stipules 2-3 mm, triangular, white-hispid along the margins; leaves 3-5 cm; leaflets 10-20, short-petiololate, 3-8 x 2-3 mm, oblong-elliptic to linear, narrowly obtuse, white-hispid on both surfaces; peduncles usually longer than the subtending leaf; racemes 2-10-flowered; bracts 1.5-3 mm; calyx 6-8 mm, densely covered with white and black hairs, the teeth $\frac{1}{4}$ - $\frac{1}{3}$ as long as the tube; corolla 1.2-1.4 cm, pink to pale purple, violet or yellow; pod 3-5 x 0.2-0.3 cm, slightly flattened, appressed white-hispid, arcuate to semicircular, attenuate at the apex, grooved on the dorsal surface, 12-25-seeded in each locule.

Two subspecies occur in Egypt:

subsp. **hispidulus**

Racemes 2-4-flowered; corolla pink to pale purple; pod 4-5 x 0.2 cm, with 20-25-seeds in each locule.

O (Siwa), M, S; fields and roadsides. Egypt, Sinai, Palestine, Syria, Libya.

subsp. **kralikii** (Batt.) Täckh. & Boulas, Publ. Cairo Univ. Herb. 5: 69 (1974).
Syn. *Astragalus kralikii* Batt. & Trab., Fl. Algérie 1: 259 (1889).

Racemes 2-10-flowered; corolla violet or yellow; pod 2-3.5 x 0.3 cm, with 12-15-seeds in each locule.

M; in barley fields and along roadsides. North Africa, from Egypt to Morocco.

12. **Astragalus annularis** Forssk., Fl. Aegypt.-Arab. 139 (1775).

Annual 10-25 cm, patulous hairy to strigose; stems few from the base, ascending; stipules 1-2 mm, lanceolate; leaves 2.5-5 cm, imparipinnate; leaflets 5-9, 0.5-1.5 x 0.2-0.4 cm, sub-opposite, short-petiololate, oblong-elliptic, strigose on both surfaces; peduncles 2-4.5 cm; racemes 2-5-flowered; bracts 1-2 mm; pedicels c. 1 mm; calyx 3-4 mm, hairy, the teeth \pm as long as the tube, subulate; corolla 6-8 mm, pink; pod 4-5 x 0.3 cm, semicircular, slightly compressed, the dorsal suture furrowed, almost glabrous at maturity, with conspicuous red spots.

M, De, S; deserts wadis and sandy plains. North Africa, from Egypt to Algeria, Sinai, Palestine, Lebanon, Arabia, Iran.

13. **Astragalus peregrinus** Vahl, Symb. Bot. 1: 57 (1790) subsp. **peregrinus**

Annual 20-50 cm, white-villous; stems prostrate, branched from the base; stipules 4-6 mm, broadly triangular, acuminate; leaves 3-10 cm, imparipinnate; leaflets 13-25; 4-8 x 2-6 mm, short-petiololate, oblong-elliptic to obovate; peduncles 3-8 cm, usually shorter than the subtending leaf; racemes 3-5-flowered; bracts 3-5 mm, triangular, villous; calyx 0.8-1 cm, densely clothed with white and black hairs, the teeth \pm equalling the tube; corolla 1.6-2 cm, pinkish-white; pod 4-5 x 0.5-0.7 cm, straight or slightly arcuate, densely clothed with long white tuberculate hairs, grooved dorsally and keeled ventrally; seeds 2 x 2 mm, tetragonous.

M, S; desert wadis and sandy plains. North Africa, from Egypt to Algeria, Sinai, Palestine.

14. **Astragalus bombycinus** Boiss., Diagn. Pl. Orient. 2: 50 (1843).

Annual 10-20 cm, densely white-villous; stems prostrate or ascending, branched from the base; stipules 3-5 mm, broadly triangular, the apex acuminate; leaves 3-5 cm, imparipinnate; leaflets 11-19, sub-opposite, petiololate, broadly elliptic to obovate, clothed with long white hairs on the lower surface and the margins, glabrous on the upper; peduncles 2-5 cm; racemes 3-7-flowered; calyx 5-6 mm, densely white-villous, the teeth slightly shorter than the tube; corolla 1.2-1.4 cm, white; pod 1.2-2 x 0.4-0.7 cm, 2-4 times as long as broad, ovoid-oblong, slightly curved, tapering to a short incurved

beak, densely covered by white-villous hairs; seeds 2.5 mm, quadrangular.

De, S; desert wadis, gravel and sandy plains. Egypt, Palestine, Syria, Iraq, Arabia, Iran.

NOTE: The type specimen was collected from a desert region near Cairo, Aucher-Eloy 1343, isotype. K!

15. **Astragalus palaestinus** Eig, J. Bot. 72: 124 (1934).

Annual or short-lived perennial, 15-50 cm, clothed with villous white and black hairs; stems branched from the base, prostrate; stipules 6-8 mm, broadly triangular, acuminate; leaves imparipinnate, 4-12 cm; leaflets 13-25, short-petiololate, 0.3-1 x 0.3-0.6 cm, obovate to oblong-elliptic, obtuse or emarginate, hairy on both surfaces; peduncles longer than the subtending leaf; racemes 5-15-flowered; bracts c. 3 mm, triangular, densely black-hairy; calyx 0.9-1.1 cm, densely clothed by black (many) and white (few) hairs, the teeth shorter than the tube, lanceolate; corolla 1.6-1.8 cm, bright violet; pod 1.5-2.5 x 0.5-0.8 cm, ovoid-oblong to oblong-lanceolate, slightly curved, sparingly white-hairy, grooved on both surfaces; seeds 2 mm, globose.

S (El-Bustan); fallow fields. Sinai, Palestine, Syria.

16. **Astragalus trimestris** L., Sp. Pl., ed. 1, 761 (1753).

Annual 10-25 cm, strigose; stems branched from the base, prostrate or ascending; stipules 2-3 mm, triangular; leaves 4-8 cm, imparipinnate, 8-12 pairs, 0.5-1 x 0.3-0.5 cm, oblong-elliptic, obtuse or retuse, white-strigose on the lower surface, glabrous on the upper; peduncles usually longer than the subtending leaf; racemes 2-6-flowered; bracts 2.5 mm; calyx 4-5 mm, strigose, the teeth slightly shorter than the tube; corolla 1-1.2 cm, white; pod 3.5-5.5 x 0.3-0.4 cm, fish-hook-shaped or semicircular, triquetrous, slightly appressed-hairy, tapering into a short beak.

M, S; sandy desert wadis and coastal plains. Egypt, Palestine.

17. **Astragalus hamosus** L., Sp. Pl., ed. 1, 758 (1753).

Syns. *Astragalus buceras* Willd., Enum. Pl. Hort. Berol. Suppl. 51 (1814).

Astragalus brachyceras Ledeb., Index Sem. Hort. Dorpat. 1822: 3 (1822).

For full synonymy see Greuter *et al.*, Med-Checklist 4: 48 (1989).

Annual 10-30 cm, appressed white-hairy; stems few from the base, erect or ascending; stipules 0.6-1.2 cm, broadly triangular, acuminate at the apex; leaves 5-12 cm, imparipinnate; leaflets 8-14 pairs, 0.5-1.5 x 0.3-0.6 cm, oblong-obovate to elliptic, appressed-hairy on the lower surface, glabrous on the upper; peduncles shorter than the subtending leaves; racemes (6-)8-12-flowered; calyx 5-7 cm, white-hairy, the teeth \pm as long as the tube; corolla 0.8-1 cm, yellowish-white; pod 4-7 x c. 0.3 cm, fishhook-shaped, attenuate at the apex, sparingly appressed white-hairy.

N, M, De, S; sandy plains and desert wadis. Mediterranean region, Sinai, extending eastwards to Iran, Atlantic Islands.

18. **Astragalus vogelii** (Webb) Bornm., Beih. Bot. Centralbl. 33 (2): 233 (1915).

Syns. *Phaca vogelii* Webb, Icon. Pl., t. 763 (1848).

Astragalus prolixus Bunge, Mém. Acad. Sci. Pétersb. 11 (16): 9 (1868).
Astragalus vogelii subsp. *prolixus* (Bunge) Maire, Mém. Soc. Hist. Nat.
Afr. Nord 3: 126 (1933).

Annual 10-40 cm, white-villous; stems prostrate or ascending, much-branched; stipules 2-3 mm, broadly triangular, hairy; leaves 2-6 cm, imparipinnate; leaflets 5-8 pairs, 3-9 x 2-4 mm, white-villous; peduncles ± as long as the subtending leaf; racemes 4-12-flowered; bracts minute; calyx 2-2.5 mm, hairy, the teeth shorter than the tube; corolla 3-3.5 mm, yellowish; pod 0.6-1 x 0.3-0.4 cm, oblong-ovoid, turgid, membranous, white appressed-hairy.

Two subspecies occur in Egypt:

subsp. **vogelii**

Calyx-teeth shorter than the tube; racemes compact.

N, O, D, R, S; sandy and desert wadis.

subsp. **fatmensis** (Chiov.) Maire, Mém. Soc. Hist. Nat. Afr. Nord 3: 126 (1933).

Syns. *Astragalus fatmensis* Chiov., Ann. Reale Ist. Bot. Roma 8: 95 (1903).

Astragalus arabicus Bunge, Mém. Acad. Sci. Pétersb. 11 (16): 9 (1868),
non Kotschy, Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss.
Cl., Abt. 1, 52: 264 (1866).

Calyx-teeth longer than the tube; racemes lax.

De, S; sandy plains and desert wadis.

Area of the species: Egypt, Sahara (Libya, Algeria, northern Sudan), Ethiopia.

19. ***Astragalus cretaceus*** Boiss. & Kotschy in Boiss., Diagn. Pl. Orient., ser. 2, 5: 84 (1856).

Syns. *Astragalus calophyllus* Boiss. & Heldr. in Boiss., Diagn. Pl. Orient., ser. 2, 2: 26 (1856).

Perennial herb, stemless, densely yellowish-green woolly throughout; roots fusiform; stipules 0.8-1.2 cm, triangular; leaves 10-25 cm, in a rosette; leaflets 20-30 pairs, densely crowded and often overlapping, 0.5-1 x 0.3-0.4 cm, oblong, retuse, densely woolly on both surfaces; peduncles (scapes) to 25 cm; inflorescence 3-5 cm, spike-like, many-flowered; bracts 0.8-1 cm, subulate; calyx 0.8-1 cm, the teeth 3 mm; corolla 1.5-1.8 cm, purple; pod 1-1.2 x 0.8 cm, oblong-ovoid, compressed, densely clothed with long bristles, ending in a 3-4 mm curved beak.

S; stony ground. East Mediterranean region, Sinai.

20. ***Astragalus sanctus*** Boiss., Diagn. Pl. Orient. 9: 47 (1849).

Perennial herb 20-40 cm, appressed-hairy; stems many from the woody base, erect or ascending; stipules 2-3 mm, triangular, hirsute; leaves 4-8 cm, imparipinnate; leaflets 4-7 pairs, 0.6-1.4 x 0.2-0.4 cm, linear-elliptic, acute, obtuse or retuse, petiololate, hairy on

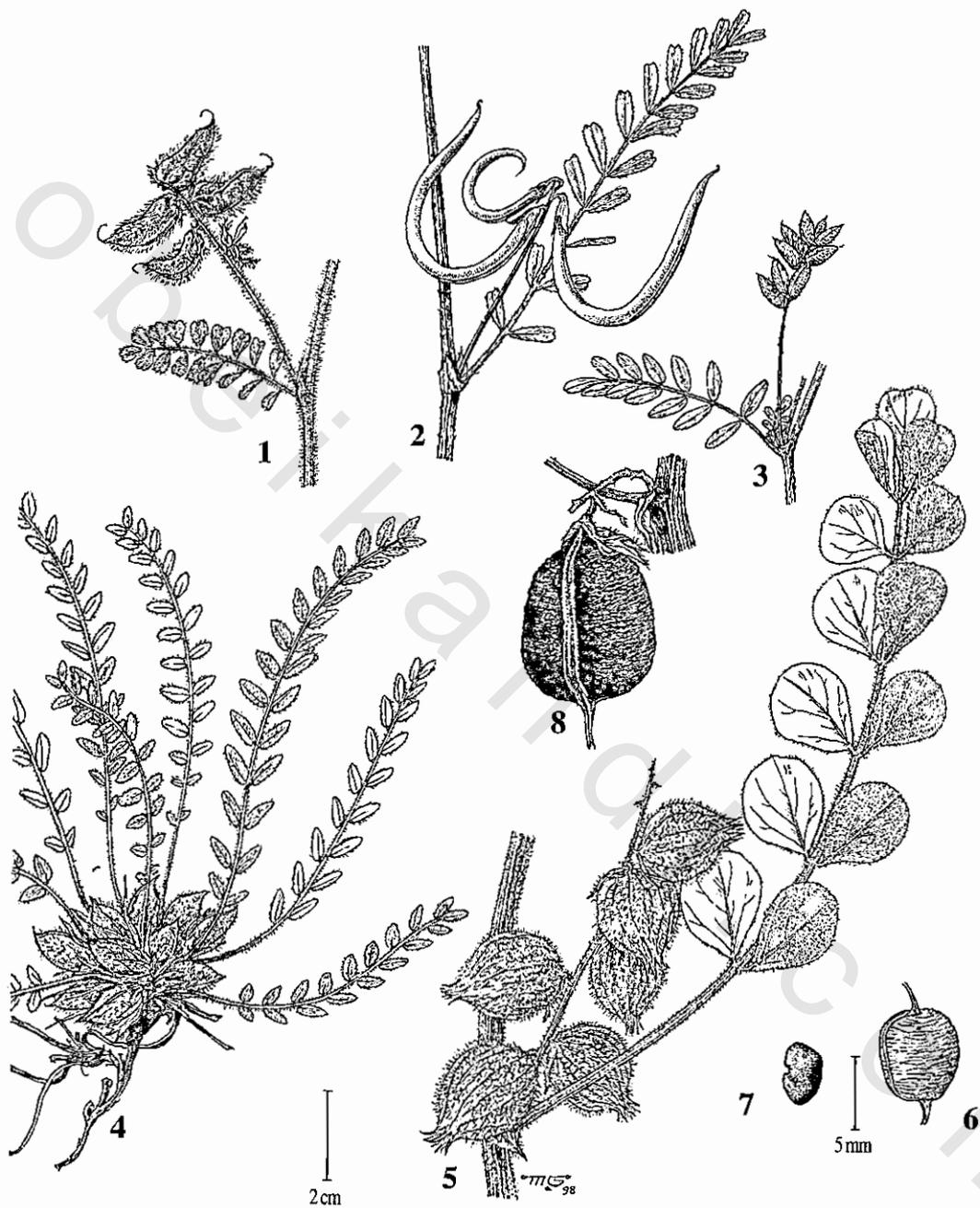


Plate 57. LEGUMINOSAE: fruiting branches of: *Astragalus bombycinus* 1. *Astragalus hamosus* 2. *Astragalus vogelii* 3. *Astragalus caprinus* 4. *Astragalus kahiricus* 5; fruit 6; seed 7. *Astragalus macrocarpus* 8. All drawings to the same scale except enlarged parts (scale given).

both surfaces; peduncles usually exceeding the subtending leaf; racemes lax, 6-12-flowered; bracts ± equalling the pedicels, clothed with white and black hairs; calyx 1-1.3 cm, black- and white-hairy, the teeth 2-3 mm; corolla 2.2-2.5 cm, violet or purple; pod 3-7 x 0.3 cm, slightly compressed, semicircular, tapering into a narrow beak, clothed with white and black hairs, keeled along both sutures.

S; stony ground. Sinai, Palestine, Syria.

NOTE: See illustration in Zohary, *Flora Palaestina* 2, plate 117 (1972). The above description is mainly after *Fl. Palaestina* 2: 81-82 (1972).

21. ***Astragalus camelorum*** Barbey in *Herb.-Boiss. & Barbey, Herbor. Levant* 131 (1882).

Perennial herb 30-70 cm, silvery-canescens with white biramous hairs; stems numerous from the base, erect; stipules 1-2 mm, triangular, ciliate; leaves 5-13 cm, lower with 3-4 pairs of leaflets, the upper with 1-2 leaflets; leaflets of lower leaves 1-2.5 x 0.3-0.7 cm, distant; upper leaflets 1 x 0.5 mm; leaflets deciduous in early summer, rachis drying later; peduncles to 35 cm; racemes to 16-flowered; calyx 4-5 mm, clothed with white and black hairs; corolla 1-1.3 cm, white; standard with purple veins at the base; pod 1-1.2 x 0.5-0.6 cm, densely white-villous, ending in a 1-2 mm indehiscent beak; seeds 2-10 per pod, 2-5 x 1.5-2 mm, lentiform, yellow.

S; in sand overlying hard fissured limestone. Endemic.

NOTE: The above description is mainly after Danin, *Israel J. Bot.* 25: 214-215 (1976). According to Danin, *l. c.*, several populations of this species, endemic to North Sinai, are known from: 1 km northwest of Tasa (c. 30 km east of Ismailia); 17 km west of Gebel Umm Khashiba, near Wadi El-Giddi; 15 km northwest of Mitla Pass, near Wadi El-Hag.

22. ***Astragalus fresenii*** Decne., *Ann. Sci. Nat. Bot.*, ser. 2, 3: 266 (1835).

Perennial villous herb, stemless; leaves in a rosette; leaflets 12-15 pairs; peduncles exceeding the leaves; racemes many-flowered; flowers conspicuous; corolla violet; pod 1 cm.

S; high altitude wadis. Endemic.

NOTE: The above description is mainly from Täckholm, *Students' Fl. Egypt*, ed. 2, 267 (1974); material of this rare endemic species has not been available.

23. ***Astragalus caprinus*** L., *Sp. Pl.*, ed. 2, 1071 (1763).

Syns. *Astragalus lanigerus* Desf., *Fl. Atlant.* 2: 181 (1799).

Astragalus alexandrinus Boiss., *Diagn. Pl. Orient.* 9: 75 (1849).

For full synonymy see Greuter *et al.*, *Med-Chæcklist* 4: 39 (1989).

Perennial villous herb, woody at the base, stemless; stipules 1-1.5 cm, lanceolate, membranous, adnate to the petiole; leaves in a rosette, 8-18 cm, imparipinnate; leaflets 10-20 pairs, 5-8 x 3-5 mm, obovate-cblong, obovate or rounded, the apex rounded or retuse, spreading-hairy on the lower surface, glabrescent on the upper; racemes 3-6-flowered, on short peduncles, not exceeding 1/3 of the subtending leaf; bracts much

longer than the pedicels; calyx 1.2-1.6 cm, the teeth 3-4 mm; corolla 2.2-3 cm, yellow; pod 1-2.5 x 0.8-1 cm, ovoid, wrinkled, grooved dorsally and keeled ventrally, ending in a 2-3 mm beak; seeds reniform.

M, S; field borders and roadsides. Egypt, Palestine.

24. **Astragalus kahiricus** DC., Prodr. 2: 292 (1825).

Syns. *Astragalus longiflorus* Delile, Descr. Egypte, Hist. Nat. 256 (1814), non Pallas, Sp. Astragal. 73 (1800-1802), nom illeg.

Perennial herb 40-80 cm, woody at the base, canescent; stems erect or ascending, branched, furrowed, hollow; stipules 6-8 mm, broadly triangular, acute or acuminate, hairy on the lower surface; leaves 8-25 cm; rachis 1-2 mm broad, flattened; leaflets imparipinnate, 4-9 pairs, 1.5-2.5 x 1.2-2 cm, broadly obovate to orbicular, apex truncate or obtuse, petiololate, white-hairy on the lower surface, glabrous on the upper; peduncles 1-2 cm; racemes 8-20 cm, many-flowered, elongating in fruit; bracts longer than the pedicels, subulate; calyx 1.5-1.8 cm, densely patulous white-hairy; teeth 3-4 mm; corolla yellow; calyx in fruit 2-2.5 cm, inflated, with white spreading hairs; pod 0.8-1 cm, ovoid-elliptic, concealed within the inflated calyx, glabrous, transversely wrinkled, ending in a 2-3 mm beak; seeds 5-6 x 3-4 mm, reniform, brownish.

De, S; sandy plains. Egypt, Palestine, Arabia, Iraq, Iran, Pakistan, Afghanistan.

25. **Astragalus macrocarpus** DC., Astragalogia 143, t. 28 (1802) subsp. **macrocarpus**

Syn. *Astragalus huninensis* Freyn & Bornm., Bull. Herb. Boiss. 6: 980 (1898).

Perennial herb 30-80 cm, woody at the base, yellow-villous; stems erect, branched from the base, yellowish, furrowed, hollow; stipules 1.5-2.5 cm, broadly triangular, scarious, hairy; leaves 10-25 cm; petiole and leaf rachis 2-3 mm broad, furrowed; leaflets 8-20 pairs, 1-1.8 x 0.5-1 cm, petiololate, broadly ovate to elliptic, obtuse, rounded or retuse, hairy on the lower surface, glabrous on the upper; peduncles 1-2 cm; racemes 5-12-flowered; bracts 4-6 mm, subulate; pedicels c. 2 mm; calyx 1-1.4 cm, teeth shorter than the tube, subulate; corolla 2.5-3.2 cm; pod 3.5-4.5 x 3(-4) cm, broadly obovoid, inflated, woody, ending with a stiff and sharp 0.8-1 cm beak.

S; edges of cultivation and sandy plains. Sinai, Palestine, Syria.

26. **Astragalus sparsus** Decne., Ann. Sci. Nat. Bot., ser. 2, 3: 267 (1835).

Perennial herb 30-80 cm, woody at the base, white-woolly; stems several from the base, prostrate; stipules 1-1.2 cm, triangular, the apex acuminate; leaves 5-10 cm, with spreading hairs; leaflets 10-15 pairs, 1-1.8 x 0.5-0.8 cm, petiololate, ovate-oblong to elliptical, obtuse or retuse, white-villous on both surfaces; racemes axillary, short pedunculate or almost sessile in the leaf axils; bracts c. 8 mm, subulate, hairy; calyx 1.5-1.8 cm, hairy; teeth 6-8 mm, subulate; corolla 2.5-3.2 cm, yellow; pod 3-4.5 x 0.7-0.8 cm, in stellate clusters, terete, slightly curved, tapering into a 5-8 mm beak, white-villous; seeds 4x3 mm, subrectangular, slightly compressed, 2 mm thick, brown.

S; desert wadis. Sinai, Palestine, Arabia.

27. **Astragalus fruticosus** Forssk., Fl. Aegypt.-Arab. 139 (1775).

Syn. *Astragalus tomentosus* Lam., Encycl. 1: 312 (1783).

Perennial herb 30-60 cm, white-tomentose, woody at the base; stems erect or procumbent; stipules 6-8 mm, broadly triangular, acuminate; leaves 10-25 cm; petiole and rhachis 2-3 mm thick, attenuate at the apex, rigid; leaflets 20-30 pairs, broadly ovate to orbicular-cordate, retuse, white-canescenscent on the lower surface, sparingly hairy on the upper; flowers 3-4 on axillary short peduncles; pedicels 1-2 mm; calyx 1-1.2 cm, the teeth equalling the tube, lanceolate; corolla 2-2.4 cm; pod 4.5-6.5 x 1-1.5 cm, terete, slightly arcuate, woody, longitudinally nerved, white-tomentose; seeds 3 mm, reniform, brown.

M, S; sandy plains and desert wadis. Egypt, Palestine.

28. ***Astragalus dactylocarpus*** Boiss., *Diagn. Pl. Orient.* 2: 60 (1843) subsp. ***acinaciferus*** (Boiss.) E. Ott, *Phanerog. Monogr.* 9: 62 (1978).
Syn. *Astragalus acinaciferus* Boiss., *Diagn. Pl. Orient.* 9: 72 (1849).

Perennial herb or subshrub, 20-50 cm, woody at the base; stems erect or ascending, densely white-strigose; stipules 1-1.5 cm, triangular, membranous, persistent in fruit; leaves 10-18 cm, petiole and rhachis 2 mm broad, attenuate towards the apex, rigid, persistent; leaflets 15-30 pairs, 0.4-1.2 x 0.3-0.4 cm, oblong-ovate, obtuse or retuse; peduncles 1-5 cm; racemes axillary, 2-5-flowered; calyx 1.4-1.6 cm, thinly villous, the teeth 3-4 mm; corolla 2.5-3.2 cm, yellow; pod (5-)6-8.5 x 0.8 cm, pedicellate, somewhat compressed, woody, slightly arcuate, attenuate to a narrow sharp beak, longitudinally reticulate-veined; seeds 5-6 mm, ± rectangular, flattened, brown.

S; sandy plains and desert wadis. Sinai, Palestine, Syria, Arabia, Iraq.

29. ***Astragalus sieberi*** DC., *Prodr.* 2: 295 (1835).

Subshrub 20-40 cm, appressed white-hairy; stems many from the base; stipules c. 8 mm, triangular, acuminate, ciliate, persistent in fruit; leaves 8-20 cm, petiole and rhachis 2 mm broad, narrower towards the apex, becoming spiny and persistent; leaflets 20-25 pairs, 2-5 x 2 mm, ovate-oblong, appressed-hairy on the lower surface, almost glabrous on the upper; racemes few-flowered, mainly at the base of the branches; flowers short-pedicellate; calyx c. 1.2 cm, the teeth 3 mm, ciliate; corolla 2.4-2.6 cm, yellow; pod 3-4.5(-5), 0.6-0.8 cm including the sharp beak, straight or slightly curved, woody, reticulate-veined, almost glabrous; seeds 4-5 mm, quadrangular, compressed, brown.

De, S; desert wadis and sandy plains. Egypt, Palestine, Syria, Arabia, Iraq.

30. ***Astragalus trigonus*** DC., *Astragalogia* 186 (1802).
Syns. *Astragalus leucacanthus* Boiss., *Diagn. Pl. Orient.* 9: 93 (1849).
Astragalus pseudotrigonus Batt. & Trab., *Bull. Soc. Bot. Fr.* 58: 670 (1912).

Like *Astragalus sieberi*, but leaves shorter with 5-7 pairs of leaflets; pod 1.8-2 cm.

M, D, S; stony and sandy desert wadis, sandy plains. North Africa (except Tunisia), Sinai, Palestine, Syria.

31. ***Astragalus spinosus*** (Forssk.) Muschl., *Verh. Bot. Vereins Prov. Brandenb.* 49: 98 (1907).
Syns. *Colutea spinosa* Forssk., *Fl. Aegypt.-Arab.* 131 (1775).

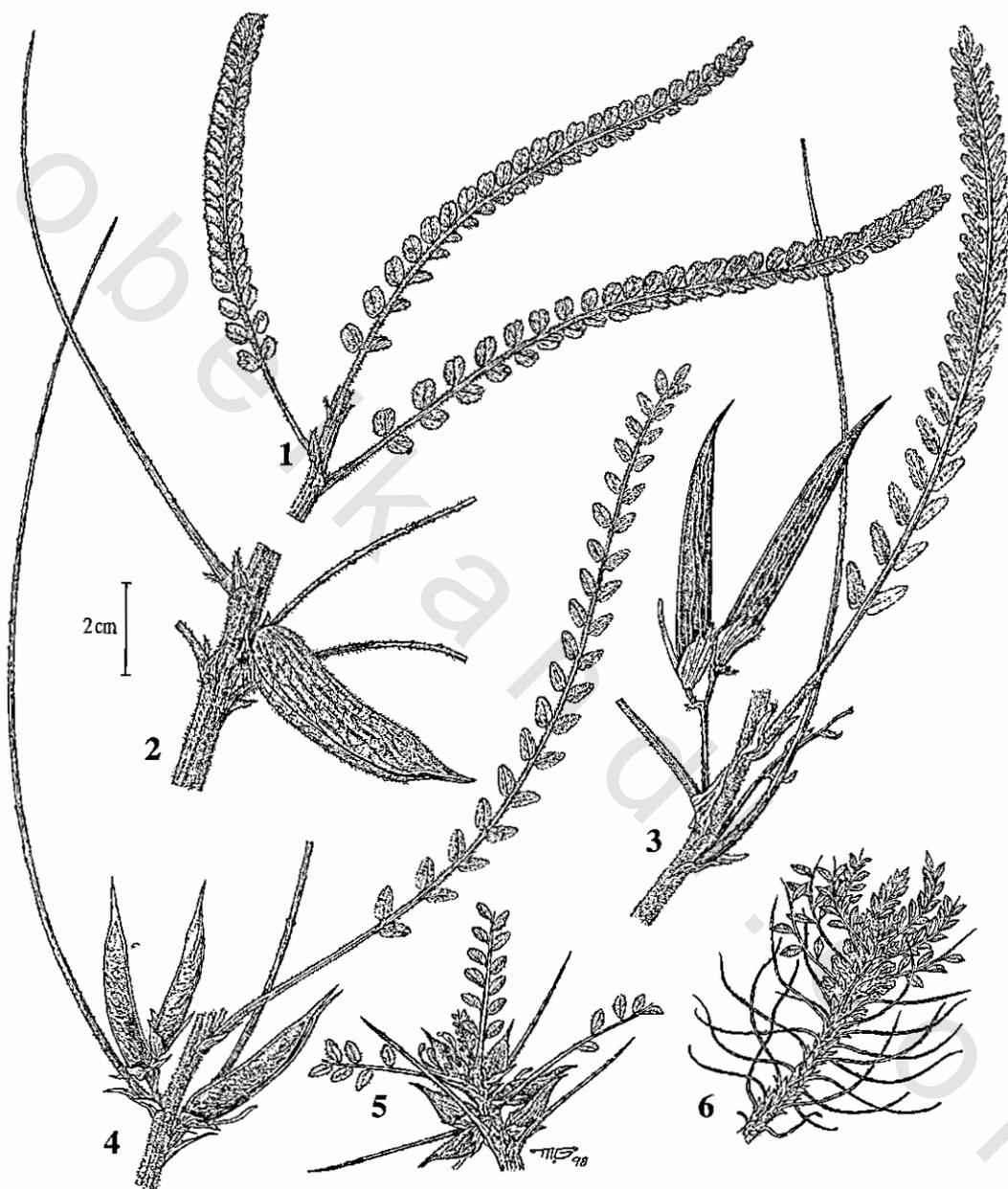


Plate 58. LEGUMINOSAE: *Astragalus fruticosus* 1, leafy branch; 2, fruiting branch. *Astragalus dactylocarpus* subsp. *acinaciferus* 3, fruiting branch. *Astragalus sieberi* 4, fruiting branch. *Astragalus trigonus* 5, fruiting branch. *Astracantha echinus* 6, flowering branch. All drawings to the same scale.

Astragalus forsskaolii Boiss., Diagn. Pl. Orient. 9: 101 (1849), nom. illeg.
Astragalus microthamnus Boiss. & Hausskn. in Boiss., Fl. Orient. 2: 393
(1872).
Astragalus kneuckeri Frey, Bull. Herb. Boiss., ser. 2, 4: 1113 (1904).

Spiny shrub 30-60 cm, appressed-canescens; stems intricate with stout spines (persistent rhachis); stipules 4-6 mm, woolly, adnate to the petiole, ending in 2 triangular free lobes; leaves 2-5.5 cm, later elongating and persistent; leaflets 3-5 pairs, 3-8 x 1.5 mm, oblong-elliptical, obtuse or subacute, hairy on both surfaces; peduncles 0.5-1 cm; racemes axillary, 1-2-flowered; calyx 1.2-1.5 x 0.3 cm, tubular, white-hairy, the teeth 2 mm, becoming inflated to 1-1.5 cm broad in fruit, membranous; corolla 1.8-2.4 cm, white; pod 0.6-1 cm, stipitate, oblong, hairy, concealed within the inflated calyx.

M, D, S; desert wadis and sandy plains. Egypt, Libya, East Mediterranean region, Arabia, Iraq.

32. *Astragalus amalecitanus* Boiss., Diagn. Pl. Orient., ser. 1, 9: 46 (1849).

Perennial herb 15-25 cm, appressed-hairy, woody at the base; stems several, branched; stipules 4-6 mm, adnate to the petiole, ending in 2 triangular teeth; leaves 3-5 cm; leaflets 4-10 pairs, 3-8 x 2-3 mm, oblong-elliptic, acute, silky-hairy; peduncles longer than the subtending leaf; racemes 6-15-flowered; bracts longer than the pedicels; calyx 1.2-1.4 x 0.3 cm, tubular, later inflated and becoming c. 1.3 cm broad, white- and black-hairy, split exposing the pod; calyx-teeth 3-4 mm, triangular; corolla 2-2.4 cm, violet with white margins; pod 0.8-1.5 x 0.4 cm, oblong, covered with dense white fleece as thick as the diameter of the pod; beak 2-3 mm, slightly curved.

S; desert wadis. Sinai, Palestine.

27. *Astracantha* Podlech

Spiny subshrubs or shrubs, often cushion-like; leaves paripinnate; rhachis woody, spiny; stipules adnate to the petiole, membranous, indurated; leaves always pungent-mucronate; flowers always sessile, in the middle parts of the branches, 2-15, densely congested in the leaf axils, often forming dense globular or ovoid inflorescences; calyx narrowly turbinate at the base, adnate to the bracts; petals persistent; pod sessile, unilocular, usually with 1, rarely 2, seeds, small and often included in the calyx; medulla and rays of the wood with mucilagenous and gummy cells (source of gum Tragacanth). 250 species, Turkey to Iran.

1. *Astracantha echinus* (DC.) Podlech, Mitt. Bot. Staatssamml. München 19:10 (1983).
Syns. *Astragalus echinus* DC., Astragalogia 197 (1802).
Astragalus libanoticus Boiss., Diagn. Pl. Orient., ser. 2, 5: 87 (1856).

Spiny subshrub 20-50 cm; stems intricate; stipules 5-7 mm, triangular, glabrous; leaves 2-4 cm, the older leaves (rhachis) spiny and persistent; leaflets 4-7 pairs, 2-6 x 1.5 mm, elliptical, mucronate to spinulose, appressed-hairy; racemes congested to a 2 cm head; calyx 7-8 mm, with densely villose teeth equalling the tube; corolla 1.5 cm; pod 5-6 mm, 1-seeded, included in the calyx, densely villous.

S; stony wadis of high altitudes. Sinai, Palestine, Syria, Lebanon, Cyprus.

28. *Taverniera* DC.

Shrubs or subshrubs; leaves 1-3-foliolate; leaflets rather thick; flowers in axillary racemes, sometimes reduced to 1- or few-flowered clusters; standard and keel longer than the wings; corolla persistent around the pod; upper filament free; pod flattened, breaking into 1-5 indehiscent 1-seeded segments. 15 species, Egypt to India, northeast Africa.

1. Leaves simple
→ Leaves 3-foliolate

1. *T. aegyptiaca*
2. *T. lappacea*

1. *Taverniera aegyptiaca* Boiss., Diagn. Pl. Orient., ser. 1, 9: 113 (1849).

Subshrub or shrub 40-80 cm, finely white-strigose; stems much branched; petiole 1-2 mm, strigose; leaves 5-8 x 4-8 mm, broadly obovate or obcordate, retuse, white-strigose on the lower surface, glabrous on the upper; racemes 1-4-flowered, on c. 2 mm axillary peduncles; calyx 3-4 mm; calyx-teeth 1.5 mm, narrowly triangular, strigose, ciliate along the margins; corolla 1-1.2 cm, rose, drying flesh-coloured, persistent; standard with parallel pink veins; pod 1.8-2.2 x 0.6 cm, of 2 or 3 1-seeded segments, flattened, white-strigose, transversely-wrinkled, spiny, with a fine 2-3 mm beak.

De, R, S; stony wadis, sandy plains. Egypt, Arabia.

2. *Taverniera lappacea* (Forssk.) DC., Prodr. 2: 339 (1825).

Syn. *Hedysarum lappaceum* Forssk., Fl. Aegypt.-Arab. 136 (1775).

Subshrub or shrub 40-80 cm, densely woolly pubescent throughout; stems much-branched; petiole 1-4 mm; leaves 3-foliolate; leaflets 0.3-1.2 x 0.3-1.2 cm, obcordate or obovate, more pubescent on the lower surface, the apex rounded or apiculate; racemes 1-5-flowered, on 1-5 mm peduncles; calyx 3-4 mm, the teeth 2.5 mm; corolla pink to purple; pod 1.5-2.5 x 0.8 cm, of 1-3 segments, pubescent, spiny.

GE; stony wadis. Egypt, Sudan, Somalia, Arabia, Pakistan.

29. *Hedysarum* L.

Perennial or annual herbs (our species) or shrubs; leaves imparipinnate; stipules scarious; leaflets entire; inflorescence axillary, racemose; bracts and bracteoles scarious; calyx-teeth subequal; petals purple, pink, white or yellow; keel longer than the wings; stamens diadelphous; ovary sessile, 4-5(-many)-ovulate; pod flattened, transversely articulated into 2-4 indehiscent segments, smooth or spiny; seeds compressed, reniform. About 100 species, north temperate regions.

1. Annual; leaflets 2-3 mm diam.
+ Perennial; leaflets 1-2 cm diam.

1. *H. spinosissimum*
2. *H. coronarium*

1. *Hedysarum spinosissimum* L., Sp. Pl., ed. 1, 750 (1753) subsp. *spinosissimum* Syn. *Hedysarum pallens* (Moris) Halácsy, Consp. Fl. Graec. 1: 453 (1900).

Annual herb 15-40 cm, glabrous, the juvenile parts pubescent; stems procumbent, branched; stipules 3-5 mm, the lower part adnate to the petiole, the upper free, triangular;

leaves 4-8 cm, imparipinnate; leaflets 4-7 pairs, 0.4-1.2 x 0.2-0.3 cm, oblong-elliptical, obtuse or retuse, petiololate; peduncles 3-9 cm; bracts 3-4 mm; racemes 2-8-flowered; pedicels 1-1.5 mm, bracteoles 2-3 mm, triangular; calyx 4-5 mm, pubescent, the teeth slightly longer than the tube, narrowly triangular, scarious at the margins; corolla 0.8-1.2 cm, pink; pod 2-3.5 x 0.5-0.8 cm, compressed; segments 2-4, 1-seeded, ovoid-orbicular, hairy, spiny, ending with a 1 mm beak.

M, S; cultivated ground and roadsides. Mediterranean region, Sinai.

2. *Hedysarum coronarium* L., Sp. Pl., ed. 1, 750 (1753).

Perennial herb 30-80 cm, sparsely appressed-pubescent; stems branched; leaflets 3-5 pairs, 1-3 x 1-1.5 cm, elliptical to obovate-orbicular, glabrescent on the upper surface, pubescent on the lower; racemes 8-30-flowered, much longer than the subtending leaf; calyx 5-6 mm, teeth \pm as long as the tube, pubescent; corolla 1.2-1.6 m, reddish-purple; pod 1.5-2 cm; segments 2-4, quadrangular, glabrous, spinulose.

M, Dw (Giza Pyramids region); waste ground, probably an escape from cultivation. southern Europe, western Mediterranean region.

30. *Onobrychis* Mill.

Annual or perennial herbs (our species) or shrubs; stipules free or connate; leaves imparipinnate; flowers in axillary racemes; calyx with 5 equal teeth; corolla white, pink, purple or yellow; stamens diadelphous; pod indehiscent, compressed, with a conspicuous toothed margin and foveolate or reticulate-veined sides, often with teeth on the ridges; seeds 1-2. About 130 species, Europe, Mediterranean region, West and Central Asia, Ethiopia.

1. Perennial; racemes 10-15 cm, many-flowered; pod 0.6-1 cm, orbicular

1. *O. ptolemaica*

+ Annual; racemes 2-4 cm, 2-4-flowered; pod 1 x 0.8-1 cm, ovoid, with conspicuous spiny crests

2. *O. crista-galli*

1. *Onobrychis ptolemaica* (Delile) DC., Prodr. 2: 347 (1825).

Syns. *Hedysarum ptolemaicum* Delile, Descr. Egypte, Hist. Nat. 255 (1814).

Onobrychis lanata Boiss., Diagn. Pl. Orient. 2: 92 (1843).

Onobrychis olivieri Boiss., Fl. Orient. 2: 547 (1872).

Perennial herb 20-50 cm, villous, woody at the base; stems erect, branched from the base; stipules 6-8 mm, triangular, villous; leaves 6-12 cm, imparipinnate; leaflets 3-8 pairs, 0.8-1.8 x 0.3-0.8 cm, oblong-elliptical, the apex acute or obtuse, glabrous on the upper surface, hairy on the lower; peduncles much longer than the subtending leaf; racemes many-flowered; pedicels 1-2 mm; calyx 6-8 mm, hairy, the teeth slightly longer than the tube, narrowly triangular; corolla yellow with brown veins; pod 0.8-1 cm diam., orbicular, flattened, densely villous, the disc and margins spinose.

De, S; desert wadis and sandy plains. Egypt, Arabia, Palestine, Syria, Iraq, Turkey.

2. *Onobrychis crista-galli* (L.) Lam., Fl. Fr. 2: 652 (1779).

Syns. *Hedysarum crista-galli* L., Syst. Veg., ed. 13, 563 (1774).



Plate 59. LEGUMINOSAE: *Taverniera aegyptiaca* 1, flowering branch; 2, pod. *Taverniera lappacea* 3, flowering branch; 4, pod. *Hedysarum spinosissimum* 5, flowering and fruiting branch; 6, pod. *Onobrychis ptolemaica* 7, flowering branch; 8, fruits. *Onobrychis crista-galli* 9, flowering and fruiting branch; 10, pod. *Ebenus armetagei* 1, flowering branch. *Alhagi graecorum* 12, flowering branch; 13, fruiting branch. All drawings to the same scale except enlarged parts (scale given).

Onobrychis ligulifera Pau, Ann. Sci. Acad. Polytechn. Porto 6: 4 (1911).

Annual herb 10-40 cm, appressed-hairy; stems erect or ascending, branched from the base; stipules 4-6 mm, triangular, acuminate, scarious with a green median nerve; leaves 5-12 cm, imparipinnate; leaflets 5-9 pairs, 0.6-1.2 x 0.1-0.3 cm, short-petiololate, oblong to linear, the apex truncate-mucronate, hairy on the lower surface, glabrous on the upper; peduncles \pm as long as the subtending leaf, elongating slightly in fruit; racemes 3-10-flowered; bracts 3-4 mm; pedicels 1-2.5 mm; calyx 6-8 mm, hairy, the teeth 5-6 mm, narrowly lanceolate; corolla as long as the calyx, pink or white; pod 1-1.2 x 0.8-1 cm, oblong to hemispherical, compressed, with a conspicuous crest of irregular spinose lobes 2-5 mm; valves pubescent, foveolate, spinose; seeds 2, 3 x 3 mm, compressed, smooth, brown.

M, D, S; North Africa, East Mediterranean region to Iran; introduced to some temperate regions.

31. *Ebenus* L.

Small shrubs or perennial herbs, pubescent; leaves trifoliolate or imparipinnate; flowers in dense axillary pedunculate heads or spikes; calyx campanulate or tubular, with 5 plumose teeth; petals yellow or purple; standard obovate or obcordate; keel truncate or obtuse; wings short; vexillary stamen connate to the others; style filiform, incurved; stigma small, terminal; fruit enclosed in the calyx, membranous, flattened, sparsely hairy, 1-seeded, indehiscent. 18 species, mainly in Turkey, a few in the Mediterranean region to Baluchistan.

1. *Ebenus armitagei* Schweinf. & Taub., Bull. Herb. Boiss. 1: 645 (1893).

Small shrub 15-25 cm, appressed-hairy; stems intricate; stipules 5-6 mm, broadly ovate-triangular, the apex 2-dentate; leaves 3-foliolate; leaflets 0.8-1.2 x 0.2-0.4 cm, oblanceolate-oblong, the apex obtuse or apiculate; flowers in head-like spikes, calyx c. 1.2 cm, densely brown-plumose; teeth twice as long as the tube; corolla 8-9 mm, shorter than the calyx, rose-pink; pod included in the calyx, 1-seeded.

M; stony ground. Egypt, Libya.

NOTE: The inflorescence has the aspect of a *Trifolium* species. The plant is known in Egypt from three localities: Ras El-Hekma, Mersa Matruh and Sollum.

32. *Alhagi* Adans.

Perennial herbs or subshrubs; stems much-branched, spinose; stipules minute; leaves simple, entire, caducous; flowers in lax few-flowered axillary racemes; rachis rigid, spine-tipped; bracts small; bracteoles present; calyx-tube campanulate, the teeth subequal, short; petals pink or purple to crimson; stamens diadelphous; ovary sessile, many-ovulate; style filiform, upcurved, glabrous; stigma small; pod indehiscent, constricted between the seeds, slightly compressed, thick-walled; seeds reniform. 3 species, Mediterranean region, Sinai to Nepal.

1. *Alhagi graecorum* Boiss., Diagn. Pl. Orient. 9: 114 (1849).

Syns. *Alhagi mannifera* Jaub. & Spach, Ill. Pl. Orient. 5: 1 (1853), nom. illeg.

Perennial herb 30-60 cm, glabrous or sparingly hairy, woody at the base; stems branched, grooved, the branchlets spiny; stipules 1-2 mm, caducous; leaves 0.5-2.5 x 0.2-0.8 cm, oblanceolate, the apex obtuse, truncate or retuse-mucronate; petiole 1-2 mm; inflorescence 1-3-flowered; rhachis terminating in a sharp spine c. 1 cm; bracts c. 1 mm, triangular, persistent; pedicels 1-2 mm; calyx 3-4 mm, the teeth minute; corolla 1-1.2 cm, crimson; pod 2-3.5 x 0.3 cm, terete or slightly compressed, irregularly constricted, glabrous or finely strigose; seeds 3 x 2 mm, reniform, brownish.

N, O, M, D, R, S; moist waste ground, edges of cultivation. East Mediterranean region from Greece to Libya and eastwards to Iran.

NOTE: *Alhagi graecorum* has long been treated as *A. maurorum* Medik. in Egypt (Täckholm, Students' Fl. Egypt, ed. 2, 272, 1974) and Palestine (Zohary, Fl. Palaest. 2: 112, 1972). On the other hand, Meikle (Fl. Cyprus 1: 532-535, 1977) distinguishes 2 species in Cyprus: *A. graecorum* and *A. maurorum*, the latter species being represented by two varieties. According to Meikle, neither of the two varieties of *A. maurorum* is known from Egypt.

33. *Vicia* L.

Annual (our species) or perennial herbs; leaves paripinnate, the leaf rhachis terminating in a simple or branched tendrill, or sometimes a short cusp; plants mostly climbing or scrambling; stipules herbaceous; flowers sessile or in axillary racemes, mostly blue, purple, yellow or white; bracts small and caducous or absent; calyx-teeth subequal; calyx-tube regular or asymmetrical at the base, gibbous above; standard ovate to oblong, narrowed to a claw; wings free or adherent to the keel; stamens diadelphous; anthers uniform; style compressed; stigma capitate; pod compressed, dehiscent; seeds globose, rarely compressed. About 140 species, North temperate, extending to South America, Hawaii and tropical East Africa.

- | | |
|--|---|
| 1. Flowers and pods sessile or subsessile in the leaf axils | 2 |
| + Flowers and pods pedunculate, in racemes | 6 |
| 2. Corolla yellow | 3 |
| + Corolla blue, violet, purple or white | 4 |
| 3. Corolla appressed-hairy; calyx hirsute | |
| + Corolla and calyx glabrous | 13. <i>V. hybrida</i>
2. <i>V. lutea</i> |
| 4. Leaflets 2-3 pairs | 1. <i>V. narbonensis</i> |
| + Leaflets 2-8 pairs | 5 |
| 5. Leaflets 0.25-1.5 cm broad, oblong, obovate, obcordate or elliptic;
calyx-teeth 0.3-1.2 cm | 3. <i>V. sativa</i> |
| + Leaflets 1-2.5 mm broad, narrowly linear; calyx teeth 1.5-2 mm | 4. <i>V. peregrina</i> |
| 6. Tendrils reduced to a mucro; pod strongly constricted
between the seeds | 5. <i>V. ervilia</i> |
| + Tendrils well-developed; pod not constricted between the seeds | 7 |
| 7. Pod 6-9 mm, (1-)2-seeded | 9. <i>V. hirsuta</i> |

+ Pod usually longer than 1 cm, 3- or more-seeded

8. Pod (0.8-)1-1.8 x 0.2-0.4 cm

+ Pod (1.8-)2-4 x 0.5-1 cm

9. Leaflets 3-6 pairs; peduncle ± equalling the leaf; pod 0.8-1.2 cm, mostly 3-4-seeded

+ Leaflets 2-3 (-5) pairs; peduncle longer than the leaf; pod 1.2-1.9 cm, mostly 5-7-seeded

10. Raceme 1- (-2)-flowered; corolla lilac

+ Raceme (1-) -8-flowered; corolla violet-blue, purplish violet, pale violet or blue

11. Calyx 2 mm; corolla 6-9 mm

+ Calyx 3-8 mm; corolla 1.2-2 cm

12. Raceme 1-3(-4)-flowered

+ Raceme 5-30-flowered

13. Plant villous to appressed-pilose or glabrescent; racemes longer than the leaves

+ Plant densely silky-canescens; racemes shorter than the leaves

1. *Vicia narbonensis* L., Sp. Pl., ed. 1, 737 (1753).

Annual herb, 15-40 cm, glabrescent to sparsely hairy; stems erect, robust, thick, angular, branched; stipules 1-1.5 cm, suborbicular, dentate to incised; leaves 5-10 cm; rachis 1-3 mm; tendrils branched; leaflets 4-6, 2-5 x 1-3 cm, subsessile, elliptical to ovate or lanceolate, the apex obtuse-mucronate, the margins entire, dentate or serrate; peduncles 1-2 mm, thick; racemes 3-5-flowered; calyx 0.8-1.2 cm, the tube ± as long as the unequal teeth; corolla 2-3 cm, purplish-violet; pod 3.5-5 x 1-1.2 cm, flattened, oblong-linear, slightly curved, beaked, tuberculate-dentate at the margins; seeds 4-5 mm, subglobose, dark brown.

Two varieties occur in Egypt:

var. *narbonensis*

Leaflets entire.

N, O, M, De, S; weed of cultivation.

var. *serratifolia* (Jacq.) Ser. in DC., Prodr. 2: 365 (1825).

Syn. *Vicia serratifolia* Jacq., Fl. Austr. 5 (App.): 30, t. 8 (1778).

Leaflets serrate or dentate.

N; weed of cultivation.

Area of the species: Mediterranean region, Southwest Asia.

2. *Vicia lutea* L., Sp. Pl., ed. 1, 736 (1753).

Syns. *Vicia laevigata* Sm. in Sowerby, Engl. Bot., t. 483 (1798).

Vicia hirta DC., Syn. Pl. Fl. Gall. 360 (1806).

Vicia vestita Boiss., Elench. Pl. Nov. 39 (1838).

Vicia cavanillesii Martínez, Bot. Soc. Esp. Hist. Nat. 29: 410 (1929).

Annual herb 15-60 cm, glabrescent; stems erect or ascending; stipules 2-4 mm, triangular, dentate, with a nectary spot at the base; leaves 2.5-6 cm, glabrous; petiole 2-4 mm; tendrils filiform, branched; leaflets 5-10 pairs, 0.8-2.2 x 0.2-0.4 cm, narrowly elliptical to oblong, short-petiololate, acute, mucronate; flowers solitary, axillary; pedicels 1-2 mm; calyx 1-1.2 cm, glabrous; the teeth unequal, longer or shorter than the tube; corolla 1.8-2.5 cm, yellow, sometimes with purple veins, glabrous; pod 2.5-3.5 x 0.8-1.2 cm, compressed, oblong-rhomboidal, beaked, with conspicuous tubercled hairs; seeds subglobose, brown, smooth.

N, O, M; cultivated ground. Mediterranean region, southern and western Europe, Caucasia, Iran.

3. *Vicia sativa* L., Sp. Pl., ed. 1, 736 (1753).

Syns. *Vicia notata* Gilib., Fl. Lit. Inch. 2: 105 (1782), nom. inval.

Vicia globosa Retz., Observ. Bot. 3: 39 (1783).

Vicia cosentinii Guss., Fl. Sicul. Prodr. 2: 426 (1828).

Vicia torulosa Boreau, Fl. Centre France, ed. 3, 2: 173 (1857).

Annual herb 15-60 cm, glabrescent to hairy; stems erect to ascending or procumbent, branched; stipules 4-8 mm, triangular, deeply dentate; leaves 3-10 cm; petiole 0.3-1 cm; tendrils branched; leaflets 4-8 pairs, variable in size and shape, 1-3.5 x 0.25-1.5 cm, oblong, obovate, linear or lanceolate, truncate, obtuse, retuse or mucronate; flowers 1-2, axillary, subsessile, short-pedicellate, sometimes subterranean and minute; calyx 1-1.8 cm, hairy; the teeth 0.3-1.2 cm, subequal, linear-subulate; corolla 1.4-2.4 cm, purplish-violet; pod 4-6.5 x 0.5-0.8 cm, 6-12-seeded, torulose or not, 1-2-seeded in subterranean pods, compressed, linear, slightly pubescent to glabrous, obscurely reticulate-veined; seeds 2.5-6.5 mm, sub-globose, brown to black.

Four subspecies occur in Egypt:

1. Aerial and subterranean flowers and pods are produced by the same plant
+ Aerial flowers and fruits only subsp. **amphicarpa** 2
2. Leaflets relatively narrow, 0.25-0.8 cm broad; calyx-teeth 3-6 mm; corolla 1.4-2 cm; seeds 2.5-4 mm
+ Leaflets relatively broad, 0.5-1.5 cm broad; calyx-teeth 0.5-1.2 cm subsp. **nigra** 3
3. Pod 3.5-6 x 0.5-0.6 cm, dark brown or blackish; seeds 3-5 mm
+ Pod 5.5-6.5 x 0.7-1 cm, torulose, brown or yellowish-brown; seeds 4.5-6 mm subsp. **cordata**
subsp. **sativa**

subsp. **sativa**

N, M; weed of cultivation.

subsp. **amphicarpa** (L.) Batt. in Batt. & Trab., Fl. Algérie 1: 268 (1889).
Syn. *Vicia amphicarpa* L., Sp. Pl., ed. 2, 1030 (1763).

M; weed of cultivation.

subsp. **cordata** (Hoppe) Batt. in Batt. & Trab., Fl. Algérie 1: 267 (1889).
Syn. *Vicia cordata* Hoppe in Sturm, Deutschl. Fl. Abth. 1, 32, fol. 1, (1812).

N, O, M, S; weed of cultivation.

subsp. **nigra** (L.) Ehrh., Hannover Mag. 18: 229 (1780).
Syns. *Vicia sativa* var. *nigra* L., Sp. Pl., ed. 2, 1037 (1763).
Vicia angustifolia L., Amoen Acad. 4: 105 (1759).
Vicia pilosa M. Bieb., Fl. Taur.-Caucas. 2: 161 (1808).
Vicia heterophylla C. Presl in J. Presl & C. Presl, Delic. Prag. 37 (1822).
Vicia cuneata Guss., Fl. Sicul. Prodr. 2: 428 (1828).

For full synonymy see Greuter *et al.*, Med-Checklist 4: 211 (1989).

N, O, M, S; weed of cultivation.

Area of the species: Temperate and many subtropical and tropical regions of the world.

NOTE: A polymorphic species, sometimes the subspecies are not well defined as intermediates occur.

4. ***Vicia peregrina*** L., Sp. Pl., ed. 1, 737 (1753).
Syns. *Vicia megalosperma* M. Bieb., Fl. Taur.-Caucas. 2: 161 (1808).
Vicia leptophylla Raf., Caratt. Nuovi Gen. 71 (1810).

Annual herb 15-60 cm, glabrescent to appressed-hairy; stems erect or procumbent, branched, angular; stipules 2-4 mm, narrowly triangular; leaves 2-6 cm; petiole 1-5 mm; tendrils simple or branched; leaflets 3-7 pairs, 1-2.5 x 0.1-0.25 cm, short-petioliolate, narrowly linear, retuse-mucronate; flowers mostly solitary, axillary; pedicels 4-7 mm; calyx 5-8 mm, the teeth 1.5-2 mm, narrowly triangular, unequal; corolla 1-1.8 cm violet or purplish; pod 2.5-4 x 0.6-0.8 cm, 3-6-seeded, compressed, oblong-linear, deflexed, with a short beak, appressed-hairy; seeds 3-4 mm, subglobose, dark brown.

M, S; weed of cultivation. Mediterranean region, South Europe, West and Central Asia, Atlantic Islands.

5. ***Vicia ervilia*** (L.) Willd., Sp. Pl., ed. 4, 3: 1103 (1802).
Syn. *Ervum ervilia* L., Sp. Pl., ed. 1, 738 (1753).

Annual herb 10-40 cm, glabrescent; stems erect, branched, angular; stipules 2-4 mm, triangular, dentate; leaves 4-8(-10) cm; petiole 2-6 mm; tendrils reduced to a mucro; leaflets 5-12 pairs, 0.5-1.5 x 0.1-0.3 cm, short-petioliolate, narrowly-linear to oblong-lanceolate, retuse-mucronate or obtuse; peduncles shorter than the subtending leaf, aristate; racemes 1-4-flowered; pedicels 2-3 mm; calyx 5-7 mm, pubescent, the teeth slightly longer than the tube, equal, subulate; corolla 1-1.2 cm, violet-blue; pod 1.5-2.5 x 0.3-0.5 cm, oblong-linear, strongly constricted between the seeds, pubescent, 2-4-seeded; seeds 4-5 mm, subglobose, dark brown, smooth.

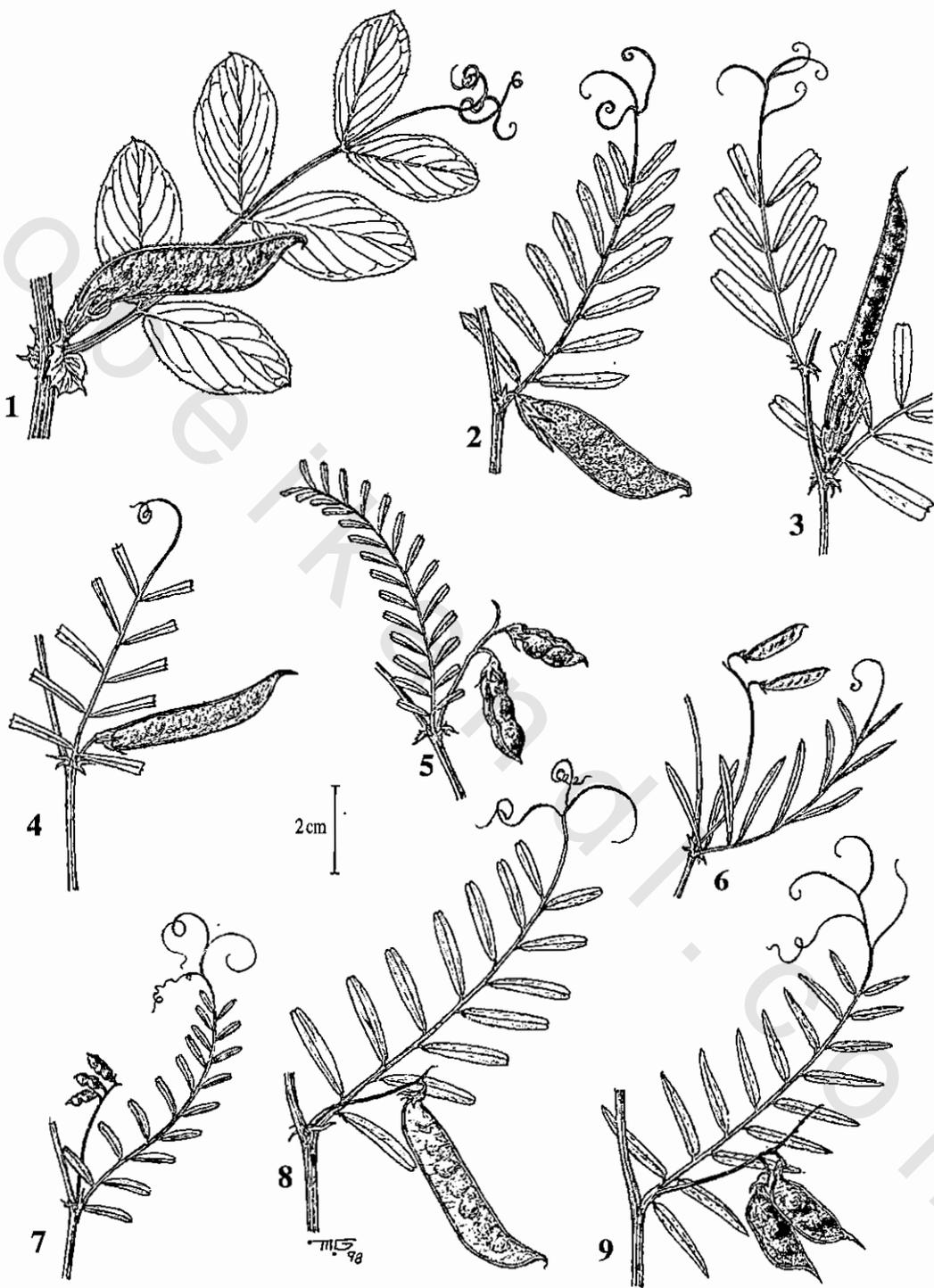


Plate 60. LEGUMINOSAE: fruiting branches of: *Vicia narbonensis* 1. *Vicia lutea* 2. *Vicia sativa* 3. *Vicia peregrina* 4. *Vicia ervilia* 5. *Vicia tetrasperma* 6. *Vicia hirsuta* 7. *Vicia monantha* 8. *Vicia palaestina* 9. All drawings to the same scale.

M; cultivated ground. Mediterranean region.

6. ***Vicia articulata*** Hornem., Enum. Pl. Hort. Hafn., ed. 2, 41 (1807).

Syns. *Vicia ciliaris* Sm., Fl. Graec. Prodr. 2: 71 (1813).

Vicia multifida Wallr., Annus Bot. 85 (1815).

Cracca monanthos (L.) Gcdron & Gren. in Gren. & Godron, Fl. Fr. 1: 47 (1849).

Vicia smyrnaea Boiss., Diagn. Pl. Orient., ser. 2, 2: 38 (1856).

Annual herb 20-50 cm, glabrous, procumbent or climbing; stems branched; stipules in dimorphic pairs, one small and subulate, the other much larger and palmately divided into several filiform lobes to 1 cm; leaves 2-6 cm; petiole 0.3-2 cm; tendrils usually 3-branched; leaflets 5-8 pairs, 0.3-1.8 x 0.1-0.3 cm, oblong to narrowly linear; peduncles longer than the subtending leaf; racemes 1(-2)-flowered, aristate; calyx 4-6 mm, the teeth slightly longer than the tube; corolla 1-1.4 cm, lilac; pod 2-3 x 0.5-0.8 cm, oblong-linear, beaked, slightly torulose; seeds 2-4, 5 x 3 mm.

N (Faiyum); weed of cultivation. Mediterranean region, Central Europe.

NOTE: The most striking feature in this species is the dimorphic stipules.

7. ***Vicia tetrasperma*** (L.) Schreb., Spic. Fl. Lips. 26 (1771).

Syns. *Ervum tetraspermum* L., Sp. Pl., ed. 1, 738 (1753).

Vicia agrestis Scheele, Flora (Regensburg) 26: 444 (1843).

Annual herb 15-60 cm, glabrescent; stems slender, procumbent or erect, angular, branched; stipules 3-4 mm, narrowly lanceolate; leaves 2-4 cm; petiole 1-3 mm; tendrils simple or biforked; leaflets 3-6 pairs, 0.5-2 x 0.1-0.25 cm, narrowly linear, mucronate or acute; peduncles \pm as long as the subtending leaf, short-aristate; racemes 1-2-flowered; pedicel 1-1.5 mm; calyx c. 4 mm, the teeth shorter than the tube; corolla 6-8 mm, pale blue; pod 0.8-1.2 x 0.2-0.3 cm, compressed, oblong, stipitate, slightly torulose, glabrous, with a short beak, mostly 3-4-seeded; seeds 2 mm, subglobular, smooth.

N; moist and cultivated ground. Mediterranean region, Southwest Asia.

8. ***Vicia parviflora*** Cav., Anales Ci. Nat. 4: 73 (1801).

Like *Vicia tetrasperma* but leaflets 2-3(-5) pairs; peduncle longer than the subtending leaf; pod 1.2-1.9 cm, mostly 5-7-seeded.

N; cultivated ground. Mediterranean region, West Europe, West Asia.

9. ***Vicia hirsuta*** (L.) Gray, Nat. Arr. Brit. Pl. 2: 614 (1821).

Syn. *Ervum hirsutum* L., Sp. Pl., ed. 1, 738 (1753).

Like *Vicia tetrasperma*, but leaflets 5-10 pairs; peduncles $\frac{1}{2}$ as long as the subtending leaf; racemes 2-6-flowered; corolla 3-4 mm; pod (1-)2-seeded.

De; edges of cultivation, sandy soils. North Africa, Europe, Southwest Asia, Ethiopia.

10. **Vicia monantha** Retz., *Observ. Bot.* 3: 39 (1783).

Syns. *Vicia biflora* Desf., *Fl. Atlant.* 2: 166 (1799).

Vicia calcarata Desf., *Fl. Atlant.* 2: 166 (1799).

Vicia cinerea M. Bieb., *Fl. Taur.-Caucas.* 3: 470 (1820).

Annual herb 10-50 cm, sparingly hairy to glabrous; stems erect or ascending, angular, branched; stipules 3-5 mm, hastate; leaves 3-8 cm; petiole 0.3-1 cm; tendrils branched; leaflets 4-8 pairs, 0.6-2.2 x 0.1-0.5 cm, short-petiololate, linear to oblong-linear or narrowly elliptical, truncate, retuse or mucronate; peduncles shorter than the subtending leaf, elongate in fruit, aristate; racemes 1-3(-4) flowered; pedicels 1-2 mm; calyx 4-5 mm, pubescent, teeth shorter than the tube; corolla 1.2-1.6 cm, bright purple; pod 2.5-4.5 x 0.6-1 cm, 4-6-seeded, flattened, oblong-linear, with a short beak, glabrous, transversely veined; seeds 3-4 mm, subglobose, dark brown, smooth.

N, O, M, S; cultivated and waste ground. Mediterranean region, eastwards to Pakistan and Afghanistan.

11. **Vicia sinaica** Boulos, *Bull. Fac. Sci. Cairo Univ.* 34: 80, f. 2 (1958).

Annual or short-lived perennial herb, densely silky-hairy throughout; stems erect, stiff; leaves 2-4 cm; leaflets 5-10 pairs; leaflets mucronate, hairy on both surfaces; racemes 5-10-flowered, shorter than the subtending leaf; calyx-teeth unequal, the lower teeth filiform, shorter than the tube; corolla violet-blue; seeds compressed, black, smooth.

S; sandy plains. Endemic.

12. **Vicia villosa** Roth, *Tent. Fl. Germ.* 2 (2): 182 (1793).

Annual herb 20-60 cm, villous to appressed-pilose or glabrescent; stems many, branched, angular, erect, procumbent or climbing; stipules 0.6-1.2 cm, hastate, acuminate; leaves 2.5-8 cm; petiole 0.2-1.5 cm; tendrils branched; leaflets 4-10 pairs, 1-2.5 x 0.2-0.4 cm, oblong-linear to narrowly elliptic, acute-mucronate; peduncles longer than the subtending leaf; racemes 3-30-flowered; pedicels 1-2.5 mm, villous; calyx 6-8 mm, villous, gibbous, the teeth \pm as long as the tube, subulate; corolla 1.4-2 cm, purple or violet-blue; pod 2-3.5 x 0.8-1 cm, 3-8-seeded, flattened, rhombic-oblong, pubescent or glabrous; seeds 2-3 mm, subglobose, dark brown, smooth.

Two subspecies occur in Egypt:

subsp. **microphylla** (d'Urv.) P. W. Ball, *Feddes Repert.* 79: 45 (1968).

Syns. *Vicia microphylla* d'Urv., *Mém. Soc. Linn. Paris* 1: 343 (1822).

Vicia salamina Boiss., *Diagn. Pl. Orient.*, ser. 2, 2: 39 (1856).

Leaflets 4-7 pairs, narrowly elliptic; racemes 3-7-flowered.

M; cultivated ground.

subsp. **varia** (Host) Corb., *Nouv. Fl. Normandie* 181 (1894).

Syns. *Vicia varia* Host, *Fl. Austriaca* 2: 332 (1831).

Vicia dasycarpa Ten., *Succ. Relaz. Viaggio Abruzzo* 81 (1830).

Leaflets 6-10 pairs, oblong-linear; racemes 5-15-flowered.

M; cultivated ground.

Area of the species: Mediterranean region, Europe, West Asia.

13. *Vicia hybrida* L., Sp. Pl., ed. 1, 737 (1753).

Syn. *Vicia spuria* Rafin., Caratt. Nuovi Gen. 72 (1810).

Annual herb 15-60 cm, appressed-hairy throughout; stems branched, procumbent, ascending or climbing; stipules 2-3 mm, hastate or lanceolate; leaves 2-6 cm; petiole 3-8 mm; tendrils simple or branched; leaflets (3-)4-7 pairs, 0.5-2.2 x 0.3-0.8 cm, short-petiololate, obovate to oblong-elliptical or obcordate, truncate- or retuse-mucronate; flowers axillary, solitary; pedicels 1.5-3 mm, deflexed; calyx 1-1.2 cm, hirsute, teeth shorter than the tube; corolla 2-3.2 cm, yellow, greyish appressed-hairy; pod 2.5-3.5 x 0.8-1 cm, oblong-rhomboidal, compressed, 2-5-seeded; seeds 3-5 mm, globose, dark brown, finely tuberculate.

N; weed of cultivation. Mediterranean region, West Asia.

14. *Vicia palaestina* Boiss., Diagn. Pl. Orient. 9: 116 (1849).

Annual herb 15-60 cm, sparingly hairy or glabrescent; stems branched, climbing; stipules 1.5-3 mm, hastate to lanceolate; leaves 3-8 cm; petiole 2-5 mm; tendrils branched; leaflets 6-10 pairs, 0.8-2.5 x 0.1-0.3 cm, short petiololate, narrowly linear, acute, mucronate; peduncles shorter than the subtending leaf; racemes 3-9-flowered; pedicels 1-2 mm, deflexed; calyx c. 2 mm, hairy, the teeth shorter than the tube; corolla 6-9 mm, pale blue; pod 1.5-2.5 x 0.5-0.8 cm, compressed, rhombic-elliptical, 2-4-seeded, with a short beak, glabrous, reticulate-veined; seeds 3-4.5 mm, globular, dark brown, smooth.

S; cultivated fields and disturbed ground. East Mediterranean region, Sinai.

34. *Lathyrus* L.

Annual (our species) or perennial herbs; stems usually winged, erect or scrambling; leaves paripinnate, the rachis ending in a tendril or a short awn; stipules herbaceous, large, sagittate; leaflets few, parallel-veined, sometimes reduced to a tendril; inflorescence axillary, racemose or flowers solitary; bracts very small, caducous; bracteoles absent; calyx-tube often oblique, slightly gibbous; calyx-teeth subequal; standard with a short claw; wings free or adherent to the keel; vexillary stamen free or connate with the others; ovary sessile or stipitate, few or many-ovulate; pod dehiscent; seeds globose or angular. About 160 species, temperate regions of the northern hemisphere and mountains of tropical Africa and South America.

1. Leaves reduced to simple filiform tendrils; stipules large, leaf-like 1. *L. aphaca*
+ Leaves well-developed; stipules not leaf-like 2

2. Pod with one prominent midrib on the valves 6. *L. gorgonei* var. *lineatus*
+ Pod without a midrib on the valves 3

3. Valves of the pod silky, with tuberculate-based hairs and sessile glandular

- indumentum
+ Valves glabrous or thinly pubescent, not silky
2. **L. hirsutus** 4
4. Pod narrowly linear, (8-)10-14-seeded, the valves with prominent parallel veins
+ Pod ± oblong, 2-8-seeded, the valves reticulate-veined
4. **L. sphaericus** 5
5. Pod with distinctly winged dorsal suture
+ Dorsal suture of pod not winged
7. **L. sativus** 6
6. Corolla bright red or pinkish-violet; pod 1.5-3 cm, 2-5-seeded 7
+ Corolla yellow, pale orange or salmon-coloured; pod 3-7 cm, 5-8-seeded 8
7. Corolla 0.7-1 cm, bright red; calyx 4 mm; pod incurved, 2-3-seeded 3. **L. setifolius**
+ Corolla 1.2-1.5 cm, pink-violet; calyx 6-8 mm; pod not incurved, 2-5-seeded 8. **L. marmoratus**
8. Raceme 1-3-flowered; petals yellow, often red-veined; pod 5-7 x 0.8-1.2 cm 5. **L. annuus**
+ Raceme 1-flowered; petals pale orange; pod 3-5 x 0.6-0.8 cm 6. **L. gorgonei** var. **gorgonei**

1. **Lathyrus aphaca** L., Sp. Pl., ed. 1, 729 (1753).

Syns. *Lathyrus pseudoaphaca* Boiss., Diagn. Pl. Orient. 2: 105 (1843).

Lathyrus affinis Guss., Fl. Sicul. Syn. 2: 853 (1845).

Lathyrus polyanthus Boiss. & Blanche in Boiss., Fl. Orient. 2: 602 (1873).

Lathyrus floribundus Velen., Fl. Belg. 156 (1891).

Annual herb 15-40 cm, glabrous; stems erect, ascending or trailing, branched, angular; stipules 0.5-2.5 x 0.5-2 cm, leaf-like, ovate-hastate, apiculate; leaves reduced to simple filiform tendrils; flowers axillary, solitary, rarely 2, on peduncles as long as or longer than the stipules; pedicels 2-3 mm; bracts minute; calyx 6-8 mm; teeth longer than the tube, subequal, lanceolate, 3-nerved; corolla 0.8-1.2 cm, yellow; pod 2-3.5 x 0.4-0.6 cm, oblong-linear, compressed, reticulate-veined; seeds 2-3 mm, dark brown, smooth.

N, O, M, S; weed of cultivation. Western Europe, Mediterranean region, West Asia to India; introduced elsewhere.

2. **Lathyrus hirsutus** L., Sp. Pl., ed. 1, 732 (1753).

Annual herb 20-80 cm, glabrous; stems trailing, branched, winged, angular, striate; stipules 1-1.5 cm, sagittate, acuminate; petiole 1-3 cm, winged; tendrils branched; leaflets 2, 4-8 x 0.5-1.2 cm, oblong-linear, 4-6-veined; peduncles longer than the subtending leaf, 1-2-flowered; pedicels 3-5 mm; calyx 5-8 mm, calyx-teeth ± as long as the tube, subequal, triangular; corolla 1-1.5 cm, crimson (standard) and blue (wings); pod 3-5 x 0.8-1 cm, oblong-linear, silky, with tuberculate-based hairs and sessile glandular indumentum; seeds 2-3 mm, subglobose, dark brown.

N, O, M; weed of cultivation. North Africa, South and Central Europe, West Asia.

3. **Lathyrus setifolius** L., Sp. Pl., ed. 1, 731 (1753).

Annual herb 25-50 cm, glabrous; stems branched from the base, ascending or climbing, angular, narrowly winged; stipules 0.7-1.5 cm, sagittate, acuminate; petiole 0.6-1.5 cm, winged; tendrils branched; leaflets 2, 1.5-6.5 x 0.1-0.3 cm, linear to linear-lanceolate, acuminate; peduncles shorter than the subtending leaf; racemes axillary, 1-flowered; bracts absent; pedicels 3-6 mm; calyx 5-5 mm, the teeth \pm as long as the tube, lanceolate, prominently 1-veined; corolla 0.7-1 cm, purple; pod 1.8-2.5 x 0.6-0.8 cm, flattened, oblong-elliptical, incurved, beaked, net-veined, 2-3-seeded; seeds 3-5 mm, subglobose, blackish-brown, reticulate.

M; waste ground and borders of cultivation. Mediterranean region.

4. **Lathyrus sphaericus** Retz., Observ. Bot. 3: 39 (1784).

Annual herb 10-30 cm, glabrous; stems erect, ascending or sprawling, branched from the base, angled, narrowly winged; stipules 0.5-1.5 cm, narrowly sagittate; petiole 3-8 mm, narrowly winged, ending in a short awn in lower leaves or unbranched tendril in upper leaves; leaflets 2, 1-6 x 0.1-0.3 cm, linear; peduncles 0.3-1 cm, ending in a long awn to 1.5 cm; pedicels c. 5 mm, elongate and thickening in fruit; racemes axillary, 1-flowered; calyx 5-7 mm; calyx-teeth slightly longer than the tube, prominently 1-veined, acuminate; corolla 5-9 mm, orange-red; pod 3.5-6.5 x 0.3-0.4 cm, narrowly linear, beaked, slightly compressed, the sutures thickened; valves with prominent parallel veins, (8-)10-14-seeded; seeds c. 2.5 mm, globose, dark brown, smooth.

N, Dw; edges of cultivation. North Africa, South Europe, East Mediterranean region, extending eastwards to Afghanistan.

5. **Lathyrus annuus** L., Demonstr. Pl. 24 (1753).

Syns. *Lathyrus hierosolymitanus* Boiss., Diagn. Pl. Orient. 9: 127 (1849).

Lathyrus chius Boiss. & Orph. in Boiss., Diagn. Pl. Orient., ser. 2, 6: 68 (1859).

Lathyrus annuus var. *hierosolymitanus* (Boiss.) Post, Fl. Syr., Pal., Sinai, 292 (1896).

Annual herb 20-50 cm, glabrous; stems sprawling or climbing, conspicuously winged; stipules 1-2 cm, sagittate; petiole 0.5-2.5 cm, winged; tendril branched; leaflets 2, 3-10 x 0.2-0.4 cm, linear to narrowly lanceolate, mucronate; peduncles 2-10 cm; racemes 1-3-flowered; pedicels 3-5 mm; calyx 5-7 mm, the teeth longer than the tube, subequal, triangular; corolla 0.8-1 cm, yellow or often red-veined; pod 5-7 x 0.8-1.2 cm, flattened, oblong, beaked, the sutures thickened; valves reticulately veined; seeds 3-4 mm, subglobose, brown, tuberculate.

N, S (El-Arish - Rafah); sandy plains, edges of cultivation. Macaronesia, Mediterranean region, Sinai, Iraq, Iran to Central Asia.

6. **Lathyrus gorgonei** Parl., Giorn. Sci. Sicilia 62: 3 (1838).

Syn. *Lathyrus amoenus* Fenzl, Pug. Pl. Nov. Syr. 3 (1842).

Annual herb 15-50 cm, glabrous; stems branched from the base, winged, striate; stipules 1-2 cm, hastate, acute; petiole 0.6-1.5 cm, winged, ending in a simple or branched



Plate 61. LEGUMINOSAE: fruiting branches of: *Lathyrus aphaca* 1. *Lathyrus hirsutus* 2. *Lathyrus setifolius*
 3. *Lathyrus sphaericus* 4. *Lathyrus annuus* 5. *Lathyrus gorgonei* var. *gorgonei* 6. *Lathyrus gorgonei* var. *lineatus*
 7, pod. *Lathyrus sativus* 8. *Lathyrus marmoratus* 9. All drawings to the same scale.

tendrils; leaflets 2, 2-5 x 0.2-0.5 cm, linear-lanceolate to narrowly elliptical, acute; peduncles 1.5-4 cm; racemes 1-flowered; pedicels 2-5 mm; bracts minute, caducous; calyx 6-8 mm, calyx-teeth twice as long as the tube, subequal, triangular, acuminate, reflexed in fruit; corolla 1.5-2 cm, pale orange; pod 3-5 x 0.6-0.8 cm, compressed, oblong-linear, beaked, reticulate-veined, the sutures thickened; seeds 3-4 mm, globose, smooth, brown.

Two varieties occur in Egypt:

var. **gorgonei**

Pod without a prominent midrib on the valves.

S; edges of cultivation and disturbed ground.

var. **lineatus** (Post) C. C. Towns., Kew Bull. 25: 471 (1971).

Syns. *Lathyrus cicera* L. var. *lineatus* Post, Fl. Syr. Pal. Sinai, 292 (1896).

Lathyrus pseudocicera Pamp., Nuov. Giorn. Bot. Ital. n. s., 31: 213 (1924).

Lathyrus gorgonei Parl. var. *lineatus* Plitm., Fl. Palaest. 2: 458 (1972).

Pod with prominent midrib on each valve.

N, M; weed of cultivation.

Area of the species: East Mediterranean to Iran, Sardinia, Sicily.

7. **Lathyrus sativus** L., Sp. Pl., ed. 1, 730 (1753).

Syn. *Lathyrus stenophyllus* (Boiss.) Gand., Fl. Cretica 27 (1916), non Boiss. & Heldr. in Boiss., Diagn. Pl. Orient. 9: 126 (1849).

Like *Lathyrus gorgonei* but pod 1.5-2 cm wide, with distinctly winged dorsal suture.

N, O, M; cultivated and waste ground, naturalized. Atlantic Islands, Mediterranean region, temperate and tropical Africa, eastwards to India.

8. **Lathyrus marmoratus** Boiss. & Blanche in Boiss., Fl. Orient. 2: 606 (1872).

Annual herb 15-40 cm, glabrous; stems ascending or procumbent, branched from the base, narrowly winged; stipules 1-2.5 cm, sagittate, the upper part lanceolate; petiole 1.5-2.5 cm, winged, ending in a cusp (lower leaves) or a branched tendril (upper leaves); leaflets 2, 2-6 x 0.1-0.5 cm, linear-lanceolate, acute; peduncles shorter than the subtending leaf; racemes 1-flowered; bracts minute; pedicels 4-6 mm; calyx 6-8 mm, calyx-teeth about twice as long as the tube, lanceolate, \pm equal; corolla 1.2-1.5 cm, pink-violet; pod 1.5-3 x 0.6-0.8 cm, compressed, oblong-rhomboid, with a short beak, narrowly 2-winged along the 2 sutures, reticulate-veined, 2-5-seeded; seeds 3-5 mm, mottled with blackish-brown spots.

N, M, S; cultivated and disturbed ground. East Mediterranean region, Sinai.

35. *Pisum* L.

—Climbing or sprawling annuals; leaves paripinnate, the rachis ending in an awn or tendril; leaflets 1-4 pairs; stipules small or large, foliaceous; flowers purple, pink or white, solitary or in axillary racemes; bracts small, caducous; bracteoles absent; calyx asymmetrical, slightly gibbous at the base; standard ± orbicular, with a short broad claw; wings adherent to the keel; stamens diadelphous; pod compressed, dehiscent; seeds subglobose. 3 species, Mediterranean region, West Asia.

1. Leaflets 1-2 pairs, toothed or incised; corolla 1.5-1.7 cm, orange-buff; pod 3-4 cm **1. *P. fulvum***
— Leaflets 1-4 pairs, entire or toothed; corolla 1.5-3 cm, lilac, purple or white; pod 4-7(-8) cm **2. *P. sativum***

1. *Pisum fulvum* Sm., Fl. Graec. Prodr. 2: 62 (1813).

—Annual herb 15-40 cm, glabrous; stems ascending or procumbent; stipules 2.5-4 cm, ovate, dentate or incised; tendrils branched; leaflets 1-2 pairs, 1.5-2.5 x 1-1.5 cm, ovate, dentate or incised; peduncles longer than the stipules; racemes 1(-3)-flowered; calyx 6-8 mm; calyx-teeth longer than the tube, lanceolate; corolla 1.5-1.7 cm, orange-buff; pod 3-4 x 0.8-1 cm, oblong-linear, compressed, short-beaked, reticulate-veined; seeds 4-5 mm, black.

—S; cultivated ground. East Mediterranean region, Sinai.

2. *Pisum sativum* L., Sp. Pl., ed. 1, 727 (1753).

Syns. *Pisum arvense* L., Sp. Pl., ed. 1, 727 (1753).

Pisum oleraceus Lam., Fl. Fr. 2: 580 (1779).

Annual herb 0.2-1.5 m, glabrous; stems climbing or sprawling, striate, branched; stipules 1-5 x 0.5-5 cm, toothed near the base; petiole 1-5 cm; tendrils branched; leaflets 1-4 pairs, 1-5 x 0.5-3.5 cm, obovate to elliptic, entire or toothed; peduncles 2-12 cm; racemes 1-3-flowered; pedicels 0.5-1.5 cm; calyx 0.8-1.2 cm; calyx-teeth longer than the tube, lanceolate, acute; corolla 1.5-3 cm, lilac, purple or white; pod 3.5-7(-8) x 1-1.8 cm, compressed, oblong-linear, with a short beak, reticulate.

Three subspecies occur in Egypt:

subsp. **sativum**

Petals white; seeds smooth, brownish-green.

N, O, M; escape from cultivation.

subsp. **elatius** (M. Bieb.) Asch. & Graebn., Syn. Mitteleur. Fl. 6 (2): 1064 (1910).

Syns. *Pisum elatius* M. Bieb., Fl. Taur.-Caucas. 2: 151 (1808).

Pisum biflorum Raf., Caratt. Nuovi Gen. 71 (1810).

Standard pink, wings purple or crimson; seeds minutely tuberculate.

N; cultivated ground.

- subsp. **humile** (Holmboe) Greuter *et al.*, Willdenowia 14: 283 (1985).
Syns. *Pisum arvense* L. subsp. *humile* Holmboe, Bergens Mus. Skr., ser. 2, 1 (2): 115 (1914).
Pisum humile Boiss. & Noë in Boiss., Diagn. Pl. Orient., ser. 2, 2: 45 (1856), non Mill., Gard. Dict., ed. 8, no. 2 (1768).
Pisum pumilio (Meikle) Greuter, Ann. Mus. Goulandris 1: 42 (1973).
Pisum sativum L. subsp. *pumilio* (Meikle) Ponert, Feddes Repert. 83: 636 (1973).

Flowers small, lilac; pods c. 4 cm.

M; cultivated ground.

Area of the species: Mediterranean region, Southeast Europe, West Asia.

36. *Clitoria* L.

Shrubs or herbs, rarely trees or climbers; stipules small, persistent, prominently veined; leaves trifoliolate or imparipinnate, stipellate; flowers blue, white or red, large, in axillary racemes, solitary or in pairs; bracts and bracteoles large, persistent; calyx campanulate, 5-dentate; standard conspicuous, keel shorter than the wings; stamens diadelphous, the vexillary stamen free or slightly fused into the staminal tube; pod linear, compressed; seeds subglobose. About 60 species, tropical and subtropical regions, especially America.

1. *Clitoria ternatea* L., Sp. Pl., ed. 1, 753 (1753).

Perennial herb; stem twining or ascending; stipules 2-4 mm, lanceolate, pubescent, strongly nerved; leaves imparipinnate; leaflets 2-4 pairs, brown; leaflets 1-5 x 0.8-3 cm, ovate to elliptic-oblong, hairy mainly on the veins of the lower surface; stipels 1-2 mm, setaceous, brown; flowers solitary, conspicuous; bracts 2, 3-4 mm, linear; bracteoles 2, 0.8-1 cm, ovate-oblong; calyx 1-1.5 cm, prominently veined; the teeth shorter than the tube, subequal, triangular; corolla 3-5 cm, bright blue; standard suborbicular; wings about half the length of the standard; pod 4-5 x 0.8-1 cm, linear, compressed, straight, glabrous at maturity, beaked; seeds 5-7 x 4 mm, flattened, dark brown.

N; escape from cultivation. Cultivated ornamental in Europe, Asia, America, spontaneous in many warm regions.

37. *Vigna* Savi

Annual or perennial herbs, rarely small shrubs; stems climbing, prostrate or erect; stipules persistent; leaves trifoliolate; stipels small; flowers yellow, rarely reddish or bluish, in short dense racemes on long peduncles; bracts and bracteoles present, caducous; calyx 5-toothed, bilabiate, the 2 upper teeth \pm connate; standard orbicular; wings obovate; keel incurved, slightly longer than the wings; stamens diadelphous, the vexillary stamen free; pod linear, terete, pulpy between the seeds, dehiscent or indehiscent; seeds reniform. About 150 species, tropical regions, especially the Old World.

- . Calyx-teeth capillary, equalling or longer than the tube
- Calyx-teeth triangular or rounded, shorter than the tube

1. **V. membranacea**

2

- ⇒. Stipules not spurred
- Stipules spurred

2. **V. luteola**

3. **V. unguiculata** subsp. **sesquipedalis**

1. **Vigna membranacea** A. Rich., Tent. Fl. Abyss. 1: 219 (1847) var. **membranacea**

⇒ Annual herb 0.2-1.5 m; stems climbing or trailing, ridged; stipules 0.3-1.2 cm, lanceolate, 2-lobed, the lobes unequal; leaflets 1.5-8 x 1.5 cm, ovate-triangular, acuminate; petiole 1.5-8(-12) cm; petiolioles 1-4 mm; flowers subumbellate, few; rachis 0.4-2 cm, with conspicuous glandular nodes; peduncles 1-30 cm; pedicels 2-4 mm; calyx 5-9 mm, the teeth capillary, equalling or longer than the tube; standard 1-1.5 x 1.5 cm, pink or blue, yellow inside; wings blue or mauve; keel pale blue; pod 3-6.5 x 0.2-0.3 cm, erect, linear-cylindrical, 10-14-seeded; seeds 2.5-4.5 x 1.5-2.5 mm, dark red, with black mottling.

⇒ GE; wadi beds. Southeast Egypt, tropical East Africa, Ethiopia.

2. **Vigna luteola** (Jacq.) Benth. in Mart., Fl. Bras. 15 (1): 194 (1859).

Syns. *Dolichos luteolus* Jacq., Hort. Bot. Vindob. 1: 39 (1770).

Vigna nilotica (Delile) Hook. f. in Hook. et al., Niger Fl. 311 (1849).

■ Perennial climber 1-1.8 m, almost glabrous; stems creeping with adventitious roots below; stipules 3-4 mm, shortly 2-lobed at the base; petiole 2-8 cm; petiolioles 2-3 mm; leaflets 3, 2.5-8 x 0.5-4 cm, ovate-elliptic to ovate-lanceolate, acute or acuminate; racemes axillary, 3-8-flowered; peduncles 5-30 cm; pedicels 4-8 mm; bracts 2 mm, deciduous; bracteoles 1.5-2 mm, deciduous; calyx 3-4 mm, the tube 3-4 mm; the teeth 2-4 mm, triangular; corolla 1.5-2.5 cm, yellow or greenish; pod 4-8 x 0.5 cm, linear, slightly constricted between the seeds, densely appressed-pubescent; 6-10-seeded; seeds 3-6 mm, ovoid-rhomboid.

N; cultivated ground. Egypt, Syria, tropical Africa, Asia and America.

3. **Vigna unguiculata** (L.) Walp., Rep. 1: 779 (1842) subsp. **sesquipedalis** (L.) Verdc.,

Kew Bull. 24: 544 (1970).

Syn. *Dolichos sesquipedalis* L., Sp. Pl., ed. 1, 725 (1753).

Annual or short-lived perennial, glabrous or slightly hairy; stems trailing or climbing; stipules 0.5-2 cm, constricted at the point of attachment, upper part lanceolate, spur 2-6 mm; petiole 1.5-10 cm; petiolioles 2-5 mm; leaflets 3, 1.5-12 x 1-10 cm, ovate or rhomboid to lanceolate, mucronate, sparsely hairy on both surfaces or glabrous; raceme axillary, 6-12-flowered; peduncle 2-30 cm; bracts 3-5 mm, lanceolate, deciduous; bracteoles 3-5 mm, ± persistent; calyx-tube 3-5.5 mm; the teeth shorter than the tube; corolla greenish, yellow or lilac; pods 30-60 x 0.5-0.8 cm, glabrous, mostly indehiscent, twining (cultivated forms); seeds 3.5-5(-8) mm, oblong or reniform, often mottled with black or brown, with a white hilum.

N; escape from cultivation. Tropical Africa, widely cultivated in warmer parts of the world.

38. **Rhynchosia** Lour., nom. conserv.

Climbing, prostrate or erect herbs or subshrubs; stipules present; stipels very small; leaves 1- or 3-foliolate; leaflets usually with conspicuous resinous gland-dots on the lower surface; flowers in axillary or terminal racemose or paniculate inflorescence; rarely solitary; bracts present, often well-developed; bracteoles absent; calyx 5-lobed; teeth unequal; corolla yellow with brownish-purple veins; standard with small auricles; vexillary stamen free; pods narrowly-oblong to almost circular, compressed, sometimes glandular and velvety; seeds reddish-brown, black or blue, compressed-globose or reniform; hilum rounded to elongate, lateral. About 300 species throughout the tropics and subtropics.

1. Flowers 1.2-1.5 cm
+ Flowers 5-9 mm

3. **R. malacophylla**

2. Lateral leaflets mostly oblique (asymmetrical), longer than broad; glands orange or black, mostly on the lower surface
+ Lateral leaflets mostly symmetric, the terminal broader than long, silky; glands yellow, on both surfaces

1. **R. minima**

2. **R. pulverulenta**

1. **Rhynchosia minima** (L.) DC., Prodr. 2: 385 (1825).

Syn. *Dolichos minimus* L., Sp. Pl., ed. 1, 726 (1753).

Perennial herb; stems 0.2-2 m from a woody rootstock, climbing or prostrate; stipules 2-3 mm, lanceolate; petiole 0.8-3.5 cm; petiolioles 0.5-1.5 mm; leaflets 3, 1-5 x 1-4 cm, rhomboid, ovate or suborbicular, the laterals oblique, longer than broader, glabrescent to velvety, densely orange or black gland-dotted mainly on the lower surface; peduncles 1-7 cm; pedicels 1-1.5 mm; bracts 1.5-2 mm, deciduous; calyx 3.5-4.5 mm, pubescent; the teeth longer than the tube; corolla 5-9 mm, yellow; pod 0.8-2.2 x 0.3-0.5 cm, glabrous or pubescent, 1-2-seeded; seeds 2.5-3.5 x 2 mm, brown.

Two varieties occur in Egypt:

var. **minima**

Leaflets almost glabrous; flowers 8-9 mm; pod glabrous.

S; wadi beds, usually climbing on other shrubs. Sinai, Palestine, Arabia, Pakistan, Afghanistan, India, China, Cape Verde, tropical Africa and America.

var. **memnonia** (Delile) Cooke, Fl. Bombay 1: 389 (1903).

Syns. *Dolichos memnonius* Delile, Descr. Egypte, Hist. Nat. 254, t. 38, 3 (1814).

Rhynchosia memnonia (Delile) DC., Prodr. 2: 386 (1825).

Leaflets velvety; flowers 5-7 mm; pod pubescent.

N, O, D, GE, S; sandy plains and desert wadis, climber on other shrubs. Egypt, Sudan, Arabia.

2. **Rhynchosia pulverulenta** Stocks in Hook., Kew J. Bot. 4: 147 (1852).

Syns. *Rhynchosia memnonia* (Delile) DC. forma *pulverulenta* (Stocks) Terracc.,



late 62. LEGUMINOSAE: *Pisum sativum* subsp. *elatius* 1, flowering branch; 2, fruit. *Pisum fulvum* 3, fruiting branch. *Clitoria ternatea* 4, flowering branch; 5, fruit. *Vigna luteola* 6, fruiting branch; 7, flowers. *Rhynchosia tinima* var. *memnonia* 8, flowering branch; 9, fruits. *Rhynchosia pulverulenta* 10, flowering and fruiting branches (twining). *Rhynchosia malacophylla* 11, fruiting branch; 12, flowers. All drawings to the same scale.

Ann. Ist. Bot. Roma 5: 110 (1893).
Rhynchosia elachistantha Chiov., Ann. Ist. Bot. Roma 8: 100, t. 11, 1
(1903).

Perennial herb woody at the base; stems 0.3-1.5 m, erect or scrambling, velvety-tomentose; stipules 2.5-4 mm, linear-lanceolate; petiole 0.5-3 cm; petiolioles 0.5-2 mm; leaflets 3, the terminal 0.4-3 x 0.6-4 cm, broader than longer, transversely elliptic or rhomboid, silky and with yellow glands on both surfaces; racemes 1-10-flowered; bracts 1.5-2 mm, pedicels 0.5-3 mm; calyx 3.5-6.5 mm, pubescent, the tube shorter than the teeth; corolla 4-6.5 mm, pale yellow; pod 1.5-2 x 0.5 cm, falcate-oblong, densely pubescent with short white hairs and small pale gland dots, 1-2-seeded; seeds 3.5-4 x 2.5-3 mm, rounded-oblong, brown, mottled black.

GE; stony wadi beds, climbers on other shrubs. Egypt, tropical East and South west Africa, Ethiopia, Somalia, Arabia, Socotra, Pakistan, India.

3. ***Rhynchosia malacophylla*** (Spreng.) Bojer, Hort. Maurit. 104 (1837).

Syns. *Glycine malacophylla* Spreng., Syst. Veg. 4, cur. post. 270 (1827).

Rhynchosia sennaarensis Schweinf., Verh. Zool.-Bot. Ges. Wien 18: 655
(1868).

Rhynchosia flavissima Baker, Fl. Trop. Afr. 2: 219 (1871).

Perennial herb 0.3-2.5 m; stems trailing or climbing from a woody base; stipules 4-5 mm, lanceolate; petiole 0.8-5.5 cm; petiolioles 1-2.5 mm; leaflets 3, 0.5-5.5 x 0.6-5 cm, ovate-rhomboid or rounded, the laterals oblique, glabrous to finely puberulent on both surfaces, densely gland-dotted on the lower surface; peduncles 1.5-6.5 cm; pedicels 1.5-2.5 mm; bracts 1.5-2 mm, lanceolate; calyx 4-7 mm, puberulent and gland-dotted, tube shorter than the teeth; corolla 1.2-1.5 cm, yellow; pod 1.5-2 x 0.5 cm, oblong-falcate, narrowed at the base, puberulent and glandular, 2-3-seeded; seeds 4x3 mm, rounded-reniform.

GE; wadi beds, climbing on other shrubs. Egypt, Sudan, tropical East Africa, Somalia, Ethiopia, southern Arabia.

II. Subfamily **Caesalpinioideae**

Trees, shrubs or lianes, rarely herbs, sometimes armed; leaves pinnate, rarely bipinnate; flowers irregular; sepals usually imbricate, free or less often partly united; petals 5 or fewer, imbricate in bud, free or some united; stamens usually 10, or fewer by abortion; anthers without an apical gland; pod various; seeds generally without areoles. About 150 genera and 2500 species, tropical and subtropical regions.

1. Leaves 2-pinnate
+ Leaves 1-pinnate

41. **Delonix**
2

2. Small shrubs or perennial herbs; pod not pulpy
+ Dioecious trees; pod thick, pulpy

39. **Senna**
40. **Ceratonia**

39. *Senna* Mill.

Unarmed trees, shrubs or herbs; leaves paripinnate, often with globose or cylindrical glands on the petiole and the rachis; flowers in few- or many-flowered racemes, ebracteate; sepals 5, imbricate; petals 5, yellow; stamens 10; filaments straight, shorter or twice as long as the basifixed anthers; pods terete or compressed, indehiscent or tardily dehiscent, valves not twisting; seeds slightly compressed. About 350 species, especially tropics of the New World.

1. Pod 10-14 x 0.5-1 cm, linear 4. *S. occidentalis*
+ Pod 2.5-6 x 1.2-2.5 cm, oblong or oblong-falcate 2
2. Leaflets glabrous, obliquely obovate to oblong, obtuse or rounded; pod with flap-like crests above the seeds 1. *S. italica*
+ Leaflets lanceolate-oblong to lanceolate-elliptic, acute; pod not crested 3
3. Plant velvet-hairy; pod oblong, slightly falcate 2. *S. holosericea*
+ Plant glabrous; pod oblong 3. *S. alexandrina*

1. *Senna italica* Mill., Gard. Dict., ed. 8, no. 2 (1768).

Syns. *Cassia aschrek* Forssk., Fl. Aegypt.-Arab. 86 (1775).

Cassia obovata Collad., Hist. Nat. Méd. Casses 92 (1816), nom. illeg.

Cassia italica (Mill.) F. W. Andrews, Fl. Pl. Anglo-Egypt. Sudan 2: 117 (1952).

Small shrub 50-80 cm; stems branched; stipules 3-5 mm, lanceolate; leaves 6-15 cm, paripinnate; leaflets 3-6 pairs, 1-2.8 x 0.5-1.8 cm, glabrous, glaucous, obliquely obovate to oblong; apex obtuse or rounded, often mucronate; racemes axillary, longer than the subtending leaf, many-flowered; bracts caducous; pedicels 2-5 mm; calyx 6-9 x 2-3 mm, oblanceolate; corolla 1.5-2.5 cm, yellow, with violet veins; anthers unequal; pod 4-6 x 1.5-2 cm, flattened, oblong-falcate, rounded at both ends, conspicuously veined transversely; valves with flap-like crests above the seeds; seeds compressed, obovate.

N, O, D, GE, S; sandy plains and desert wadis. Macaronesia, North Africa, West Asia to India, Nigeria, Sudan, Somalia, Ethiopia, Djibouti.

2. *Senna holosericea* (Fresen.) Greuter, Willdenowia 15: 429 (1986).

Syn. *Cassia holosericea* Fresen., Flora (Regensburg) 22: 54 (1839).

Small shrub 20-50 cm; stems densely pubescent; stipules 3-6 mm, narrowly triangular; leaves 6-12 cm, eglandular; leaflets 4-8 pairs, 1-2 x 0.5-0.8 cm, lanceolate-oblong to lanceolate-elliptic, acute, densely velvet-hairy; racemes 2-10 cm; bracts 5-8 mm, ovate-elliptic; sepals 4-6 mm, glabrescent, broadly ovate, obtuse, scarious-margined; petals 5-8 mm, yellow; pod 3-5 x 2-2.5 cm, oblong, slightly falcate, flattened, valves without flap-like crests, the transverse veins inconspicuous; immature pods pubescent, becoming almost glabrous at maturity; seeds compressed.

De, R, GE; sandy plains, desert wadis. Egypt, Sudan, Somalia, Arabia, Socotra, Pakistan.

3. *Senna alexandrina* Mill., Gard. Dict., ed. 8, no. 1 (1768).

Syns. *Cassia senna* L., Sp. Pl., ed. 1, 377 (1753).

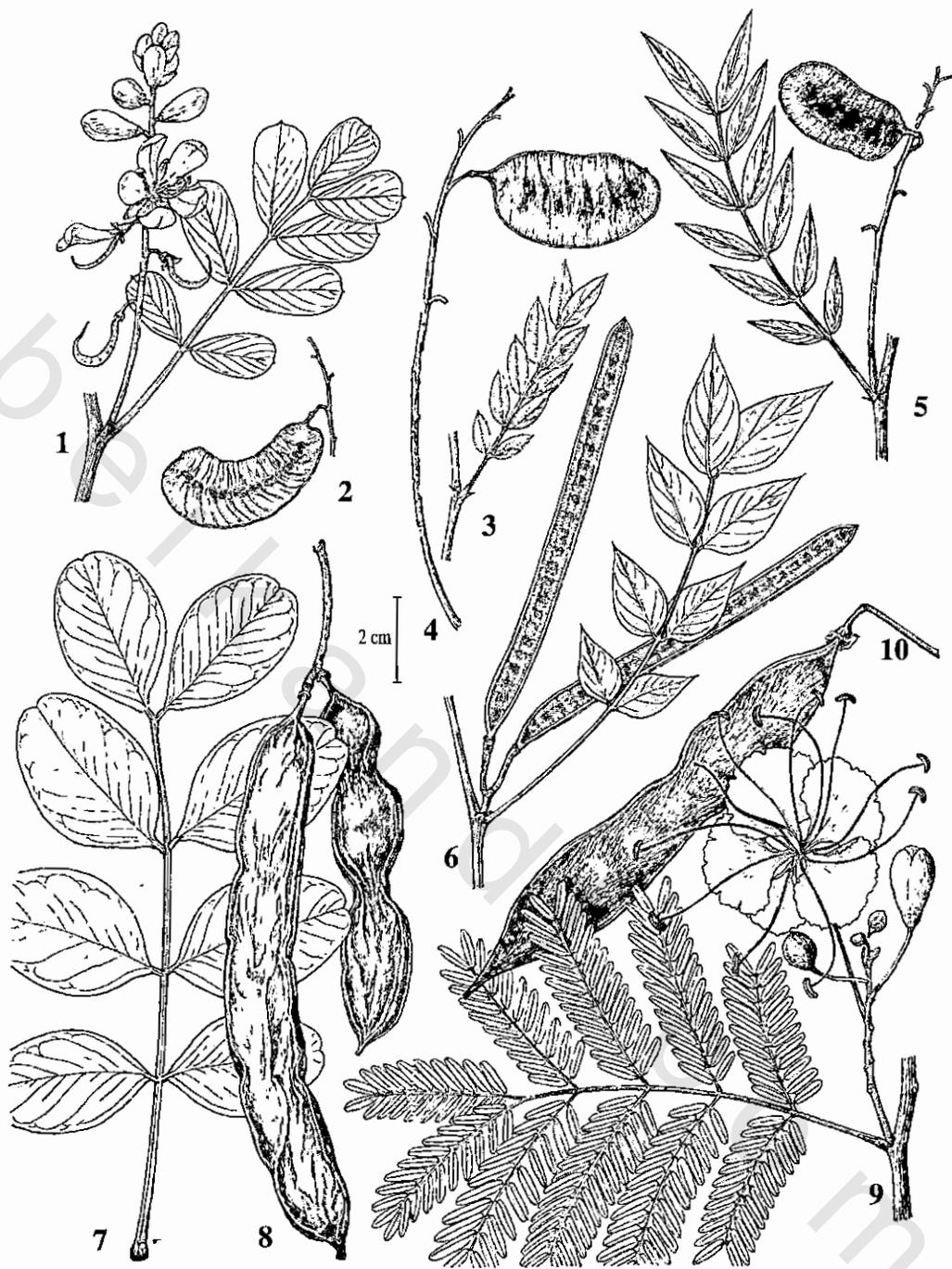


Plate 63. LEGUMINOSAE: *Senna italica* 1, flowering branch; 2, fruit. *Senna holosericea* 3, leafy branch; 4, fruiting branch. *Senna alexandrina* 5, leafy and fruiting branch. *Senna occidentalis* 6, leafy and fruiting branch. *Ceratonia siliqua* 7, leaf; 8, fruits. *Delonix elata* 9, flowering branch; 10, fruit. All drawings to the same scale.

Cassia lanceolata Forssk., Fl. Aegypt.-Arab. 85 (1775).
Cassia acutifolia Delile, Mém. Egypte 3: 316 (1802).

Shrub 0.3-1.5 m, glabrescent; stems much-branched; stipules 3-6 mm, subulate; leaves 6-15 cm, eglandular; leaflets 4-10 pairs, 1.5-4.5 x 0.4-0.8 cm, lanceolate to elliptic, acute, glabrescent; racemes 12-25 cm; bracts 5-8 mm; sepals 5-7 mm, broadly ovate; petals 0.8-1.5 cm, yellow to orange-yellow; pod 3-5.5 x 1.6-2.4 cm, oblong, glabrous, dehiscent; seeds 3-5 x 2-3 mm, compressed, ovate, apiculate, rugose.

N, De, R, GE, S; sandy plains and desert wadis. North Africa, Sinai, Arabia to India, Sudan, Somalia, Djibouti.

NOTE: The pods and leaves are widely used as a purgative.

4. ***Senna occidentalis*** (L.) Link, Handbuch 2: 140 (1831).
Syn. *Cassia occidentalis* L., Sp. Pl., ed. 1, 377 (1753).

Annual or short-lived perennial herb, 20-80 cm, glabrescent; stems branched; leaves 10-18 cm, with a sessile gland near the base of the petiole; leaflets 4-6 pairs, 3-8 x 1.5-3 cm, lanceolate to ovate-elliptic, acute, glabrous, with small inconspicuous glands on the lower surface; racemes very short; peduncles 0.3-1 cm; bracts acute; sepals 6-8 mm, obovate-elliptic, scarious-margined, obtuse; petals 1-1.5 cm, yellow with brownish veins, obovate; stamens unequal; pod 10-15 x 0.5-0.8 cm, almost straight, compressed, transversely septate between the seeds; seeds numerous, 4-5 x 4 mm, ovoid-globose, compressed, brownish, tuberculate.

N, O; Nile and canal banks and edges of cultivation. Pantropical weed.

40. ***Ceratonia*** L.

Dioecious evergreen trees; stipules minute or absent; leaves paripinnate; inflorescence racemose on young or older branches; bracts and bracteoles small, caducous; flowers small, green; calyx tube short, with 5 minute caducous teeth; petals absent; stamens 5, episepalous; anthers versatile; ovary short-stipitate; style short, stigma peltate; pod thick, fleshy, linear-oblong, indehiscent; seeds compressed, obovate, hard, glossy. 2 species, Mediterranean region, southwestern Arabia and Somalia.

1. ***Ceratonia siliqua*** L., Sp. Pl., ed. 1, 1026 (1753).

Evergreen tree 2-6 m; leaves 10-25 cm; leaflets 2-4 pairs, 3-6 x 2.5-4 cm, coriaceous, glabrous, short-petiololate, ovate to oblong-ovate, emarginate or obtuse; racemes solitary or in groups, many flowered; female flowers with a thick deflexed ovary; style short, stigma thick; male flowers with 5 stamens; pod 8-25 x 1.5-2.5 cm, c. 5 mm thick, linear, straight or slightly curved, violet-brown, glossy, mesocarp pulpy, sweet; seeds 5-6 x 4 mm, compressed, obovate, hard, glossy.

S; wadi beds. Mediterranean region, Sinai.

NOTE: Also cultivated for its pods from which a refreshing drink is made.

41. *Delonix* Raf.

Unarmed trees; leaves bipinnate; leaflets small, opposite; flowers conspicuous, in short axillary corymbose racemes; sepals 5, valvate; petals 5, the upper smaller; stamens 10, exserted; ovary subsessile, many-ovulate; pod flattened, linear-oblong, dehiscent; valves woody, septate between the seeds; seeds hard, oblong-subcylindrical to flattened. 12 species, tropical East Africa to India and Madagascar.

1. *Delonix elata* (L.) Gamble, Fl. Madras 1 (3): 396 (1919).
Syn. *Poinciana elata* L., Cent. Pl. 2: 16 (1756).

Tree 2-8 m; with smooth bark; stipules small, subulate, deciduous; leaves 8-20 cm; pinnae 3-10; leaflets 10-22 pairs, 0.4-1.5 x 0.2-0.4 cm, linear-oblong, glabrescent, short-petioliolate; racemes 5-15-flowered; bracts small, deciduous; sepals 1.4-1.6 cm, leathery, ovate-elliptic; petals 1.8-3.5 cm, upper petal smaller than the others, yellow; stamens 10, filaments 4-8 cm, reddish; ovary hairy; pod 10-20 x 2-3.5 cm, oblong-elliptic, attenuate at both ends, valves woody; seeds 1-1.5 x 0.6-0.8 cm, mottled, smooth, brownish.

GE; stony hillsides. Southeast Egypt, northeast Sudan, tropical East Africa to Somalia, Ethiopia and Zaire, Arabia and India.

III. Subfamily **Mimosoideae**

Trees, shrubs, lianes or rarely herbs, often prickly or spiny; leaves 2-pinnate, pinnate or modified into phyllodes, or absent; flowers regular, bisexual, small, in spikes, racemes or heads; sepals valvate, usually united into a tube; petals (3-)5(-6), valvate in bud, united into a tube, rarely free; stamens usually exserted, as many as or twice as many as the petals, or numerous, free or adnate to the corolla, or filaments united below into a tube; pods various; seeds generally with areoles. About 64 genera and 2950 species, mostly tropical and subtropical, especially of the southern hemisphere.

- | | |
|---|--------------------------|
| 1. Stamens numerous | 2 |
| + Stamens 8 or 10 | 3 |
| 2. Leaf-rhachis with a conspicuous gland between each pair of pinnae;
anthers eglandular | 45. <i>Faidherbia</i> |
| + Leaf-rhachis without conspicuous glands (sometimes very small);
anthers with a caducous apical gland | 44. <i>Acacia</i> |
| 3. Spikes 2-coloured | 46. <i>Dichrostachys</i> |
| + Spikes or heads 1-coloured | 4 |
| 4. Flowers in spikes; pod not bristly | 42. <i>Prosopis</i> |
| + Flowers in heads; pod bristly | 43. <i>Mimosa</i> |

42. *Prosopis* L.

Trees or shrubs, deciduous, armed with prickles or spines; leaves 2-pinnate; rhachis glandular; leaflets opposite; flowers in axillary spike-like racemes or capitata; bracts absent; calyx campanulate, 5-toothed; petals 5, connate at the base or free, greenish or



Plate 64. LEGUMINOSAE: flowering and fruiting branches of: *Prosopis farcta* 1. *Mimosa pigra* 2. *Dichrostachys cinerea* 3. *Faidherbia albida* 4. All drawings to the same scale.

yellow; stamens 10; anthers glabrous with a terminal gland; ovary stipitate; style filiform, stigma short; pod straight, curved or spirally coiled, woody or coriaceous, indehiscent, with fleshy portions between the seeds; seeds unwinged, hard. About 44 species, mainly tropical America, a few in tropical Africa and Asia.

1. **Prosopis farcta** (Banks & Sol.) Macbr., Contr. Gray Herb., ser. 2, 59: 17 (1919).

Syn. *Mimosa farcta* Banks & Sol. in Russel, Nat. Hist. Aleppo, ed. 2, 2: 226 (1794).

Prosopis stephaniana (M. Bieb.) Spreng., Syst. Veg. 2: 326 (1825).

Lagonychium farctum (Banks & Sol.) Bobrov in Komarov, Fl. SSSR 11: 14 (1945).

Shrub 0.5-2.5 m, propagating by suckers from the long rhizomes; stems much branched, prickly, hairy when young; leaves 3-6 cm, with 4-7 pairs of pinnae; stipules caducous; leaflets 8-12 pairs, 3-7 x 1.5-2.5 mm, subsessile, ovate-oblong, acute, hairy; spikes 3-8 cm, axillary, exceeding the leaves, many-flowered; peduncles 1.5-2.5 cm; pedicels 0.5-1 mm; calyx 1-1.5 mm, 5-toothed; corolla 3-4 mm, pale yellow or cream; stamens exserted; pod 2-4.5 x 1.5-3 cm, ovoid-cylindrical, the mesocarp spongy, dark purplish-brown; seeds 7 x 4 mm, obovate, brown.

N, O, M, D, S; sandy plains, disturbed ground, fallow fields, borders of springs and canal banks. East Mediterranean region, extending to Caucasus, Sinai, Arabia, Iran, Afghanistan and India.

NOTE: The plants often form thickets near the springs in the oases. The pods are eaten by cattle.

43. **Mimosa** L.

Herbs or shrubs; prickles usually present; leaves 2-pinnate (our species), rarely absent or modified into phyllodes; flowers bisexual, sessile, in heads (our species) or spikes; calyx minute; corolla 4(-6)-lobed; stamens as many as or twice as many as the petals; anthers eglandular at the apex; pod flattened, straight or curved, usually splitting at maturity into 1-seeded segments. About 480 species, especially tropics of Central and South America.

1. **Mimosa pigra** L., Cent. Pl. 1: 13 (1755).

Syn. *Mimosa polyacantha* Willd., Sp. Pl., ed. 4, 4: 1034 (1806).

Shrub 0.5-2.5 m; stems armed with prickles, bristly between the prickles; leaves with 5-12 pairs of pinnae, leaflets 20-40 pairs, 3-8 x 1-2 mm, linear-oblong; flowers pink in heads; peduncles 3-5 cm; calyx minute, laciniate; petals 2-3 mm; stamens 8; pod 3-8 x 1-1.4 cm, in clusters, densely bristly, brown.

N, De; canal and Nile banks, moist ground. Tropical Africa and America.

44. **Acacia** Mill.

Trees or shrubs, armed with stipular spines or prickles (our species) or unarmed; leaves 2-pinnate (our species) or modified to phyllodes; pinnae with 1 or many pairs of leaflets; petiole usually with a gland on the upper side and glands often at the point of attachment of pinnae to the rachis; inflorescence axillary, racemose or paniculate; peduncle with

involucel in capitate inflorescences; flowers in spikes or spicate racemes or heads, each flower subtended by a bract; all flowers bisexual, or male and bisexual; calyx with 4-5 teeth or lobes; corolla 4-5-lobed; stamens numerous, fertile; filaments free, some anthers with an apical gland; ovary stipitate or sessile; pod variable, mostly dehiscent, flattened or terete, straight, curved, spiral or contorted, glabrous to densely pubescent; seeds unwinged, with a hard smooth testa; areole present; endosperm absent. About 1200 species, tropics and subtropics, especially Australia and Polynesia.

- | | |
|--|---|
| 1. Flowers in elongate spikes or spicate racemes | 2 |
| + Flowers in spherical heads | 4 |
| 2. Pinnae with 1-2 pairs of leaflets | 1. A. mellifera |
| + Pinnae with 3 or more pairs of leaflets | 3 |
| 3. Pinnae with 3-5(-7) pairs of leaflets; pod 2-7 x 1.5-2.8 cm | 2. A. laeta |
| + Pinnae with 8-18 pairs of leaflets; pod 7-12 x 1-1.3 cm | 3. A. asak |
| 4. Pod consistently constricted between the seeds | 5 |
| + Pod not constricted between the seeds | 8 |
| 5. Leaves with 1-2(-3) pairs of pinnae | 9. A. ehrenbergiana |
| + At least some of the leaves with 4 or more pairs of pinnae | 6 |
| 6. Pod indehiscent, straight or slightly curved, 1.2-2.2 cm diam. | 5. A. nilotica |
| + Pod dehiscent, falcate, contorted or spirally coiled, 0.4-1.2 cm diam. | 7 |
| 7. Stems covered with a greenish-yellow or orange-red powdery layer, overlying the greenish bark; pod slightly falcate, 0.3-0.5 cm diam. | 8. A. seyal |
| + Stems not as above; pod contorted or spirally coiled, 0.6-1.2 cm diam. | 4. A. tortilis |
| 8. Pod with flat, wing-like margins 1.5-2.5 mm diam. | 7. A. oerfota var. oerfota |
| + Pod without flat margins | 9 |
| 9. Pod thin, straight, glabrous, purplish-brown; leaflets glabrous (Gebel Elba and vicinity) | 10. A. etbaica |
| + Pod thick, falcate or coiled, yellowish-brown, pubescent when immature almost glabrous at maturity; leaflets hairy (Sinai) | 6. A. pachyceras var. najdensis |

1. **Acacia mellifera** (Vahl) Benth., J. Bot. (London) 1: 507 (1842).
Syn. *Mimosa mellifera* Vahl, Symb. Bot. 2: 103 (1791).

Shrub or tree to 6 m; bark greyish-brown to dark purplish; young stems reddish-brown; stipules not spinescent, caducous; prickles in pairs, just below the nodes, hooked, purple-brown; leaves glabrous or glabrescent; petiole 0.5-2 cm, with 1 gland; pinnae 2 pairs; leaflets 1-2 pairs, 0.5-1.8 x 0.2-1.2 cm, opposite or subopposite, obliquely obovate; inflorescence an elongate raceme 1.2-4 cm; peduncles shorter than the rhachis; flowers shortly but distinctly pedicellate; calyx 1 mm, reddish; corolla c. 3 mm, cream to white; pod 2.5-6 x 1.2-1.8 cm, flattened, oblong, pale brown to straw-coloured, glabrous, dehiscent, 1-3-seeded; seeds c. 1 cm diam., suborbicular, the areole 2.5 x 2.5 mm, horseshoe-shaped.

De, R, GE; rocky hillsides. Egypt, Arabia, Sudan, Ethiopia, Somalia, Tanzania, Southwest Africa.

2. **Acacia laeta** R. Br. ex Benth., J. Bot. (London) 1: 508 (1842).

Shrub or tree to 5 m; stems smooth; the bark greyish-brown, not flaking; stipules not spinescent, caducous; prickles in pairs, hooked; leaves glabrous or sparsely hairy; petiole 0.5-1.8 cm, with one gland near the base to just below the rhachis; rhachis 0.8-3 cm; pinnae 2-3 pairs, opposite or subopposite; leaflets 3-5(-7) pairs, shortly but distinctly petiololate, variable in size and shape, (0.3)0.5-1(-1.5) x 0.2-0.4(-0.7) cm, obliquely-elliptic, obovate or linear; inflorescence 4-7 cm spicate raceme; peduncle 1-1.5 cm; rhachis 3-5.5 cm; calyx 1.5-2 cm, sometimes red-tipped or tinged pinkish; corolla 3-3.5 mm; cream or yellowish-white; pod 4-7 x 1.5-2.8 cm, flattened, oblong, veined, glabrous, dehiscent, 1-2-seeded; seeds 8-9 mm diam., suborbicular, the areole 1.5-2 mm, horseshoe-shaped.

N, O, GE; rocky hillsides, volcanic scils and open scrubland. Northeast Africa from Egypt to Ethiopia and Somalia, extending to tropical West Africa.

NOTE: *Acacia laeta* is most probably of hybrid origin, a view shared by Brenan (Fl. Trop. E. Afr., Mimosoideae: 83, 1959), and Ross (Conspect. Afr. Acacia species, Mem. Bot. Surv. S. Afr. 44: 67, 1979). It is morphologically intermediate between *A. mellifera* and *A. senegal*.

3. **Acacia asak** (Forssk.) Willd., Sp. Pl., ed. 4, 4: 1077 (1806).

Syns. *Mimosa asak* Forssk., Fl. Aegypt.-Arab. 176 (1775).

Acacia glaucophylla A. Rich., Tent. Fl. Abyss. 1: 243 (1847).

Acacia triacantha Hochst. ex A. Rich., Tent. Fl. Abyss. 1: 244 (1847).

Shrub or tree to 6 m; young stems slender, reddish- or purplish-brown, glabrous; old stems greyish and fissured; stipules not spinescent, caducous; prickles solitary or in threes, the central slightly hooked, sometimes all prickles much reduced; leaves glabrous or sparingly hairy; petiole with one gland near the base; pinnae 3-6 pairs; leaflets 8-18 pairs, 1.5-7 x 1-2.5 mm; inflorescence 4-10 cm, spicate; flower buds pear-shaped; calyx 1.5-2 mm; corolla c. 2.5 mm; white to cream; stamen filaments 4-5 mm; pod 7-12 x 1-1.3 cm, compressed, broadly linear, straight or slightly curved, reddish-brown, sometimes tinged purple, glabrous, dehiscent; seeds c. 9 mm diam., suborbicular, greenish-brown, the areole 2.5-3 mm, horseshoe-shaped.

GE; rocky hillsides and wadis. Southeast Egypt, Sudan, Ethiopia, Saudi Arabia, Yemen, Oman.

4. **Acacia tortilis** (Forssk.) Hayne, Geträue Darstell. Gew. 10, t. 31 (1827).

Syn. *Mimosa tortilis* Forssk., Fl. Aegypt.-Arab. 176 (1775).

Tree 5-12 m; young branches glabrous or pubescent; stipular spines in pairs, 2-5 mm, hooked, mixed with straight spines to 10 cm; pinnae 3-10 pairs; leaflets 6-20 pairs, with a small gland under each pair, 0.5-5 x 0.5-1 mm, oblong, obtuse, glabrous or appressed-hairy; peduncles 0.5-3.5 cm, with involucre below the middle; heads axillary; calyx 1-2 mm; corolla 1.5-2.5 mm; whitish-yellow; pod 3-8 x 0.6-1.2 cm, contorted or spirally coiled, constricted between the seeds, longitudinally veined, glabrous or



Plate 65. LEGUMINOSAE: *Acacia mellifera* 1, flowering and fruiting branches. *Acacia laeta* 2, flowering and fruiting branches. *Acacia asak* 3, flowering and fruiting branches. *Acacia tortilis* subsp. *raddiana* 4, flowering branch; 5, fruiting branch (immature fruits); 6, fruiting branch (mature fruit). *Acacia nilotica* subsp. *nilotica* 7, flowering and fruiting branch. All drawings to the same scale.

tomentose; seeds 4-7 x 4-6 mm, compressed, the areole 3-5 x 2-3 mm, brown, smooth.

Two subspecies occur in Egypt:

subsp. **tortilis**

Tree, branched from the base, the crown flat-topped; juvenile branches, leaves and pods pubescent.

De, R, GE, S; desert wadis and sandy plains, usually in water catchment areas. Egypt, Palestine, Arabia, Algeria, tropical East Africa extending to southern Africa.

subsp. **raddiana** (Savi) Brenan, Kew Bull. 12: 87 (1957).

Syn. *Acacia raddiana* Savi, Alc. Acacie Egiz. 1 (1830).

Tree, not branched from the base, with a distinct trunk and irregular crown; juvenile branches, leaves and pods glabrous.

N, O, D, R, GE, S; sandy plains and desert wadis. Egypt, Algeria, Sudan; tropical East Africa, extending to Nigeria and Senegal.

5. **Acacia nilotica** (L.) Delile, Descr. Egypte, Hist. Nat. 79 (1814).

Syn. *Mimosa nilotica* L., Sp. Pl., ed. 1, 521 (1753).

Tree 3-15 m, with glabrous or tomentose branches; stipular spines to 8 cm, straight, sometimes deflexed; pinnae 3-14 pairs; leaflets 12-25(-30) pairs, 1.5-6 x 0.5-2 mm, oblong, glabrous or pubescent; flowers in heads; peduncles to 5 cm; involucre usually near the base; calyx 1-2 mm; corolla 2.5-4 mm; bright yellow; pod 8-16(-20) x 1.2-2.2 cm, straight or slightly curved, necklace-like, deeply constricted between the seeds or the margin entire, indehiscent, glabrous or whitish-grey tomentose; seeds 6-9 x 5-8 mm, the areole 5-6.5 x 4-6 mm.

Two subspecies occur in Egypt:

subsp. **nilotica**

Pod glabrous.

N, O, Dw; Nile and canal banks, moist ground. Egypt, Sudan.

subsp. **tomentosa** (Benth.) Brenan, Kew Bull. 12: 84 (1957).

Syns. *Mimosa arabica* Lam., Encycl. 1: 19 (1783).

Acacia arabica (Lam.) Willd., Sp. Pl., ed. 4, 4: 1085 (1806).

Pod whitish-grey tomentose.

N (south of Aswan); Nile banks. Southern Egypt, Sudan, tropical East Africa.

6. **Acacia pachyceras** O. Schwartz, Fl. Trop. Arabien, Mitt. Inst. Allg. Bot. Hamburg 10:

85 (1939) var. **najdensis** (Chaudhary) Boulos, Kew Bull. 50: 336 (1995).

Syns. *Acacia gerrardii* Benth. subsp. *negevensis* Zohary var. *najdensis*

Chaudhary, *Acacia*, other genera, Mimosoideae, Saudi Arabia, Min. Agric., Water, Riyadh: 28 (1983).

Acacia iraqensis Rech. f., Anz. Oesterr. Akad. Wiss. Math.-Nat. 1964 (101): 16 (1964).

Acacia gerrardii Benth. subsp. *negevensis* Zohary, Israel J. Bot. 13: 39 (1964).

Tree 3-8 m, trunk single, crown rounded or slightly flattened; young branches pubescent, becoming reddish-brown and glabrous; bark smooth, not flaking; stipular spines in pairs, 0.5-8 cm, straight; leaves pubescent to glabrescent; petiole 0.3-1.5 cm, with 1 gland at the base of the lowermost pair of pinnae; rhachis 0.3-3 cm, with 1 gland at the base of the uppermost 1-3 pairs of pinnae; pinnae 8-20 pairs; leaflets 1.75-2.5(-3.5) x 1-1.25 mm,airy, oblong to oblong-elliptic, obtuse; flowers in heads, sweet-scented; peduncle 1-3 cm; involucre c. 1.5 mm, usually near the base; calyx c. 1.5 mm; corolla c. 2.5 mm, white, cream or yellowish; pod 7-10 x 1-1.6 cm, broadly linear, thick, coiled or falcate at maturity; immature pods pubescent, glabrous to glabrescent at maturity, yellowish-brown; seeds 6-8 x 6-8 mm, compressed, subquadrate, greenish-brown, the areole 4-6 x 3-4 mm.

S; wadi beds. Sinai, southern Palestine, southern Iraq, Kuwait, Saudi Arabia, Oman.

7. *Acacia oerfota* (Forssk.) Schweinf., Bull. Herb. Boiss. 4, app. 2: 213 (1896) var.

oerfota

Syns. *Mimosa oerfota* Forssk., Fl. Aegypt.-Arab. 177 (1775).

Acacia nubica Benth. in Hook., J. Bot. (London) 1: 498 (1842).

Acacia aucheri Benth. in Hook., J. Bot. (London) 1: 499 (1842).

Shrub 1.5-4 m, branched from the base; young branches yellowish-green and pubescent, becoming whitish to greyish-brown and glabrous; stipular spines in pairs, to 1.5 cm, curved or hooked; leaves at first pubescent, especially the petiole, rhachis and rhachillae, later glabrescent or glabrous; petiole 0.5-1.5 cm, with 1 gland near the base; rhachis 2-4.5 cm, ending with a sharp pointed spine and 1 gland at the base of the upper pair of pinnae; pinnae 3-6 pairs; leaflets 6-16 pairs, 3-6 x 1-1.5 mm; flowers in heads, white, becoming cream-white after anthesis; pod 4-10 x 1-1.5 cm, strongly compressed, oblong-linear, straight or slightly curved, not constricted between the seeds, greenish-yellow to brownish-yellow, pubescent, with a narrow flat wing-like margin 1.5-2.5 mm broad, dehiscent; seeds 5-6 x 4-5 mm, subglobose to ellipsoid, slightly compressed, the areole 4 x 3 mm, horseshoe-shaped.

GE; stony and sandy wadis and plains. Southeast Egypt, Sudan, tropical East Africa to Somalia, southern Arabia.

NOTE: *Acacia oerfota* is named after its Arabic vernacular name "ORFOT", branches have fetid smell when freshly cut.

3. *Acacia seyal* Delile, Descr. Egypte, Hist. Nat. 286, t. 52, f. 2 (1814).

Tree 6-12 m, with a flattened crown; stems covered with a greenish-yellow or orange-red powdery meal overlying the greenish bark; young branches with numerous sessile reddish-brown glands, otherwise glabrous; stipular spines in pairs, 2-6 cm; leaves glabrous or sparingly ciliate; petiole 0.5-1 cm, with one gland; rhachis with one gland at



Plate 66. LEGUMINOSAE: flowering and fruiting branches of: *Acacia pachyceras* var. *najdensis* 1. *Acacia oerfota* var. *oerfota* 2. *Acacia seyal* 3. *Acacia ehrenbergiana* 4. *Acacia etbaica* 5. All drawings to the same scale

The base of the uppermost pinnae pairs; pinnae 3-6 pairs; leaflets 10-16 pairs, 3-6 x 1 mm; inflorescence capitate; involucre c. 2 mm; flowers with sharp spicy smell; calyx c. 2 mm, corolla c. 3 mm, bright yellow; pod 6-15 x 0.3-0.5 cm, linear, slightly falcate, constricted between the seeds; valves with small, sessile brownish glands otherwise glabrous, finely longitudinally veined, dehiscent; seeds 7-8 x 4-5 mm, compressed, elliptic, the areole 4-5 x 3 mm.

(Qena-Aswan); Nile banks and Islands. Egypt, Sudan, tropical East Africa, southern Arabia.

49. **Acacia ehrenbergiana** Hayne, Getreue Darstell. Gew. 10, t. 29 (1827).

Syns. *Mimosa flava* Forssk., Fl. Aegypt.-Arab. 176 (1775), nom. illeg.

Acacia flava (Forssk.) Schweinf., Bull. Herb. Boiss. 4, app. 2: 214 (1896).

Shrub 1.5-5 m, stems many from the base; juvenile branches reddish or greyish-brown, glabrous or short-puberulent; bark peeling or flaking in small parts; stipular spines in pairs, 0.5-5 cm, straight; leaves glabrescent to pubescent, usually shorter than the stipular spines; petiole 0.2-1 cm, with 1 gland; rachis 0-1 cm, eglandular or with 1 gland at the base of the upper pair of pinnae; pinnae 1 or 2, rarely 3 pairs; leaflets 5-10(-12) pairs, 0.5-4 x 1(-2) mm, oblong-linear or obovate, glandular to slightly pubescent beneath, the margins ciliate; flowers in heads, sweetly-scented; peduncle 1-3 cm; involucre c. 1.25 cm; variably located on the peduncle; calyx c. 1.25 mm; corolla c. 2.5 mm, bright yellow; stamen-filaments 4-5 mm; pod 5-12 x 0.3-0.5 cm, compressed, linear, falcate, attenuate at both ends, constricted between the seeds, reddish-brown, glabrous, with narrow margins, dehiscent; seeds 3.5-6.5 x 2-3 mm, compressed, smooth, brownish, elliptic, the areole 3-3.5 x 2 mm.

N, O, D, S; sandy and stony desert wadis and plains. Egypt, West and Central Sahara, Sudan, Ethiopia, Arabia.

50. **Acacia etbaica** Schweinf., Linnaea 35: 330 (1868).

Shrub or small tree to 6 m; bark rough, not flaking; juvenile branches grey-brown to purplish-brown, glabrous to puberulent; stipular spines 3-7 mm, hooked or straight, with straight spines to 5 cm; pinnae 3-10 pairs; leaflets 6-30 pairs, 0.5-4 x 0.5-1.25 mm, glabrous or puberulous; flowers in heads; peduncles 1-3 cm, involucre around the middle; calyx 1 mm; corolla 3 mm, white to cream; pod 4-10 x 0.8-1.5 cm, straight, thin, purplish-brown, longitudinally veined, glabrous or puberulent near the base; seeds 6-8 mm, suborbicular, the areole 3.5-4.5 mm.

S, R, GE; stony wadis and hillsides. Southeast Egypt, tropical East Africa, Ethiopia, Somalia, Arabia.

45. **Faidherbia** A. Chev.

Tree, the branches with spinescent stipules; leaves 2-pinnate; petiole eglandular; inflorescence spicate; stamens numerous, filaments shortly connate at the base, anthers eglandular; ovary shortly stipitate; pod twisted, indehiscent; seeds exalbuminous, with a filiform funicle; seedlings with the first leaf 2-pinnate. 1 species in tropical and subtropical Africa, Palestine, Arabia.

1. **Faidherbia albida** (Delile) A. Chev., Rev. Int. Bot. Appl. Agric. Trop. 14: 876 (1934).

Syn. *Acacia albida* Delile, Descr. Egypte, Hist. Nat. 286 (1814).

Tree to 18 m; bark greenish-grey; juvenile branches whitish; stipules spinescent, in pairs; leaves glabrous to pubescent; petiole eglandular; rhachis with a conspicuous gland at the junction of most pinnae; pinnae 3-8 pairs; leaflets 6-18 pairs, 2-8 x 1-3 mm, oblong to oblong-ovate, short-petiololate; inflorescence 5-12 cm, axillary, spicate; flowers subsessile; calyx c. 1 mm; corolla c. 2.5 mm, yellowish-white; stamen filaments 4-4.5 mm, shortly connate at the base; anthers eglandular even in bud; pod 8-20 x 1.5-2.5 cm, thick, curled, twisted or coiled, glabrous, indehiscent; seeds 8-9 x 5-6 mm, elliptic, the areole 7-8 x 5 mm, lenticular.

N, De; Nile and canal banks, alluvial and sandy soils, moist ground. Egypt, Sudan, tropical and subtropical Africa, Palestine, Arabia.

46. **Dichrostachys** (DC.) Wight. & Arn., nom. conserv.

Shrubs or small trees, usually armed with spines, prickles absent; leaves bipinnate; rhachis glandular at the insertion of pinnae; flowers in axillary spikes, upper part of spike of bisexual flowers, lower part mostly of differently coloured sterile flowers; calyx 5-lobed; corolla 5-lobed, connate at the base; stamens 10, free, all fertile in bisexual flowers; anthers with a deciduous apical gland; staminodes of sterile flowers elongate without anthers; pod contorted or straight, indehiscent or dehiscent. About 12 species tropics of the Old World.

1. **Dichrostachys cinerea** (L.) Wight & Arn., Prodr. Fl. Ind. Orient. 271 (1834).

Syns. *Mimosa cinerea* L., Sp. Pl., ed. 1, 520 (1753).

Mimosa glomerata Forssk., Fl. Aegypt.-Arab. 177 (1775).

Mimosa nutans Pers., Syn. 2: 266 (1807).

Dichrostachys nutans (Pers.) Benth. in Hook., J. Bot. 4: 353 (1841).

Dichrostachys glomerata (Forssk.) Chiov., Ann. Bot. Roma 13: 409 (1915).

Spinose shrub 1-2.5 m; leaves with 4-16 pairs of pinnae; petiole 1-2.5 cm; rhachis 4-12 cm; leaflets 10-40 pairs, 2-8 x 0.5-3 mm, linear-oblong; peduncles 1-8 cm; spikes 2-5 cm, pendent, yellow in the upper bisexual part, mauve or white in the lower sterile part; calyx 0.5-1.25 mm; corolla 1.5-2.5 mm; staminodes 0.5-1.5 cm; pod 2-8 x 0.5-1.5 cm, in clusters, contorted, indehiscent.

N (Nubia); Nile banks. Egypt, tropical Africa, Arabia, tropical Asia and Australia.

PODOSTEMACEAE

(incl. Tristichaceae)

Moss-like herbs on rocks in rivers or cataracts subjected to swift-flowing water or spray of waterfalls, usually submerged and often annual, producing aerial flowers and fruits at low water levels; leaves entire to dissected; flowers bisexual, regular or irregular, small, solitary or in spicate cymes, wind- or insect-pollinated or cleistogamous, subtended or enclosed by 2 bracteoles; perianth 2 or 3(-5), ± connate, or 2-many, free or a small

annular scale or 0; stamens 1-2 or many in several whorls with filaments basally connate; ovary superior, (1-)2(-3) carpels, 2-locular, with thick axile placentas; ovules numerous; fruit a septicial capsule with numerous very small seeds, with mucilaginous testa. 47 genera, 280 species, especially tropical America and Asia.

1. *Tristicha* Thouars.

Polymorphic herbs, with a linear branched thallus attached to the substratum; stems leafy, moss-like, with rows of usually closely imbricate leaves, sometimes distant; leaves sessile; perianth of 3 tepals; stamen 1; styles 3; capsule opening by 3 valves. 2 species, tropical America, Africa to India and North Australia.

1. *Tristicha trifaria* (Bory ex Willd.) Spreng., Syst. 1: 22 (1825).

Syn. *Dufourea trifaria* Bory ex Willd., Sp. Pl., ed. 4, 5: 55 (1810).

Annual or perennial herb; leaves closely imbricate or sometimes distant, sessile, ovate to narrowly lanceolate at the apex, membranous, 1-veined; tepals equal or subequal, slightly connate at the base; filament filiform; styles 3; ovary 3-celled, with many ovules; capsule ellipsoid, 3-valved.

N (Aswan, waterfalls, first cataract); on rocks. Tropical Africa and America.

OXALIDACEAE

Annual or perennial herbs (our species) or subshrubs, rarely shrubs or trees; leaves alternate, exstipulate, simple or more frequently digitately or pinnately compound; flowers in axillary cymes or pseudo-umbels or solitary, regular, bisexual; sepals 5, free, imbricate; petals 5, free or slightly connate at the base; stamens 10, rarely 15; filaments fused at the base to form a tube with alternate short and long stamens; ovary superior, 5-locular; styles 5; stigmas capitate; ovules 1-many in each locule, placentation axile; fruit a loculicidal capsule or a berry; seeds with fleshy endosperm, or endosperm 0. 6 genera, 775 species, mainly tropical, few temperate.

1. *Oxalis* L.

Annual or perennial herbs, sometimes stemless or bulbous; leaves basal or cauline, alternate, digitately or pinnately (1-)3-foliolate, petiolate, sometimes with membranous stipules adnate to the petiole; flowers pedicellate, bracteate, in pseudo-umbels or cymes or solitary; petals falsely connate at the base; stamens 10, 2-seriate, the outer 5 filaments short and opposite the petals, the inner long and opposite the sepals; ovary of 5 fused carpels, with 1-many ovules in each carpel; plants usually heterostylous; fruit a capsule; seeds covered by a white fleshy integument which bursts by contraction to expel the ripe seeds. About 700 species, cosmopolitan, especially South America and the Cape.

1. Stems creeping, leafy, rooting at the nodes; bulbils absent

3. *O. corniculata*

+ Plant without aerial leafy stems; bulbils present at the base of leaves and along underground stems

2

2. Flowers yellow

1. *O. pes-caprae*

+ Flowers pink or purple

2. *O. anthelmintica*



Plate 67. PODOSTEMACEAE: *Tristicha trifaria* 1, habit, flower and open capsule exposing seeds. OXALIDACEAE: *Oxalis pes-caprae* 2, habit. *Oxalis anthelmintica* 3, habit. *Oxalis corniculata* 4, habit. All drawings to the same scale except enlarged parts (scale given).

1. **Oxalis pes-caprae** L., Sp. Pl., ed. 1, 434 (1753).
Syn. *Oxalis cernua* Thunb., Diss. Oxalis 14 (1781).

Perennial herb 15-40 cm, glabrous or glabrescent; bulbils present at the base of leaves and along the underground stems (rhizomes); leaves 5-20 cm, all basal; petiole long, glabrous; stipules partly adnate to the petiole; leaflets 1-2 x 1-2 cm, obcordate, glabrescent on the upper surface, hairy on the lower; flowers in umbel-like cymes, on long scapes much exceeding the leaves; pedicels 0.8-1.8 cm; flowers 2-3 cm diam.; calyx 4-6 mm; corolla yellow.

N, M, S; moist and cultivated ground, naturalized. Native of southern Africa, naturalized as a weed in many warm regions.

NOTE: The plant reproduces vegetatively in Egypt, all populations have short styles and no seeds are produced.

2. **Oxalis anthelmintica** A. Rich., Tent. Fl. Abyss. 1: 124 (1847).
Syns. *Oxalis abyssinica* Turcz., Bull. Soc. Nat. Moscou 31: 432 (1858), non (A. Rich.) Walp. (1852), nom. illeg.
Oxalis caprina L. var. *abyssinica* (Turcz.) Oliv., Fl. Trop. Afr. 1: 296 (1868).

Perennial herb 20-50 cm; rhizome vertical, arising from an ovoid bulb 1-1.5 cm; leaves 3-foliolate, in a basal rosette; petiole 4-8 cm; leaflets 1-2 x 1-2 cm, sessile, obovate, emarginate, glabrous on the upper surface, hairy on the midrib on the lower surface; flowers in pseudo-umbels, on a scape 8-18 cm, arising from the leaf rosette, usually exceeding the petiole; bracts linear to lanceolate; pedicels 1-2 cm, hairy; sepals 4-6 mm, ovate-lanceolate; petals 1.2-1.5 cm, pink or purple; long stamen filaments pubescent, short filaments glabrous; capsule globose, shorter than the sepals, with 3 seeds in each locule; seeds rugose, reddish.

GE; appearing after rain on sandy and loamy soils. Southeast Egypt, tropical East and Southeast Africa extending to Congo.

3. **Oxalis corniculata** L., Sp. Pl., ed. 1, 435 (1753).
Syns. *Oxalis repens* Thunb., Diss. Oxalis 16 (1781).
Oxalis villosa M. Bieb., Fl. Taur.-Caucas. 1: 355 (1808).

Annual or short-lived perennial herb, 10-30 cm; stems many, procumbent to ascending, rooting at the nodes, leafy; leaves 1-5 cm, alternate, long-petiolate; stipules oblong, adnate to the petiole; leaflets 0.4-1 x 0.4-1.2 cm, obcordate-cuneate, hairy on the lower surface; peduncles 2-5 cm, axillary, 1-6-flowered, in umbellate cymes; calyx 3-5 mm; petals 6-9 mm, yellow; capsule 1.2-2 x 0.3 cm, deflexed, prismatic-cylindrical, puberulent; seeds 1-1.5 mm, ovoid, wrinkled.

N, O, M, De (along Suez Canal), S; moist ground. Cosmopolitan, especially warm regions.

obeikandi.com



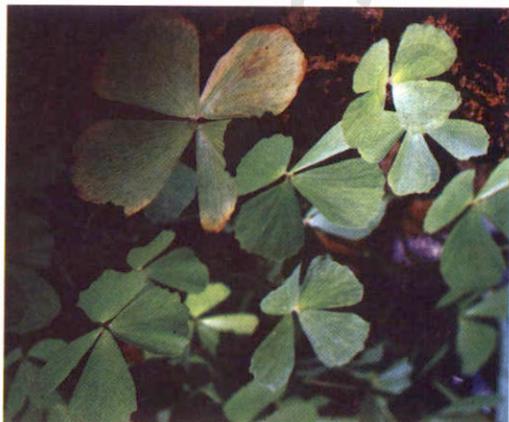
Onychium divaricatum



Salix tetrasperma



Adiantum capillus-veneris



Marsilea aegyptiaca



Juniperus phoenicea



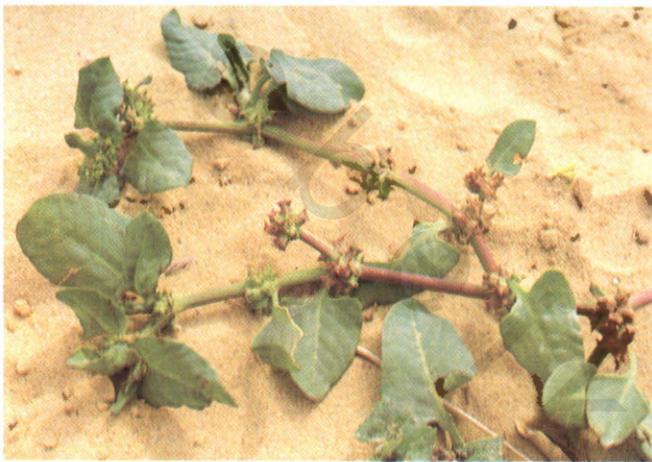
Forsskaolea tenacissima



Thesium humile



Plicosepalus curviflorus



Emex spinosa

Atraphaxis spinosa var. *sinaica*



Persicaria salicifolia



Calligonum polygonoides



Mesembryanthemum crystallinum



Mesembryanthemum crystallinum (flowering)

Rumex vesicarius



Commicarpus helena





Mesembryanthemum forsskaolii



Portulaca oleracea



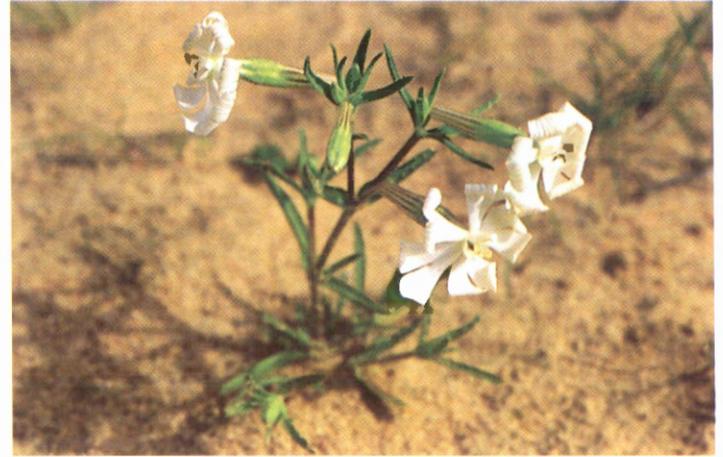
Gypsophila capillaris



Vaccaria hispanica



Silene succulenta



Silene arabica



Silene aegyptiaca



Polycarpon succulentum



Paronychia sinaica



Gymnocarpus decandrus



Herniaria hirsuta



Herniaria hemistemon



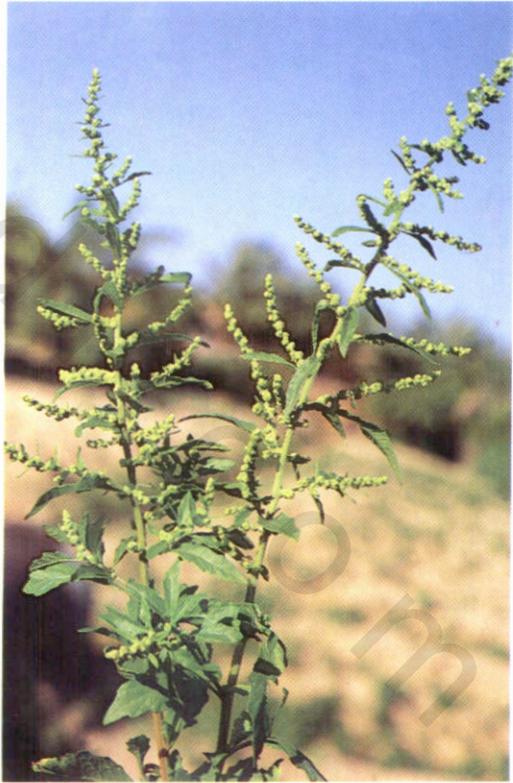
Sclerocephalus arabicus



Paronychia arabica



Cometes abyssinica



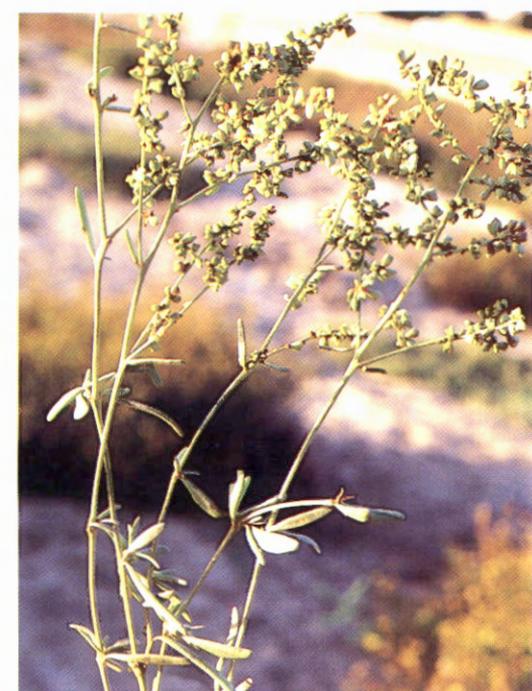
Chenopodium ambrosioides



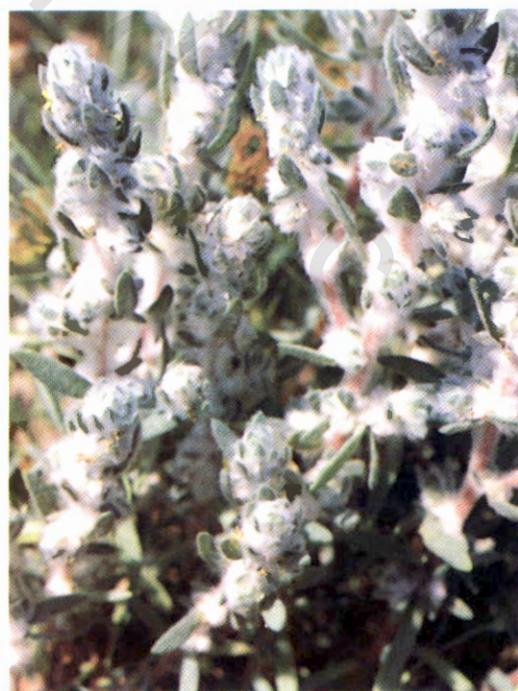
Chenopodium album



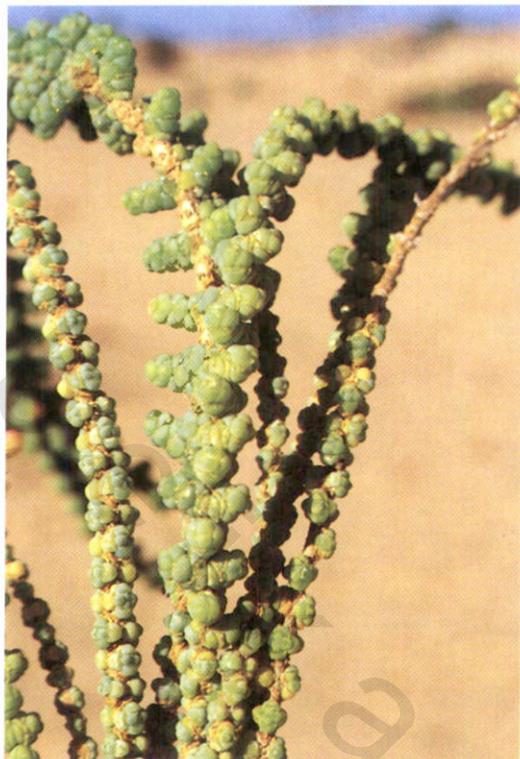
Atriplex halimus



Atriplex portulacoides



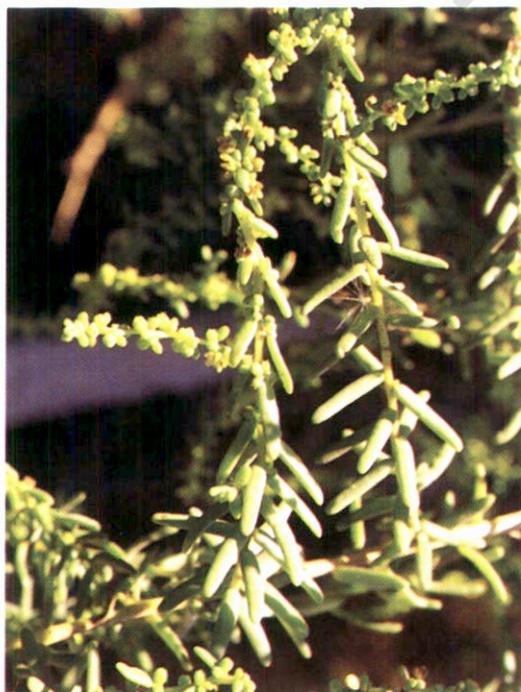
Bassia eriophora



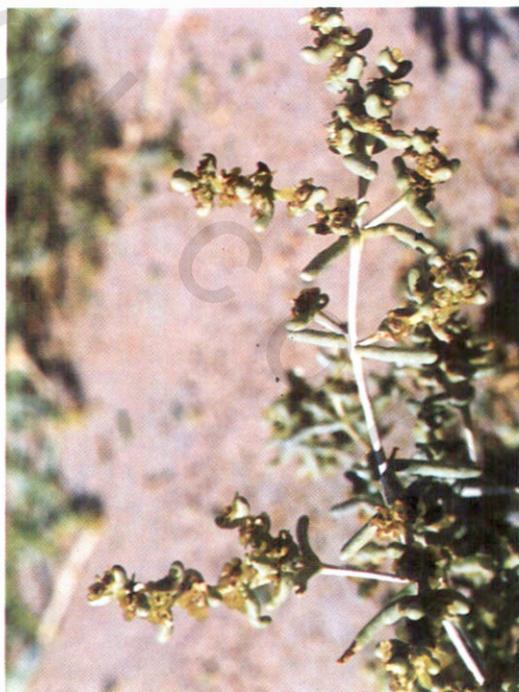
Halocnemum strobilaceum



Sarcocornia fruticosa



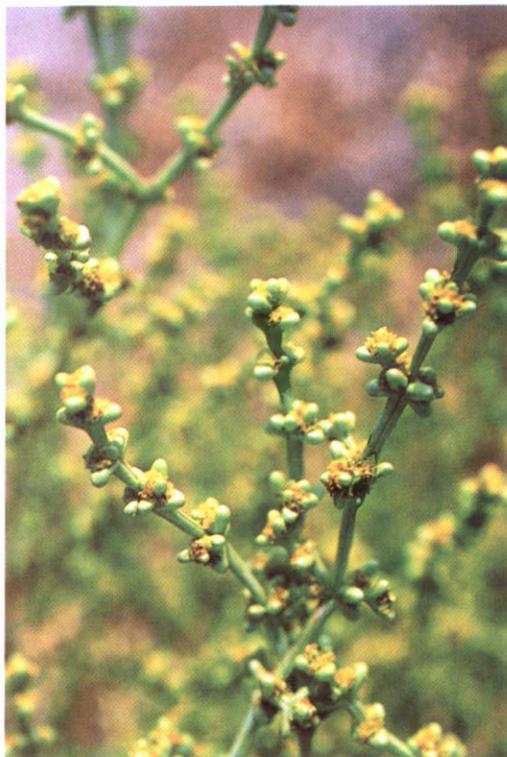
Suaeda monoica



Seidlitzia rosmarinus



Haloxylon salicornicum



Anabasis setifera



Cornulaca monacantha



Amaranthus graecizans



Amaranthus lividus



Anemone coronaria



Ranunculus asiaticus



Aerva lanata



Adonis dentata



Cocculus pendulus (liane)



Fumaria densiflora



Capparis decidua



Capparis spinosa var. *deserti*



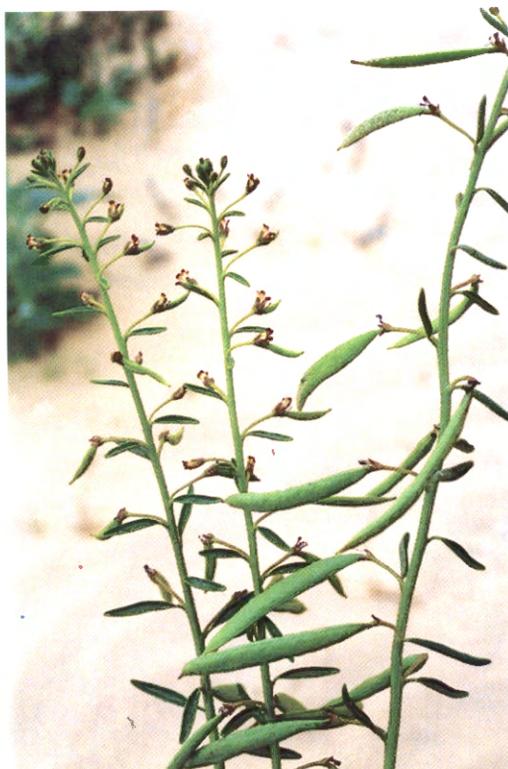
Maerua crassifolia



Cleome droserifolia
390



Cleome arabica



Cleome amblyocarpa



Sisymbrium irio



Schimpera arabica



Matthiola longipetala



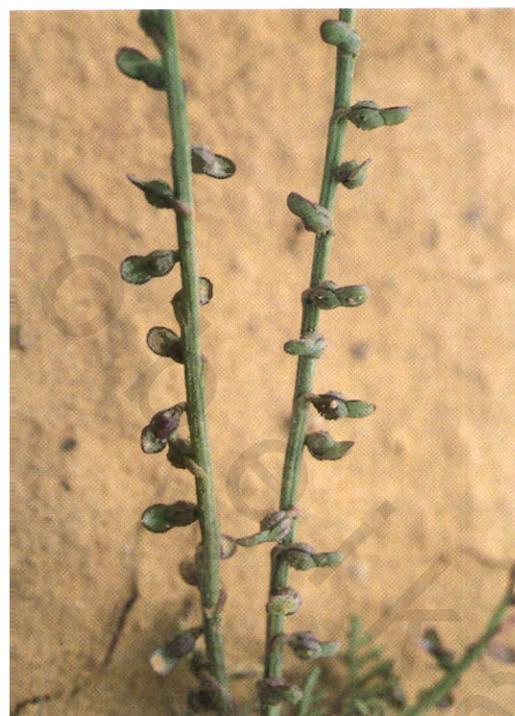
Diplotaxis harra



Diplotaxis acris



Zilla spinosa



Carrichtera annua



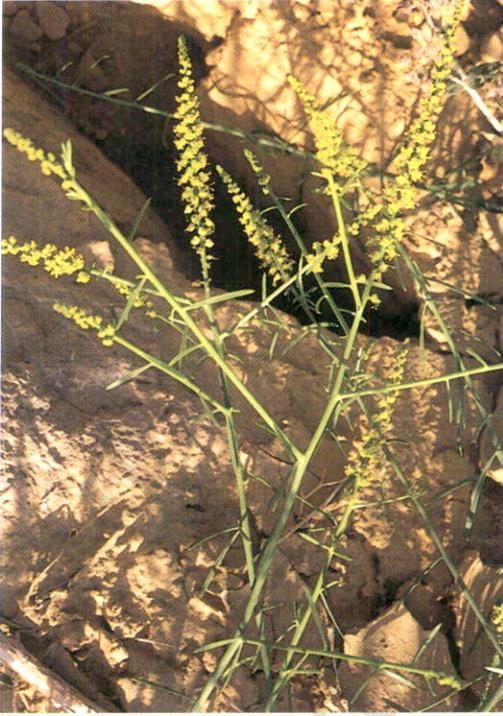
Schouwia purpurea



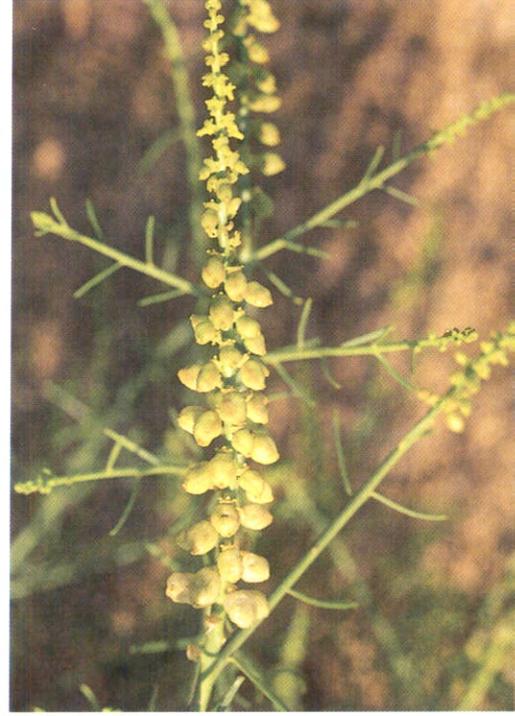
Savignya parviflora



Reseda pruinosa



Ochradenus baccatus (male)



Ochradenus baccatus (female)



Oligomeris linifolia



Neurada procumbens



Ononis reclinata



Trigonella arabica

Retama raetam



Ononis vaginalis



Indigofera spinosa



Trigonella stellata



Tephrosia purpurea



Lotus hebranicus



Astragalus schimperi



Sesbania sesban



Astragalus corrugatus



Astragalus tribuloides



Astragalus vogelii



Astragalus hauarensis



Astragalus annularis



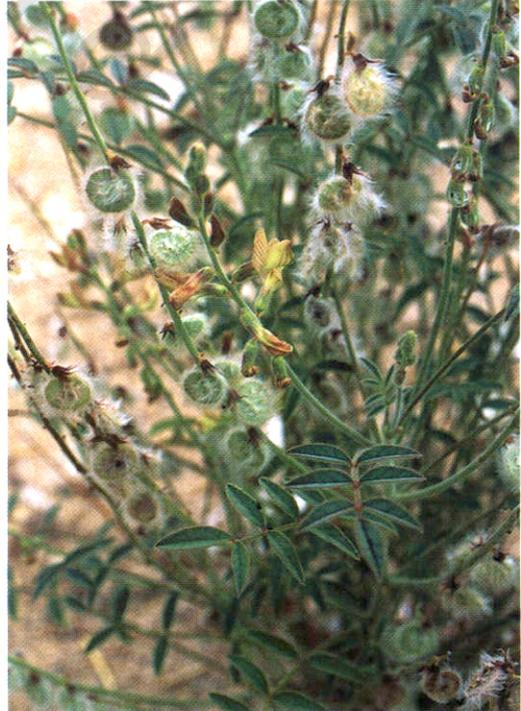
Astragalus sieberi



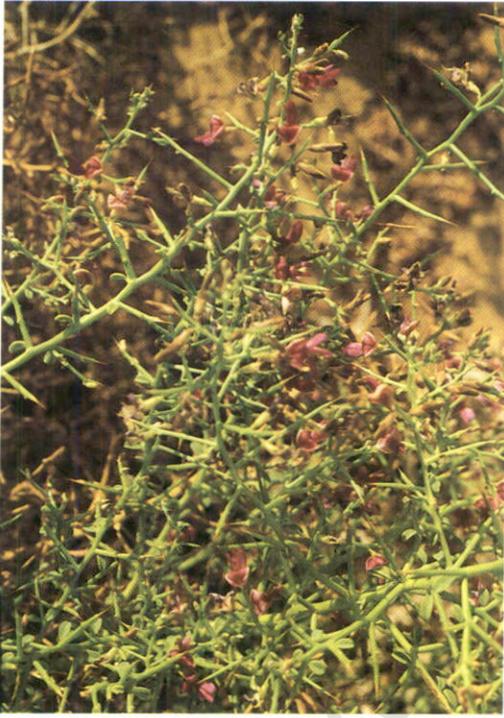
Astragalus spinosus



Taverniera aegyptiaca



Onobrychis ptolemaica



Alhagi graecorum



Dichrostachys cinerea



Acacia mellifera

400



Senna italica



Oxalis corniculata

Index to scientific names

accepted names in **bold type**, synonyms in *italic type*

page numbers in *italic type* for line drawings, **bold type** for colour photographs

- Acacia albida* Delile 372
Acacia arabica (Lam.) Willd. 368
Acacia asak (Forssk.) Willd. 366, 367
Acacia aucheri Benth. 369
Acacia ehrenbergiana Hayne 371, 370
Acacia etbaica Schweinf. 371, 370
Acacia flava (Forssk.) Schweinf. 371
Acacia gerrardii Benth. 368
 subsp. *negevensis* Zohary 368, 369
 var. *najdensis* Chaudhary 368
Acacia glaucophylla A. Rich. 366
Acacia iraqensis Rech. f. 369
Acacia laeta R. Br. ex Benth. 366, 367
Acacia mellifera (Vahl) Benth. 365, 367, **400**
Acacia nilotica (L.) Delile 368
 subsp. *nilotica* 368, 367
 subsp. *tomentosa* (Benth.) Brenan 368
Acacia nubica Benth. 369
Acacia oerfota (Forssk.) Schweinf. 269
 var. *oerfota* 369, 370
Acacia pachyceras O. Schwartz 368
 var. *najdensis* (Chaudhary) Boulos 368, 370
Acacia raddiana Savi 368
Acacia seyal Delile 369, 370
Acacia tortilis (Forssk.) Hayne 366
 subsp. *raddiana* (Savi) Brenan 368, 367
 subsp. *tortilis* 368
Acacia triacantha Hochst. ex A. Rich. 366
Achyranthes alternifolia L. 136
Achyranthes argentea Lam. 139
Achyranthes aspera L. 139, 141
 var. *argentea* (Lam.) Boiss. 139
 var. *pubescens* (Moq.) C. C. Towns. 139
 var. *sicula* L. 139
Achyranthes corymbosa L. 81
Achyranthes fruticosa Lam. 139
 var. *pubescens* Moq. 139
Achyranthes lanata L. 138
Achyranthes muricata L. 136
Achyranthes repens L. 140
Acrostichum dichotomum Forssk. 6
Acrostichum velleum Aiton 5
ACTINOPTERIDACEAE 6
Actinopteris australis (L. f.) Link
 var. *radiata* (Sw.) C. Chr. 6
Actinopteris semiflabellata Pic. Serm. 6, 9
ADIANTACEAE 3
Adiantum capillus-veneris L. 3, 4, **377**
Adonis dentata Delile 147, 149, **389**
 subsp. *dentata* 147
Aellenia postii (Eig) Aellen 129
Aerva bovei (Webb) Edgew. 137
Aerva elegans Moq. 138
Aerva javanica (Burm. f.) Juss. ex Schult. 137
 var. *bovei* Webb 137
 var. *javanica* 137, 141
Aerva lanata (L.) Juss. ex Schult. 138, 141, **388**
Aerva tomentosa Forssk. 137
Aeschynomene sesban L. 319
Aethionema carneum (Banks & Sol.) Fedtsch. 225, 228
Aethionema cristatum DC. 225
Agathophora algeriensis Botsch. 129
Agathophora alopecuroides (Delile) Fenzl ex Bunge 129, 128
 var. *alopecuroides* 129
 var. *papillosa* (Maire) Boulos 129
Agathophora galalensis Botsch. 129
Agathophora iraqensis Botsch. 129
Agathophora postii (Eig) Botsch. 129
AIZOACEAE 44
Aizoon canariense L. 46, 47
Aizoon hispanicum L. 46, 47
Albersia caudata (Jacq.) Boiss. 135
Alhagi graecorum Boiss. 340, 339, **400**
Alhagi mannifera Jaub. & Spach 340
Allosorus melanolepis Decne. 6
Alsine boeconii Scheele 80
Alsine brevis Boiss. 75
Alsine media L. 76
Alsine meyeri Boiss. 73
Alsine pallida Dumort. 76
Alsine picta (Sibth. & Sm.) Fenzl 73
Alsine procumbens (Vahl) Fenzl 73
Alsine prostrata Forssk. 83
Alsine sinaica Boiss. 73
Alsine succulenta Delile 83
Alsine tenuifolia (L.) Crantz 75
 var. *mucronata* (Sibth. & Sm.) Boiss. 75
Alternanthera nodiflora R. Br. 140, 141
Alternanthera pungens Kunth 140, 141
Alternanthera repens J. F. Gmel. 142
Alternanthera sessilis (L.) DC. 142, 141
 var. *nodiflora* (R. Br.) Kuntze 140
Alyssum campestre L. 207
Alyssum clypeatum L. 204
Alyssum desertorum Stapf 205, 206
Alyssum homalocarpum (Fisch. & C. A. Mey.) Boiss. 207, 206
Alyssum marginatum Steud. ex Boiss. 207
Alyssum maritimum (L.) Lam. 208

- Alyssum minus* (L.) Rothm. 207
Alyssum nanum Pomel 207
Alyssum simplex Rudolphi 207
 AMARANTHACEAE 129
Amaranthus albus L. 133, 134
Amaranthus angustifolius Lam. 133
Amaranthus ascendens Loisel. 135
Amaranthus aschersonianus (Thell.) Chiov. 133
Amaranthus blitoides S. Watson 136, 134
Amaranthus blitum L. 135
Amaranthus caudatus L. 131
Amaranthus chlorostachys Willd. 132
Amaranthus cruentus L. 132
Amaranthus delilei Loret 132
Amaranthus gangeticus L. 133
Amaranthus gracilis Poir. 135
Amaranthus graecizans L. 133, 387
 subsp. **graecizans** 133, 134
 subsp. **silvestris** (Vill.) Brenan 135
 subsp. **thellungianus** (Nevski) Gusev 135
Amaranthus hybridus L. 132
 subsp. **cruentus** (L.) Thell. 132
 subsp. **hybridus** 132, 134
Amaranthus hypochondriacus L. 132
Amaranthus lividus L. 135, 388
Amaranthus mangostanus L. 132
Amaranthus melancholicus L. 132
Amaranthus oleraceus L. 135
Amaranthus palmeri S. Watson 125
Amaranthus paniculatus L. 132
Amaranthus patulus Bertel. 132
Amaranthus polygonoides, sensu Täckh. 135
Amaranthus retroflexus L. 132, 134
Amaranthus sanguineus L. 131
Amaranthus silvestris Vill. 135
Amaranthus spinosus L. 132, 134
Amaranthus thellungianus Nevski 135
Amaranthus tricolor L. 132
Amaranthus tristis L. 132
Amaranthus viridis L. 135, 134
Anabasis alopecuroides (Delile) Moq. 129
Anabasis aphylla, acut. 126
Anabasis articulata (Forssk.) Moq. 126, 128
 subsp. **oropediorum** (Maire) Ozenda 126
Anabasis haussknechtii, sensu Täckh. 126
Anabasis oropediorum Maire 126
Anabasis setifera Moq. 125, 128, 387
Anabasis syriaca Iljin 126
 var. **zoharyi** (Iljin) Zohary 126
Anabasis zoharyi Iljin 126
Anagyris foetida L. 253, 255
Anagyris neapolitana Ten. 253
Anastatica hierochuntica L. 203, 206
Anemone coronaria L. 147, 149, 388
Ankyropetalum coelesyriacum Boiss. 58
Ankyropetalum gypsophiloides Fenzl 58, 55
 var. **coelesyriacum** (Boiss.) Barkoudah 58
Anogramma leptophylla (L.) Link 3, 4

Anthyllis maura Beck 289
Anthyllis tetraphylla L. 290, 294
Anthyllis vulneraria L. 289, 294
 subsp. **maura** (Beck) Maire 289
Arabidopsis kneuckeri (Bornm.) O. E. Schulz 192
Arabidopsis pumila (Stephan ex Willd.) Busch 191, 189
Arabidopsis schimperii (Boiss.) N. Busch 187
Arabis albida Jacq. f. 194
Arabis alpina L. 194, 198
 subsp. **caucasica** (Willd.) Briq. 194
Arabis auriculata Lam. 194
 var. **sinaica** (Boiss.) Boiss. 194
Arabis cadmea Boiss. 194
Arabis caucasica Willd. 194
Arabis nova Vill. 194
 var. **sinaica** (Boiss.) Täckh. 194
Arabis sinaica Boiss. 194
Arabis verna (L.) R. Br. 194
Arabis viscosa DC. 194
Arenaria deflexa Decne. 72, 74
 subsp. **deflexa** 72
Arenaria diandra Guss. 80
Arenaria filiformis Labill. 73
Arenaria geniculata Poir. 73
Arenaria glutinosa M. Bieb. 77
Arenaria hybrida Vill. 75
Arenaria marina (L.) Roth. 78
Arenaria maritima All. 78
Arenaria media L. 78
Arenaria mediterranea Ledeb. 75
Arenaria picta Sibth. & Sm. 73
Arenaria procumbens Vahl 73
Arenaria rubra L. 78
 var. **marina** L. 78
Arenaria serpyllifolia L. 72, 74
Argemone mexicana L. 161, 163
Argyrolobium abyssinicum Jaub. & Spach 257
Argyrolobium arabicum (Decne.) Jaub. & Spach 257, 261
Argyrolobium saharae Pomel 258
Argyrolobium sinaicum Boiss. 258
Argyrolobium uniflorum (Decne.) Jaub. & Spach 258, 261
Aristolochia abyssinica Klotzsch 155
Aristolochia bracteata Retz. 155
Aristolochia bracteolata Lam. 155, 154
Aristolochia kotschyi A. Rich. 155
Aristolochia maurorum L. 155, 154
Aristolochia sempervirens, sensu Forssk. 155
 ARISTOLOCHIACEAE 155
Arthrocnemum fruticosum (L.) Moq. 110
Arthrocnemum glaucum (Delile) Ung.-Sternb. 108
Arthrocnemum macrostachyum (Moric.) K. Koch 108, 109
Arthrocnemum macrostachyum (Moric.) Moris 108

- rthrocnemum perenne* (Mill.) Moss 111
- SPLENIACEAE 6
- splenium adiantum-nigrum* L. 7, 9
- splenium ceterach* L. 7, 9
- stracantha echinus* (DC.) Podlech 336, 335
- stragalus acinaciferus* Boiss. 334
- stragalus alexandrinus* Boiss. 332
- stragalus amalecitanus* Boiss. 336
- stragalus annularis* Forssk. 328, 326, 398
- stragalus arabicus* Bunge 330
- Astragalus asterias* Steven 323
subsp. *asterias* 324
subsp. *radiatus* (Batt.) Greuter 324
- Astragalus boeticus* L. 322, 326
- Astragalus bombycinus* Boiss. 328, 331
- Astragalus brachyceras* Ledeb. 329
- Astragalus buceras* Willd. 329
- Astragalus calophyllus* Boiss. & Heldr. 330
- Astragalus camelorum* Barbey 332
- Astragalus caprinus* L. 332
- Astragalus corrugatus* Bertol. 325, 326, 397
subsp. *corrugatus* 325
subsp. *tenuirugis* (Boiss.) Eig 325
- Astragalus cretaceus* Boiss. & Kotschy 330
- Astragalus cruciatus* Link 324, 325
subsp. *radiatus* Batt. 324
- Astragalus cruciatus*, sensu Zohary 323
- Astragalus dactylocarpus* Boiss. 334
subsp. *acinaciferus* (Boiss.) E. Ott 334, 335
- Astragalus echinus* DC. 336
- Astragalus eremophilus* Boiss. 327, 326
- Astragalus falcinellus* Boiss. 327
- Astragalus fatmensis* Chiov. 330
- Astragalus forsskaolii* Boiss. 336
- Astragalus fresenii* Decne. 332
- Astragalus fruticosus* Forssk. 333, 335
- Astragalus gyzensis* Bunge 325
- Astragalus hamosus* L. 329, 331
- Astragalus hauarensis* Boiss. 325, 326, 398
- Astragalus hispidulus* DC. 327, 326
subsp. *hispidulus* 328
subsp. *kralikii* (Batt.) Täckh. & Boulos 328
- Astragalus huninensis* Freyn & Bornm. 333
- Astragalus intercedens* Sam. ex Rech. f. 325
- Astragalus kahiricus* DC. 333, 331, 398
- Astragalus kneuckeri* Freyn 336
- Astragalus kralikii* Batt. & Trab. 328
- Astragalus lanigerus* Desf. 332
- Astragalus leucacanthus* Boiss. 334
- Astragalus libanoticus* Boiss. 336
- Astragalus longiflorus* Delile 333
- Astragalus macrocarpus* DC. 333, 331
subsp. *macrocarpus* 333
- Astragalus mareoticus* Delile 327
- Astragalus maris-mortui* Eig 325
- Astragalus microthamnus* Boiss. & Hausskn. 336
- Astragalus minutus* Boiss. 323
- Astragalus palaestinus* Eig 329
- Astragalus peregrinus* Vahl 328, 326
subsp. *peregrinus* 328
- Astragalus prolixus* Bunge 330
- Astragalus pseudotrigrinus* Batt. & Trab. 334
- Astragalus radiatus* Bunge 324
- Astragalus sanctus* Boiss. 330
- Astragalus schimperii* Boiss. 324, 326, 397
var. *schimperii* 324
var. *subsessilis* Eig 324
- Astragalus sieberi* DC. 334, 335, 399
- Astragalus sinaicus* Boiss. 323
- Astragalus sparsus* Decne. 333
- Astragalus spinosus* (Forssk.) Muschl. 334, 399
- Astragalus stella*, sensu Täckh. 324
- Astragalus tenuirugis* Boiss. 325
- Astragalus tomentosus* Lam. 333
- Astragalus tribuloides* Delile 322, 326, 397
var. *elarishensis* Eig 323
var. *leiocarpus* Boiss. 323
var. *mareoticus* Sirj. 323
var. *minutus* (Boiss.) Boiss. 323
var. *tribuloides* 323
- Astragalus trigrinus* DC. 334, 335
- Astragalus trimestris* L. 329
- Astragalus vogelii* (Webb) Bornm. 329, 331, 398
subsp. *fatmensis* (Chiov.) Maire 330
subsp. *prolixus* (Bunge) Maire 330
subsp. *vogelii* 330
- Atraphaxis sinaica* Jaub. & Spach 22
- Atraphaxis spinosa* L. 22
var. *sinaica* (Jaub. & Spach) Boiss. 22, 23, 379
- Atriplex alexandrina* Boiss. 102
- Atriplex canescens* (Pursh) Nutt. 103
- Atriplex coriacea* Forssk. 103, 104
- Atriplex crystallina* Boiss. 102
- Atriplex dimorphostegia* Kar. & Kir. 100, 104
- Atriplex farinosa* Forssk. 103, 104
- Atriplex glauca* L. 102, 104
- Atriplex halimus* L. 103, 104, 385
- Atriplex hastata*, sensu Täckh. 101
- Atriplex holocarpa* F. Muell. 100
- Atriplex inamoena* Aellen 102
- Atriplex inflata* F. Muell. 99
- Atriplex laciniata* L. 102
var. *turcomanica* Moq. 102
- Atriplex leucoclada* Boiss. 102
var. *inamoena* (Aellen) Zohary 102
var. *turcomanica* (Moq.) Zohary 102, 104
subsp. *turcomanica* (Moq.) Aellen 102
- Atriplex lindleyi* Moq. 99
subsp. *inflata* (F. Muell.) P. G. Wilson 99, 104
- Atriplex littoralis* L. 101
- Atriplex nummularia* Lindl. 103
- Atriplex ocymifolium* Viv. 103
- Atriplex palaestina* Boiss. 102

- Atriplex patula** L. 102
Atriplex portulacoides L. 105, 104, 385
Atriplex prostrata Boucher ex DC. 101
Atriplex rosea L. 100
Atriplex semibaccata R. Br. 101
Atriplex serrata Huds. 101
Atriplex spongiosa F. Muell. 100
 var. *holocarpa* (F. Muell.) J. Black 100
Atriplex stylosa Viv. 102
Atriplex suberecta Verd. 101
Atriplex tatarica L. 100
Atriplex triangularis Willd. 101
Axyris ceratoides L. 105
Azolla caroliniana Willd. 2
Azolla filiculoides Lam. 2, 4
AZOLLACEAE 1
Bassia arabica (Boiss.) Maire & Weiller 106
Bassia eriophora (Schrad.) Asch. 106, 109, 385
Bassia indica (Wight) A. J. Scott 107
Bassia joppensis Bornm. & Dinsm. 107
Bassia latifolia (Fresen.) Asch. 106
Bassia muricata (L.) Asch. 106, 109
Batrachium roinii (Lagger) Nyman 144
Behen vulgaris Moench 61
BERBERIDACEAE 151
Beta maritima L. 94
Beta perennis (L.) Halácsy 94
Beta vulgaris L. 94
 subsp. *maritima* (L.) Arcang. 94, 97
Bilderdykia convolvulus (L.) Dumort. 30
Biscutella apula L. 227
Biscutella ciliata DC. 229
Biscutella depressa Willd. 229
Biscutella didyma L. 227, 228
 var. *depressa* (Willd.) El-Naggar 229
 var. *didyma* 229
 var. *elbensis* (Chrtek) El Naggar 229
Biscutella elbensis Chrtek 229
Biscutella leiocarpa DC. 229
Bistella geminiflora Delile 244
Bituminaria bituminosa (L.) C. H. Stirt. 306, 307
Bituminaria flaccida (Nábelek.) Greuter 308
Blackiella inflata (F. Muell.) Aellen 100
Boerhavia boissieri Heimerl 35
Boerhavia coccinea, sensu Täckh. 37
Boerhavia diandra L. 37
Boerhavia diffusa L. 37, 38
Boerhavia elegans Choisy 39, 38
Boerhavia grandiflora A. Rich. 36
Boerhavia helenae Schult. 36
Boerhavia plumbaginea Cav.
 var. *viscosa* Boiss. 35
Boerhavia repens L. 37, 38
 subsp. *diandra* (L.) Maire & Weiller 37
 subsp. *repens* 37
 subsp. *viscosa* (Choisy) Maire 37
 var. *diffusa* (L.) Hook. f. 37
 var. *viscosa* Choisy 37
Boerhavia rubicunda Steud. 39
Boerhavia sinuata (Meikle) Greuter & Burdet 35
Boerhavia stellata Wight 36
Boerhavia viscosa, sensu Täckh. 37
Boerhavia vulvarifolia Poir. 37
Bolanthus hirsutus (Labill.) Barkoudah 56, 55
Boscia angustifolia A. Rich. 174, 175
Boscia octandra Radlk. 174
Boscia senegalensis Poir. 174, 175
Brassica arabica (Fisch. & C. A. Mey.) Fiori 212
Brassica bracteolata Fisch. & C. A. Mey. 211
Brassica campestris L. 211
Brassica crassifolia Forssk. 215
Brassica deserti Danin & Hedge 211
Brassica juncea (L.) Czernj. & Coss. 212
Brassica nigra (L.) Koch 211, 216
Brassica orientalis L. 223
Brassica rapa L. 211, 216
Brassica sinaica Boiss. 223
Brassica sinapistrum Boiss. 213
Brassica teretifolia Desf. 224
Brassica tournefortii Gouan 211
Bufonia multiceps Decne. 71
Bunias aegyptiaca L. 195
Bunias myagroides L. 215
Bunias spinosa L. 218
Cadaba farinosa Forssk. 174, 175
Cadaba glandulosa Forssk. 173, 175
Cadaba rotundifolia Forssk. 173, 175
Caidbeja adhaerens Forssk. 18
Cakile aegyptiaca Willd. 218
Cakile hispanica Jord. 218
Cakile littoralis Jord. 218
Cakile maritima Scop. 218
 subsp. *aegyptiaca* (Willd.) Nyman 218, 222
Calligonum canescens Pursh 103
Calligonum comosum L'Hér. 24
Calligonum polygonoides L. 24, 23, 379
 subsp. *comosum* (L'Hér.) Soskov 24
 subsp. *polygonoides* 24
Camelina hispida Boiss. 229, 228
Camelina persistens Rech. f. 229
Camelina rumelica Velen. 230
CAPPARACEAE 170
Capparis aegyptia Lam. 172
Capparis aphylla Roth 171
Capparis cartilaginea Decne. 171
Capparis decidua (Forssk.) Edgew. 171, 175, 389
Capparis deserti (Zohary) Täckh. & Boulos 173
Capparis galeata Fresen. 171
Capparis leucophylla DC. 172
Capparis mithridatica Forssk. 176
Capparis oblongifolia Forssk. 176
Capparis orientalis Duh. 172

- *Capparis ovata* Desf. 172
 var. *canescens* (Coss.) Heywood 172
 var. *palaestina* Zohary 172
 ■ *Capparis rupestris* Sibth. & Sm. 172
 ■ *Capparis sicula* Duh. 172
 ■ *Capparis sinaica* Veill. 171, 175
 ■ *Capparis sodata* R. Br. 171
 ■ *Capparis spinosa* L. 172
 subsp. *catilaginea* (Decne.) Maire & Weiller 171
 subsp. *orientalis* (Duh.) Jafri 172
 var. *aegyptia* (Lam.) Boiss. 172
 var. *canescens* Coss. 172
 var. *deserti* Zohary 173, 390
 var. *inermis* Turra 172
 var. *rupestris* (Sibth. & Sm.) Viv. 172
 var. *spinosa* 172
 ■ *Capsella bursa-pastoris* (L.) Medik. 230, 228
Capsella procumbens (L.) Fries 230
Cardamine lunaria L. 205
Cardaria draba (L.) Desv. 226
Caroxylon imbricatum (Forssk.) Moq. 118
Caroxylon salicornicum Moq. 124
Carrichtera annua (L.) DC. 221, 222, 393
 CARYOPHYLLACEAE 50
Cassia acutifolia Delile 361
Cassia aschrek Forssk. 359
Cassia holosericea Fresen. 359
Cassia italica (Mill.) F. W. Andrews 359
Cassia lanceolata Forssk. 361
Cassia obovata Collad. 359
Cassia occidentalis L. 361
Cassia senna L. 359
Caylusea canescens A. St. Hil. 237
Caylusea hexagyna (Forssk.) M. L. Green 237, 235
Caylusea jaber Abedin 237
Cerastium dichotomum L. 77, 79
 subsp. *dichotomum* 77
 subsp. *inflatum* (Link) Cullen 77
Cerastium glomeratum Thuill. 76, 79
Cerastium inflatum Link 77
Cerastium viscosum L. 76
Ceratogonum atriplicifolium Meisn. 25
Ceratogonum cordofanum Meisn. 25
Ceratogonum sinuatum Meisn. 25
Ceratoides latens (J. F. Gmel.) Reveal & N. H. Holmgren 105
Ceratoides papposa Botsch. & Ikonn. 105
Ceratonia siliqua L. 361, 360
 CERATOPHYLLACEAE 153
Ceratophyllum demersum L. 153, 154
Ceratophyllum muricatum Cham. 153, 154
Ceratophyllum submersum L. 153
 subsp. *muricatum* (Cham.) Wilmot-Dear 153
Ceterach officinarum Willd. 7
Cheilanthes catanensis (Cosent.) H. P. Fuchs 5
Cheilanthes coriacea Decne. 5, 4
Cheilanthes fragrans (L.) Sw. 5
Cheilanthes pteridioides (Reichard) C. Chr. 5, 4
Cheilanthes suaveolens Sw. 5
Cheilanthes vellea (Aiton) F. Muell. 5, 4
Cheiranthus bicornis Sm. 201
Cheiranthus coronopifolius Sm. 200
Cheiranthus fruticosus L. 200
Cheiranthus lividus Delile 201
Cheiranthus longipetalus Vent. 201
Cheiranthus parviflorus Schousb. 200
Cheiranthus tristis L. 200
Chelidonium corniculatum L. 162
Chelidonium dodecandrum Forssk. 161
Chelidonium hybridum L. 161
Chenolea arabica Boiss. 106
Chenoleoides arabica (Boiss.) Botsch. 106
 CHENOPODIACEAE 92
Chenopodium aegyptiacum Hasselq. 112
Chenopodium album L. 96, 97, 385
Chenopodium altissimum L. 114
Chenopodium amaranticolor (Coste & Reyn.) Coste & Reyn. 98
Chenopodium ambrosioides L. 95, 97, 384
Chenopodium baryosmum Schult. ex Roem. & Schult. 118
Chenopodium botrys L. 95, 97
Chenopodium ficifolium Sm. 96, 97
Chenopodium fruticosum L. 113
Chenopodium giganteum D. Don 98, 97
Chenopodium glaucum L. 98, 97
Chenopodium maritimum L. 114
Chenopodium moquinianum, sensu Täckh. 98
Chenopodium murale L. 96, 97
Chenopodium opulifolium Schrad. ex Koch & Ziz 96, 97
Chenopodium salsum L. 114
Chenopodium vulvaria L. 95, 97
Clandestinarina indica (L.) Spach 193
Cleome africana Botsch. 180
Cleome amblyocarpa Barratte & Murb. 180, 179, 391
Cleome arabica L. 178, 179, 391
Cleome arabica, acut. 180
Cleome areysiana Defflers 178
Cleome brachycarpa DC. 178, 179
Cleome chrysantha Decne. 178, 179
Cleome deflersii Blatter 178
Cleome droserifolia (Forssk.) Delile 177, 179, 390
Cleome gynandra L. 181
Cleome hanburyana Penz. 178
Cleome papillosa T. Anderson 178
Cleome paradoxa R. Br. ex DC. 180
Cleome pentaphylla L. 181
Cleome scaposa DC. 178, 179
Cleome trinervia Fresen. 178
Cleome viscosa L. 180, 179
Clitoria ternatea L. 354, 357

- Clypeola glabra* Boiss. 208
Clypeola hispida C. Presl 208
Clypeola jonthlaspi 208
 subsp. *macrocarpa* (Caruel) Fiori 208
Clypeola jonthlaspi L. 208, 206
Clypeola maritima L. 208
Clypeola microcarpa Moris 208
Clypeola minor L. 207
Cocculus leoba (Delile) DC. 152
Cocculus pendulus (J. R. & G. Forst.) Diels
 152, 154, **389**
Cochlearia nilotica Delile 227
Colutea halepica Lam. 319
Colutea istria Mill. 319, 317
Colutea spinosa Forssk. 334
Cometes abyssinica R. Br. 90, 91, **384**
Cometes surattensis L. 92, 91
Commicarpus boissieri (Heimerl) Cufod. 35,
 38
Commicarpus ehrenbergii Täckh. & Boulos 35
Commicarpus grandiflorus (A. Rich.) Standl.
 36, 38
Commicarpus helenae (Schult.) Meikle 36,
 38, **380**
Commicarpus sinuatus Meikle 35, 38
Commicarpus stellatus (Wight) Berhaut 36
Commicarpus verticillatus, sensu auct. mult.
 36
Conringia orientalis (L.) Dumort. 223, 222
Consolida deserti (Boiss.) Munz 151
Consolida flava (DC.) Schrödinger 151, 149
Corbichonia decumbens (Forssk.) Exell 43
Cornulaca aucheri, sensu Täckh. 127
Cornulaca ehrenbergii Asch. 127, 128
Cornulaca monacantha Delile 127, 128, **387**
Coronilla repanda (Poir.) Guss. 301
 subsp. *repanda* 301
Coronilla scorpioides (L.) Koch 301, 304
Coronilla securidaca L. 302
Coronilla sericea Willd. 319
Coronopus didymus (L.) Sm. 227, 228
Coronopus niloticus (Delile) Spreng. 227, 228
Coronopus squamatus (Forssk.) Asch. 227,
 228
Corrigiola repens Forssk. 81
Cosentinia vellea (Aiton) Tod. 5
Cotoneaster orbicularis Schltld. 247, 248
Cotyledon horizontalis Guss. 242
Cotyledon lineata (Boiss.) Dinsm. 239
Cotyledon pendulina (DC.) Vierh. 240
Cotyledon pendulinus Drar 240
Cotyledon rupestris Salisb. 240
Cotyledon tuberosa (L.) Halácsy 240
Cotyledon umbilicus L. 240
 var. *botryoides* (Hochst. ex A. Rich.) Engler
 240
Cracca monanthos (L.) Godron & Gren. 346
Cracca purpurea L. 316
Crassula alata (Viv.) A. Berger 239, 241

 CRASSULACEAE 238
Crataegus aronia (L.) Bosc ex DC. 247
Crataegus azarolus L. 247, 248
 var. *aronia* L. 247
Crataegus azarolus L. x *monogyna* Jacq. 247
Crataegus x sinaica Boiss. 247, 248
Crotalaria abyssinica D. Dietr. 254
Crotalaria aegyptiaca Benth. 254, 255
Crotalaria impressa Nees ex Walp. 254
Crotalaria maxillaris Klotzsch 254
Crotalaria microphylla Vahl 254, 255
Crotalaria senegalensis (Pers.) DC. 254, 255
Crotalaria sennii Chiov. 254
Crotalaria striata A. Braun. 254
Crotalaria thebaica (Delile) DC. 253, 255
Crotalaria astragalina Hochst. ex A. Rich. 254
 CRUCIFERAE 181
Cucubalus aegyptiacus L. 65
Cucubalus behen L. 61
Cullen plicata (Delile) C. H. Stirt. 305, 307
 CUPRESSACEAE 10
Cytisus arabicus Decne. 257
Cytisus uniflorus Decne. 258
Darniella longifolia (Forssk.) Brullo 121
Darniella schweinfurthii (Solms.) Brullo
 121
Darniella sinaica (Brullo) Brullo 121
Delonix elata (L.) Gamble 362, 360
Delphinium ambiguum L. 150, 149
Delphinium bovei Decne. 150
Delphinium deserti Boiss. 151
Delphinium flavum DC. 151
Delphinium halteratum, sensu Qaiser 150
Delphinium nanum DC. 150
Delphinium orbordatum DC. 150
Delphinium peregrinum, sensu Täckh. 150
Descurainia sophia (L.) Webb ex Prantl 187,
 189
Dianthus auranticus Post. 53
Dianthus axilliflorus Fenzl 53
Dianthus cyri Fisch. & C.A. Mey. 52, 55
Dianthus guessfeldtianus Muschl. 53
Dianthus judaicus Boiss. 53, 55
Dianthus libanotis Labill. 53
Dianthus monadelphus Vent. 53
 subsp. *judaicus* (Boiss.) Greuter & Burdet
 53
Dianthus multipunctatus Ser. 53
Dianthus sinaicus Boiss. 54
Dianthus strictus Banks & Sol. 53
 subsp. **multipunctatus** (Ser.) Greuter &
 Burdet 53, 55
Diceratella elliptica (DC.) Jonsell 199, 198
Dichoglottis linearifolia Fisch. & C. A. Mey.
 58
Dichrostachys cinerea (L.) Wight & Arn. 372,
 363, **400**
Dichrostachys glomerata (Forssk.) Chiov. 372
Dichrostachys nutans (Pers.) Benth. 372

- Didesmus aegyptius** (L.) Desv. 217, 222
Didesmus bipinnatus (Desf.) DC. 218
Didesmus tenuifolius (Sm.) DC. 217
Digera alternifolia (L.) Asch. 136
Digera arvensis Forssk. 136
Digera muricata (L.) Mart. 136, 141
Diplochonium sesuvioides Fenzl 46
Diplotaxis acris (Forssk.) Boiss. 209, 216, 392
Diplotaxis eruroides (L.) DC. 210
 subsp. **eruroides** 210
Diplotaxis harra (Forssk.) Boiss. 209, 216, 392
 subsp. **harra** 209
Diplotaxis hispidula Ten. 210
Diplotaxis muralis (L.) DC. 210
 var. **muralis** 210
 var. **simplex** (Viv.) El Naggar 210
 subsp. **simplex** (Viv.) Jafri 210
Diplotaxis scaposa DC. 210
Diplotaxis simplex (Viv.) Spreng. 210
Dipterygium glaucum Decne. 176, 179
Dolichos luteolus Jacq. 355
Dolichos memnonius Delile 356
Dolichos minimus L. 356
Dolichos sesquipedalis L. 355
Dufourea trifaria Bory ex Willd. 373
Ebenus armitagei Schweinf. & Taub. 340, 339
Emex spinosa (L.) Campd. 24, 23, 379
Enarthrocarpus lyratus (Forssk.) DC. 219, 222
Enarthrocarpus pterocarpus (Pers.) DC. 220, 222
Enarthrocarpus strangulatus Boiss. 220, 222
Ephedra alata Decne. 11, 12
Ephedra alte C. A. Mey. 11
Ephedra aphylla Forssk. 11, 12
Ephedra campylopoda C. A. Mey. 11
Ephedra ciliata Fischer & C. A. Mey. 11, 12
Ephedra foemina Forssk. 11, 12
Ephedra foliata Boiss. 11
Ephedra fragilis Desf. 11
 subsp. **campylopoda** (C. A. Mey.) Asch. & Graebn. 11
Ephedra pachyclada Boiss. 11
 subsp. **sinaica** (Riedl) Freitag & Maier-Stolte 11, 12
Ephedra peduncularis Boiss. & Hausskn. 11
Ephedra sinaica Riedl 11
EPHEDRACEAE 10
Epibaterium pendulum J. R. & G. Forst. 152
EQUISETACEAE 2
Equisetum ramosissimum Desf. 2, 4
Equisetum ramosum DC. 2
Eremobium aegyptiacum (Spreng.) Asch. & Schweinf. ex Boiss. 196, 198
 var. **aegyptiacum** 196
 var. **lineare** (Delile) Zohary 197
 var. **pyramidum** (C. Presl) Täckh. & Boulos 196
Eremobium diffusum (Decne.) Botsch. 197
Eremobium lineare (Delile) Asch. & Schweinf. ex Boiss. 197
Eremobium pyramidum (C. Presl) Botsch. 196
Eruca lativalvis Boiss. 214
Eruca sativa Mill. 214, 216
Erucaria aegiceras Coss. 215
Erucaria aleppica Gaertn. 215
Erucaria crassifolia (Forssk.) Delile 215, 216
Erucaria hispanica (L.) Druce 215, 216
Erucaria latifolia DC. 215
Erucaria microcarpa Boiss. 215, 216
Erucaria myagroides (L.) Halácsy 215
Erucaria pinnata (Viv.) El Naggar 215
Erucaria pinnata (Viv.) Täckh. & Boulos 214
Erucaria uncata (Boiss.) Asch. & Schweinf. 215
 subsp. **aegiceras** Maire & Weiller 215
Erucastrum arabicum Fisch. & C. A. Mey. 212, 216
Ervum ervilia L. 344
Ervum hirsutum L. 346
Ervum tetraspermum L. 346
Erysimum bicorne Aiton 202
Erysimum repandum L. 192, 189
Erysimum rigidum DC. 192
Eurotia ceratoides (L.) C. A. Mey. 105
Factorovskya aschersoniana (Urb.) Eig 276
Faidherbia albida (Delile) A. Chev. 372, 363
Fallopia convolvulus (L.) Á. Löve 30, 29
Farsetia aegyptia Turra 203, 206
 subsp. **aegyptia** 203
Farsetia depressa Kotschy 203
Farsetia hameltonii Royle 203
Farsetia longisiliqua Decne. 204, 206
Farsetia oblongata C. Presl 203
Farsetia ovalis Boiss. 203
Farsetia ramosissima Fourn. 203
Farsetia rostrata Schenk 204
Farsetia stylosa R. Br. 203, 206
Fibigia clypeata (L.) Medik. 204, 206
Fibigia rostrata (Schenk) Boiss. 204
Ficus ambiguum Forssk. 14
Ficus carica L. 16
Ficus cordata Thunb. 14
 subsp. **salicifolia** (Vahl) C. C. Berg 14, 15
Ficus palmata Forssk. 16
Ficus pseudo-sycomorus Decne. 16
Ficus salicifolia Vahl 14
Forskaolea cossoniana Webb 18
Forskaolea tenacissima L. 18, 19, 378
Fumaria bracteosa Pomel 165
Fumaria capreolata L. 166
Fumaria densiflora DC. 165, 169, 389
 subsp. **bracteolosa** (Pomel) Murb. 165
 subsp. **micrantha** (Lag.) Maire & Weiller 165
Fumaria emarginata Braun-Blanq. 165

- Fumaria gaillardotii** Boiss. 166, 169
Fumaria glauca Jord. 165
Fumaria judaica Boiss. 167, 169
 subsp. **judaica** 167
Fumaria leucantha Viv. 165
Fumaria micrantha Lag. 165
Fumaria microstachys Hausskn. 166
Fumaria minima Pugsley 166
Fumaria obtusisejala Pugsley 165
Fumaria officinalis L. 166
 subsp. **officinalis** 166
Fumaria pallidiflora Jord. 166
Fumaria parlatoireana (Boiss.) Bornm. 165
Fumaria parviflora Lam. 165, 169
Fumaria platycalyx Pomel 166
Fumaria speciosa Jord. 166
 FUMARIACEAE 164
Galega apollinea Delile 318
Galega colutea Burm. f. 310
Genista raietam Forssk. 258
Gisekia pharnaceoides L. 40, 42
 var. **pharnaceoides** 40
 var. **pseudopaniculata** C. Jeffrey 40
Glaucium arabicum Fresen. 164, 163
Glaucium corniculatum (L.) Rudolph 162, 163
 subsp. **corniculatum** 162
Glaucium flavum Cranz 162, 163
Glaucium fulvum Sm. 164
Glaucium grandiflorum Boiss. & A. Huet 162, 163
Glaucium judaicum Bornm. 162
Glaucium luteum Scop. 162
Glaucium phoeniceum Crantz 162
Glaucium rubrum Sm. 162
Glaucium tricolor Besser 162
Glinus chrysellinus Forssk. 46
Glinus dictamnoides Burm. f. 41
Glinus lotoides L. 41, 42
Glinus mucronatus (Klotzsh) Klotzsh 43
Glinus runkewitzii Täckh. & Boulos 41
Glinus trianthemoides F. Heyne 43
Glycine malacophylla Spreng. 358
Gompherna sessilis L. 142
 GUTTIFERAE 156
Gymnocarpus decandrus Forssk. 88, 91, 383
Gymnocarpus fruticosus Pers. 88
Gymnogramma leptophylla (L.) Desv. 3
Gynandropsis gynandra (L.) Briq. 181, 179
Gypsophila antari Post & Beauverd ex Dinsm. 57
Gypsophila arabica Barkoudah 57
Gypsophila capillaris (Forssk.) C. Chr. 57, 381
 subsp. **capillaris** 57
 subsp. **confusa** Zmarzty 57
Gypsophila hirsuta (Labill.) Spreng. 56
Gypsophila linearifolia (Fisch. & C. A. Mey.) Boiss. 58
Gypsophila obconica Barkoudah 57
Gypsophila rokejeka Delile 57
Gypsophila viscosa Murray 58, 55
Hagea alsinifolia Biv. 83
Halimione portulacoides (L.) Aellen 105
Halocnemum strobilaceum (Pall.) M. Bieb. 108, 109, 386
Halogeton alopecuroides (Delile) Moq. 129
 var. **papillosus** Maire 129
 var. **papillosus** Eig 129
Halogeton tetrandrus (Forssk.) Moq. 120
Halopeplis amplexicaulis (Vahl) Ung.-Sternb. ex Ces. 107, 109
Halopeplis perfoliata (Forssk.) Bunge ex Asch. 107, 109
Haloxyton articulatum (Cav.) Bunge 124
Haloxyton negevensis (Iljin & Zohary) Boulos 124
Haloxyton persicum Bunge 123, 128
Haloxyton salicornicum (Moq.) Bunge ex Boiss. 124, 128, 387
Haloxyton schweinfurthii Asch. 124
Haloxyton scoparium Pomel 124
Hammada articulatum (Cav.) Bunge 124
Hammada elegans (Bunge) Botsch. 124
Hammada negevensis Iljin & Zohary 124
Hammada salicornica (Moq.) Iljin 124
Hammada scoparia (Pomel) Iljin 124
Hedysarum coronarium L. 338
Hedysarum crista-galli L. 338
Hedysarum lappaceum Forssk. 337
Hedysarum pallens (Moris) Halácsy 337
Hedysarum ptolemaicum Delile 338
Hedysarum spinosissimum L. 337, 339
 subsp. **spinosissimum** 337
Herniaria cinerea DC. 84, 85
Herniaria cyrenaica F. Herm. 84
Herniaria diandra Bunge 84
Herniaria fontanesii J. Gay 86, 85
Herniaria glabra L. 86
Herniaria hemistemon J. Gay 86, 85, 383
Herniaria hirsuta L. 84, 383
 subsp. **cinerea** (DC.) Cout. 84
Herniaria incana Lam. 84
 subsp. **cyrenaica** (F. Herm.) Maire & Weiller 84
Herniaria virescens DC. 84
Hesperis acris Forssk. 209
Hesperis africana L. 190
Hesperis crenulata DC. 190
Hesperis nitens Viv. 224
Hesperis pygmaea DC. 188
Hesperis verna L. 194
Heuchera dichotoma Murray 243
Hippocrepis areolata Desv. 305, 304
Hippocrepis bicontorta Loisel. 305
Hippocrepis biflora Spreng. 303
Hippocrepis bisiliqua Forssk. 303
Hippocrepis constricta Kunze 303, 304

Hippocrepis cornigera Boiss. 305
Hippocrepis cyclocarpa Murb. 305, 304
Hippocrepis multisiliquosa L. 305, 304
Hippocrepis unisiliquosa L. 303, 304
 subsp. *biflora* (Spreng.) O. Bolòs & Vigo 303
 subsp. **bisiliqua** (Forssk.) Bornm. 303
 subsp. **unisiliquosa** 303
Holosteum glutinosum (M. Bieb.) Fisch. & C. A. Mey. 77
Holosteum umbellatum L. 77, 79
 subsp. **glutiniosum** (M. Bieb.) Nyman 77
Hussonia pinnata (Viv.) Jafri 215
Hussonia uncatata Boiss. 214
Hymenocarpus circinnatus (L.) Savi 290, 294
Hymenocarpus nummularis (DC.) G. Don 290
Hymenolobus procumbens (L.) Nutt. ex Torr. & A. Grey 230, 228
Hypocoum aegyptiacum (Forssk.) Asch. & Schweinf. 170, 169
Hypocoum aequilobum Viv. 168
Hypocoum deuteroparviflorum Fedde 168
Hypocoum dimidiatum Delile 168
Hypocoum geslinii Coss. & Kralik 168
Hypocoum glaucescens Guss. 170
Hypocoum grandiflorum Benth. 170
Hypocoum imberbe Sm. 170
Hypocoum littorale Wulfen 168
Hypocoum parviflorum Kar. & Kir. 167
Hypocoum pendulum L. 167, 169
Hypocoum ponticum Velen 168
Hypocoum procumbens L. 168, 169
 subsp. **procumbens** 168
Hypocoum tetragonum Bertol. 167
Hyperanthera peregrina Forssk. 238
Hypericum crispum L. 156
Hypericum lanuginosum Lam. 156, 159
Hypericum sinaicum Hochst. & Steud. 156, 159
Hypericum triquetrifolium Turra 156, 159
Illecebrum arabicum L. 87
Illecebrum capitatum L. 88
Indigofera anabaptista Baker 309
Indigofera arabica Jaub. & Spach 309, 311
Indigofera arabica, sensu Baker 310
Indigofera arenaria A. Rich. 309
 var. *strigosa* N. Terrac. 312
Indigofera argentea Burm. f. 312
Indigofera articulata Gouan. 313, 311
Indigofera coerulea Roxb. 313
 var. **coerulea** 313, 311
Indigofera colutea (Burm. f.) Merr. 310, 311
Indigofera cordifolia Roth 310, 311
Indigofera desodioides Baker 312
Indigofera glauca Lam. 313
Indigofera hochstetteri Baker 309, 311
Indigofera leptocarpa Hochst. & Steud. ex Balf. f. 314
Indigofera lotoides Lam. 312
Indigofera lotononoides Baker f. 309
Indigofera multifoliolata De Wild. 310
Indigofera oblongifolia Forssk. 312
Indigofera ornithopodioides Jaub. & Spach 309
Indigofera paucifolia Delile 312
Indigofera semhaënsis Vierh. 309
Indigofera semitrijuga Forssk. 312
 var. *tetrasperma* DC. 312
Indigofera sessiliflora DC. 310
Indigofera spiniflora Boiss. 312
Indigofera spinosa Forssk. 310, 311, 396
 var. *spiniflora* (Boiss.) Schweinf. 312
Indigofera subulata Vahl ex Poir. 313
 var. *nubica* J. B. Gillett 313
Indigofera tenuisiliqua Schweinf. 314
Indigofera tinctoria, sensu Forssk. 313
Indigofera tribuloides Boiss. 310
Indigofera trigonelloides, sensu Baker 310
Indigofera trita L. f. 313
 subsp. **subulata** (Vahl ex Poir.) Ali 313
 var. **nubica** (J. B. Gillett) Boulos & Schrire 313, 311
Indigofera tritoides Baker 314
Indigofera viscosa Lam. 310
Iresine javanica Burm. f. 137
Isatis aegyptiaca L. 195
Isatis aleppica Scop. 195
Isatis lusitanica L. 195, 198
Isatis microcarpa J. Gay ex Boiss. 195
Juniperus phoenicea L. 10, 12, 378
Kochia eriophora Schrad. 106
Kochia indica Wight 107
Kochia latifolia Fresen. 106
Kochia muricata (L.) Schrad. 106
Kochia scoparia (L.) Schrad. 107
 subsp. *indica* (Wight) Aellen 107
Koniga arabica Boiss. 208
Koniga libyca (Viv.) R. Br. 208
Koniga maritima (L.) R. Br. 208
Krascheninnikovia ceratoides Gueldenst. 105, 109
Lagonychium farctum (Banks & Sol.) Bobrov 364
Lathyrus affinis Guss. 349
Lathyrus amoenus Fenzl 350
Lathyrus annuus L. 350, 351
 var. *hierosolymitanus* (Boiss.) Post 350
Lathyrus aphaca L. 349, 351
Lathyrus chius Boiss. & Orph. 350
Lathyrus cicera L. 352
 var. *lineatus* Post 352
Lathyrus floribundus Velen. 349
Lathyrus gorgonei Parl. 350
 var. **gorgonei** 352, 351
 var. *lineatus* Plitm. 352
 var. *lineatus* (Post) C. C. Towns. 352, 351
Lathyrus hierosolymitanus Boiss. 350
Lathyrus hirsutus L. 349, 351
Lathyrus marmoratus Boiss. & Blanche 352.

- 351
Lathyrus polyanthus Boiss. & Blanche 349
Lathyrus pseudoaphaca Boiss. 349
Lathyrus pseudocicera Pamp. 352
Lathyrus sativus L. 352, 351
Lathyrus setifolius L. 350, 351
Lathyrus sphaericus Retz. 350, 351
Lathyrus stenophyllus (Boiss.) Gand. 352
LEGUMINOSAE 249
Leontice leontopetalum L. 151, 154
 subsp. *leontopetalum* 151
Lepidium aucheri Boiss. 226, 228
Lepidium didymum L. 227
Lepidium draba L. 226, 228
Lepidium latifolium L. 225
Lepidium procumbens L. 230
Lepidium sativum L. 225, 228
 subsp. *sativum* 226
 subsp. *spinescens* (DC.) Thell. 226
Lepidium spinescens DC. 226
Lepidium squamatum Forssk. 227
Leptaleum filifolium (Willd.) DC. 202, 198
Limeum indicum T. Anderson 40
Limeum obovatum Vicary 40, 42
Lobularia arabica (Boiss.) Muschl. 208, 206
Lobularia libyca (Viv.) C. F. W. Meissn. 208, 206
Lobularia maritima (L.) Desv. 208, 206
Loeflingia hispanica L. 86, 91
LORANTHACEAE 21
Loranthus acaciae Zucc. 21
Loranthus arabicus Defl. 21
Loranthus curviflorus Benth. ex Oliv. 21
Loranthus faurotii Franch. 21
Lotononis persica (Jaub. & Spach) Boiss. 257
Lotononis platycarpa (Viv.) Pic. Serm. 257, 261
Lotus allionii Desv. 293
Lotus angustissimus L. 296, 299
Lotus arabicus L. 296, 299
 var. *glabrescens* Schweinf. 297
Lotus argenteus Webb & Berthel. 293
Lotus carmeli Boiss. 295
Lotus commutatus Guss. 292
Lotus corniculatus L. 295
 subsp. *tenuifolius* (L.) E. Fourn. 295
 subsp. *tenuis* (Willd.) Berher 295
Lotus creticus L. 292
Lotus cytisoides L. 292, 294
Lotus decumbens Poir. 295
Lotus deserti Täckh. & Boulos 297
Lotus edulis L. 292
Lotus ehrenbergii Schweinf. ex Vierh. 298
Lotus glaber Mill. 295, 299
Lotus glinoides Delile 298, 299
Lotus halophilus Boiss. & Spruner 293, 294
Lotus hebranicus Hochst. ex Brand 297, 299, 396
Lotus lalambensis Schweinf. 297, 299
Lotus lamprocarpus Boiss. 296
Lotus lanuginosus Vent. 296, 299
Lotus mossamedensis Baker 296
Lotus nubicus Baker 298, 299
Lotus ornithopodioides L. 293, 294
Lotus palaestinus Boiss. 298
Lotus palustris Willd. 296, 299
 var. *glaberrimus* (Asch. & Schweinf.) Täckh. & Boulos 296
Lotus patens C. Presl 293
Lotus pedunculatus Cav. 295
Lotus peregrinus L. 295, 294
Lotus platycarpus Viv. 257
Lotus polyphyllus E. D. Clarke 293, 294
Lotus prostratus Desf. 292
Lotus purpureus Moench 300
 var. *palaestinus* (Boiss.) Post 300
Lotus pusillus Viv. 293
Lotus roseus Forssk. 296
Lotus salzmannii Boiss. & Reut. 292
Lotus schimperi Steud. ex Boiss. 298
Lotus tenuifolius Rchb. 295
Lotus tenuis Willd. 295
Lotus tetragonolobus L. 298, 299
Lotus trigonelloides Webb 298
Lotus uliginosus Schkuhr 295
Lotus villosus Forssk. 293
Lunaria libyca Viv. 208
Lunaria parviflora Delile 221
Lupinus albus L. 257
Lupinus angustifolius L. 256, 255
Lupinus digitatus Forssk. 256, 255
Lupinus leucospermus Boiss. & Reut. 256
Lupinus palaestinus Boiss. 256
Lupinus termis Forssk. 257
Lupinus varius L. 256
 subsp. *orientalis*, sensu Täckh. 256
Lygos raetam (Forssk.) Heywood 258
Maerua arabica J. F. Gmel. 176
Maerua crassifolia Forssk. 176, 175, 390
Maerua oblongifolia (Forssk.) A. Rich. 176, 175
Maerua scbelensis Chiov. 176
Maerua uniflora Vahl 176
Maerua virgata Gilg 176
Malcolmia aculeolata (Boiss.) Boiss. 191
Malcolmia aegyptiaca Spreng. 196
Malcolmia africana (L.) R. Br. 190, 189
Malcolmia calycina Sennen 190
Malcolmia confusa Boiss. 188
Malcolmia crenulata (DC.) Boiss. 190
Malcolmia nana (DC.) Boiss. 188, 189
Malcolmia pygmaea (DC.) Boiss. 188
Malcolmia pyramidum C. Presl 196
Malcolmia torulosa (Desf.) Boiss. 190
 var. *leiocarpa* Boiss. 191
Maresia crenulata (DC.) Dvorák 190
Maresia nana (DC.) Batt. 188
Maresia pygmaea (DC.) O. E. Schulz 188

- Marsilea aegyptiaca** Willd. 8, 9, 377
Marsilea capensis A. Braun 8, 9
Marsilea minuta L. 8
Marsilea pubescens Ten. 8
Marsilea strigosa Willd. 8, 9
 MARSILEACEAE 7
Matthiola arabica Boiss. 200, 198
Matthiola bicornis (Sm.) DC. 201
Matthiola elliptica DC. 199
Matthiola fruticulosa (L.) Maire 200
Matthiola humilis DC. 201
Matthiola linearis Delile 197
Matthiola livida (Delile) DC. 201
Matthiola longipetala (Vent.) DC. 201, 392
 subsp. *aspera*, sensu Täckh. 201
 subsp. *bicornis* (Sm.) P. W. Ball 201
 subsp. *hirta* (Conti) Greuter & Burdet 201
 subsp. *livida* (Delile) Maire 201
 subsp. *longipetala* 201
 subsp. *pumilio*, sensu Täckh. 201
Matthiola oxyceras DC. 201
Matthiola parviflora (Schousb.) R. Br. 200
Matthiola prostrata Hochst. & Steud. ex Steud. 203
Matthiola pumilio (Sm.) DC. 201
 subsp. *hirta* Conti 201
Matthiola stenopetala Pomel 200
Matthiola arabica Velen. 200
Medicago arabica (L.) Huds. 270
Medicago arenaria Ten. 271
Medicago aschersoniana Urb. 274
Medicago ciliaris (L.) All. 272
Medicago circinnata L. 290
Medicago coronata (L.) Bartal. 269, 273
Medicago cylindracea DC. 271
Medicago denticulata Willd. 269
Medicago depressa Jord. 272
Medicago galilaea Boiss. 271
Medicago gerardii Willd. 272
Medicago granadensis Willd. 271
Medicago hirsuta (L.) All. 274
Medicago hypogaea E. Small 276, 273
Medicago intertexta (L.) Mill. 272
 var. *ciliaris* (L.) Heyn 272
Medicago laciniata (L.) All. 274
Medicago laciniata (L.) Mill. 274
 var. *brachyacantha* Boiss. 274, 273
 var. *laciniata* 274
Medicago littoralis Rohde ex Loisel. 271, 273
Medicago lupulina L. 269, 273
Medicago maculata Willd. 270
Medicago marginata Willd. 269
Medicago marina L. 268, 273
Medicago minima (L.) Bartal. 274
Medicago minima (L.) L. 274
Medicago monspeliaca (L.) Trautv. 275, 273
Medicago nigra Krock. 269
Medicago orbicularis (L.) Bartal. 269, 273
Medicago polyceratia (L.) Trautv. 275, 273
Medicago polymorpha L. 269, 273
 var. *arabica* L. 270
 var. *brevispina* (Benth. emend. Heyn) Heyn 270
 var. *ciliaris* L. 272
 var. *coronata* L. 269
 var. *laciniata* L. 274
 var. *minima* L. 274
 var. *orbicularis* L. 269
 var. **polymorpha** 270
 var. *tuberculata* Retz. 272
 var. *turbinata* L. 272
 var. *vulgaris* (Benth.) Shinnars 270
Medicago rigidula (L.) All. 272
Medicago sativa L. 275
 subsp. *sativa* 275
Medicago spinulosa DC. 272
Medicago tribuloides Desr. 271
Medicago truncatula Gaertn. 271, 273
Medicago tuberculata (Retz.) Willd. 272
Medicago turbinata (L.) All. 272
Medicago uncinata Willd. 271
Melilotus albus Medik. 277, 279
Melilotus argutus Rchb. 277
Melilotus bonplandii Ten. 278
Melilotus elegans Salzm. ex Ser. 278, 279
Melilotus indicus (L.) All. 278, 279
Melilotus messanensis (L.) All. 277, 279
Melilotus parviflorus Desf. 278
Melilotus segetalis (Brot.) Ser. 277, 279
Melilotus serratifolius Täckh. & Boulos 278
Melilotus siculus (Vitman) B. D. Jacks. 277
Melilotus sulcatus Desf. 277, 279
 subsp. *segetalis* (Brot.) P. Fourn. 277
Melilotus tommasinii Jord. 278
 MENISPERMACEAE 151
Mesembryanthemum crystallinum L. 45, 47, 380
Mesembryanthemum forsskaolii Hochst. ex Boiss. 45, 47, 381
Mesembryanthemum nodiflorum L. 45, 47
Microcharis tritoides (Baker) Schrire 314
 subsp. *tritoides* 314
Mimosa arabica Lam. 368
Mimosa asak Forssk. 366
Mimosa cinerea L. 372
Mimosa farcta Banks & Sol. 364
Mimosa flava Forssk. 371
Mimosa glomerata Forssk. 372
Mimosa mellifera Vahl 365
Mimosa nilotica L. 368
Mimosa nutans Pers. 372
Mimosa oerfota Forssk. 369
Mimosa pigra L. 364, 363
Mimosa polyacantha Willd. 364
Mimosa tortilis Forssk. 366
Minuartia geniculata (Poir.) Thell. 73, 74
Minuartia hybrida (Vill.) Schischk. 75, 74
 subsp. *hybrida* 75

- Minuartia mediterranea** (Ledeb.) K. Maly 75, 74
Minuartia meyeri (Boiss.) Bornm. 73
Minuartia picta (Sibth. & Sm.) Bornm. 73, 74
 var. **picta** 73
 var. **sinaica** (Boiss.) Bornm. 73
Minuartia procumbens (Vahl) Graebn. 73
Minuartia sinaica (Boiss.) Danin 73
Minuartia tenuifolia (L.) Hiern 75
Minuartia tenuifolia 75
 subsp. **hybrida** (Vill.) Mattf. 75
Mnemosilla aegyptiaca Forssk. 170
 MOLLUGINACEAE 39
Mollugo cerviana (L.) Ser. 41, 42
Mollugo glinus A. Rich. 41
Mollugo hirta Thunb. 41
Mollugo nudicaulis Lam. 43, 42
Mollugo tetraphylla L. 82
 MORACEAE 14
Morettia asperima Boiss. 199
Morettia canescens Boiss. 197, 198
Morettia parviflora Boiss. 199
Morettia philaeana (Delile) DC. 199, 198
Moricandia clavata Boiss. & Reut. 224
Moricandia dumosa Boiss. 224
Moricandia nitens (Viv.) Durand & Barratte 224, 222
Moricandia sinaica (Boiss.) Boiss. 223, 222
Moringa aptera Gaertn. 238
Moringa arabica Pers. 238
Moringa peregrina (Forssk.) Fiori 238, 241
 MORINGACEAE 238
Myagrurn aegyptium L. 217
Myagrurn rugosum L. 217
Nasturtiopsis arabica Boiss. 187
Nasturtiopsis coronopifolia (Desf.) Boiss. 187, 189
 subsp. **arabica** (Boiss.) Greuter & Burdet 187
 var. **arabica** (Boiss.) O. E. Schulz 187
Nasturtium fontanum Asch. 192
Nasturtium indicum (L.) DC. 193
Nasturtium niloticum Boiss. 193
Nasturtium officinale R. Br. 192, 189
Nasturtium palustre (L.) DC. 193
Neotorularia aculeolata (Boiss.) Hedge & J. Léonard 191
Neotorularia torulosa (Desf.) Hedge & J. Léonard 190, 189
 var. **scorpiuroides** (Boiss.) Hedge & J. Léonard 191
 var. **torulosa** 191
Neslia apiculata Fisch. 204, 206
Neurada procumbens L. 249, 248, 394
 NEURADACEAE 249
Nieuhria oblongifolia (Forssk.) DC. 176
Nigella arvensis L. 148, 149
 subsp. **taubertii** (Brand) Maire 148
 var. **arabica** (Boiss.) Zohary 148
Nigella assyriaca (Boiss.) Boiss. 148
Nigella deserti Boiss. 148
Nigella sativa L. 148, 149
Nigella taubertii Brand 148
Noaea mucronata (Forssk.) Asch. & Schweinf. 125, 128
Noaea spinosissima (L. f.) Moq. 125
Notholaena vellea (Aiton) R. Br. 5
Notoceras bicorne (Aiton) Amo 202, 198
Notoceras canariensis R. Br. 202
 NYCTAGINACEAE 35
Nymphaea caerulea Savigny 152, 154
Nymphaea lotus L. 152, 154
Nymphaea stellata Willd. 152
 NYMPHAEACEAE 152
Obione coriacea (Forssk.) Moq. 103
Obione portulacoides (L.) Moq. 105
Ochradenus baccatus Delile 231, 235, 394
Ochthodium aegyptiacum (L.) DC. 195, 198
Oldenlandia dichotoma (Murray) Spreng. 243
Oldenlandia digyna Retz. 243
Oldenlandia pentandra Retz. 243
Oligomeris glaucescens Cambess. 237
Oligomeris linifolia (Vahl ex Hornem.) J. F. Macbr. 237, 235, 394
Oligomeris subulata (Delile) Webb 237
Onobrychis crista-galli (L.) Lam. 338, 339
Onobrychis lanata Boiss. 338
Onobrychis ligulifera Pau 340
Onobrychis olivieri Boiss. 338
Onobrychis ptolemaica (Delile) DC. 338, 339, 399
Ononis diffusa Ten. 262
Ononis glaucescens Pomel 262
Ononis marmorata Murb. 262
Ononis mitissima L. 262, 261
Ononis natrix L. 260, 261
 subsp. **natrix** 260
 subsp. **stenophylla** (Boiss.) Sirj. 260
 var. **stenophylla** Boiss. 260
Ononis pubescens L. 262
Ononis reclinata L. 260, 261, 395
Ononis serrata Forssk. 262
Ononis sicula Guss. 260, 261
Ononis vaginalis Vahl 260, 261, 395
Ononis variegata L. 262
Ononis vestita Viv. 260
Onychium divaricatum (Poir.) Alston 6, 9, 377
Onychium melanolepis (Decne.) Kunze 6
 OPHIOGLOSSACEAE 2
Ophioglossum polyphyllum A. Braun 3, 4
Opophytum forsskaolii (Boiss.) N. E. Br. 45
Ornithopus repandus Poir. 301
Ornithopus scorpioides L. 301
Orygia decumbens Forssk. 43
 OXALIDACEAE 373
Oxalis abyssinica Turcz. 375
Oxalis anthelmintica A. Rich. 375, 374

- Oxalis cernua* Thunb. 375
Oxalis corniculata L. 375, 374, 400
Oxalis pes-caprae L. 375, 374
Oxalis repens Thunb. 375
Oxalis caprina L. 375
 var. *abyssinica* (Turcz.) Oliv. 375
Oxalis villosa M. Bieb. 375
Oxygonum atriplicifolium (Meisn.) Martelli 25, 23
 var. *sinuatum* (Meisn.) Baker 25
Oxygonum sinuatum (Meisn.) Dammer 25, 23
Oxygonum somalense Chiov. 25
Papaver apulum Ten. 158
 var. *gracillimum* Fedde 158
Papaver argemone L. 158, 159
Papaver decaisnei Hochst. & Steud. ex Elkan 160, 159
Papaver divergens Fedde & Bornm. 158
Papaver dubium L. 160
 subsp. *dubium* 160
Papaver hispidum Lam. 158
Papaver humile Fedde 160, 159
Papaver hybridum L. 158, 159
Papaver macrostomum Boiss. & A. Huet 158
Papaver rhoeas L. 160, 159
Papaver siculum Guss. 158
 PAPAVERACEAE 157
Parietaria alsinifolia Delile 18, 19
Parietaria debilis G. Forster 18, 19
Parietaria diffusa Mert. & W. D. J. Koch 18
Parietaria judaica L. 18, 19
Parietaria punctata Willd. 18
Paronychia arabica (L.) DC. 87, 91, 384
 subsp. *annua* (Delile) Chaudhri 87
 subsp. *arabica* 87
 subsp. *longiseta* Batt. 87
Paronychia argentea Lam. 88, 91
Paronychia capitata (L.) Lam. 88
Paronychia desertorum Boiss. 87
Paronychia flavescens Boiss. 88
Paronychia nivea DC. 88
Paronychia sclerocephala Decne. 89
Paronychia sinaica Fresen. 88, 383
Persicaria decipiens (R. Br.) K. L. Wilson 26
Persicaria dolichopoda (Ohki) Sasaki 26
Persicaria lanigera (R. Br.) Soják 27, 29
Persicaria lapathifolia (L.) Gray 27, 29
Persicaria limbata (Meisn.) Hara 27
Persicaria maculosa Gray 26
Persicaria obtusifolia (Täckh. & Boulos) Greuter & Burdet 26
Persicaria salicifolia (Brouss. ex Willd.) Assenov 26, 29, 379
Persicaria senegalensis (Meisn.) Soják 27, 29
Petrorhagia arabica (Boiss.) P. W. Ball & Heywood 54, 55
Petrorhagia illyrica (Ard.) P. W. Ball & Heywood 54, 55
 subsp. *angustifolia* (Poir.) P. W. Ball & Heywood 54
Phaca vogelii Webb 329
Pharnaceum cerviana L. 41
Pharnaceum umbellatum Forssk. 41
Physanthyllis tetraphylla (L.) Boiss. 290
Pirazzia elliptica (DC.) Chiov. 199
Pisum arvense L. 353
 subsp. *humile* Holmboë 354
Pisum biflorum Raf. 353
Pisum elatius M. Bieb. 353
Pisum fulvum Sm. 353, 357
Pisum oleraceum Lam. 353
Pisum sativum L. 353
 subsp. *elatius* (M. Bieb.) Asch. & Graebn. 353, 357
 subsp. *humile* (Holmboe) Greuter *et al.* 354
 subsp. *pumilio* (Meikle) Ponert 354
 subsp. *sativum* 353
Plicosepalus acaciae (Zucc.) Wiens & Polhill 21, 23
Plicosepalus curviflorus (Benth. ex Oliv.) Tiegh. 21, 23, 378
 PODOSTEMACEAE 372
Pogonostigma abyssinicum Jaub. & Spach 315
Pogonostigma nubicum Boiss. 315
Poinciana elata L. 362
Polycarpaea confusa Maire 82
Polycarpaea corymbosa (L.) Lam. 81
Polycarpaea fragilis Delile 81
Polycarpaea memphitica Delile 83
Polycarpaea repens (Forssk.) Asch. & Schweinf. 81, 85
Polycarpaea robbairea (Kuntze) Greuter & Burdet 82, 85
Polycarpaea spicata Wight ex Arn. 81, 85
Polycarpon alsinifolium (Biv.) DC. 83
Polycarpon arabicum Boiss. 83
Polycarpon floribundum Willk. 83
Polycarpon prostratum (Forssk.) Asch. & Schweinf. 83, 85
Polycarpon robbairea Kuntze 82
Polycarpon succulentum (Delile) J. Gay 83, 85, 382
Polycarpon tetraphyllum (L.) L. 82, 85
 var. *alsinifolium* (Biv.) Ball 83
 var. *tetraphyllum* 83
 var. *verticillatum* Fenzl 83
 POLYGONACEAE 21
Polygonum arenastrum Boreau 28
Polygonum aviculare L. 28, 29
Polygonum bellardii All. 28, 29
Polygonum convolvulus L. 30
Polygonum decipiens R. Br. 26
Polygonum equisetiforme Sm. 30, 29
Polygonum herniarioides Spreng. 28
Polygonum lanigerum R. Br. 27
Polygonum lapathifolium L. 27
Polygonum limbatum Meisn. 27

- Polygonum maritimum** L. 30, 29
Polygonum obtusifolium Täckh. & Boulos 26
Polygonum owenii Bojer 25
Polygonum patulum auct. 28
Polygonum persicaria L. 26
Polygonum plebeium R. Br. 28
Polygonum salicifolium Brouss. ex Willd. 26
Polygonum senegalense Meisn. 27
Polygonum serrulatum Lag. 26
Polygonum tomentosum Schrank 27
Polypodium leptophyllum L. 3
Polypodium pteridioides Reichard 5
Populus euphratica Oliv. 14, 15
Portulaca oleracea L. 49, 381
 subsp. *nitida* Danin & H. G. Baker 50
 subsp. *oleracea* 50
 subsp. *stellata* Danin & H.G. Baker 50
PORTULACACEAE 49
Potentilla supina L. 246, 248
Poterium verrucosum Link ex G. Don 246
Prosopis farcta (Banks & Sol.) Macbr. 364, 363
Prosopis stephaniana (M. Bieb.) Spreng. 364
Pseuderucaria clavata (Boiss. & Reut.) O. E. Schulz 224, 228
 subsp. *clavata* 224
Pseuderucaria teretifolia (Desf.) O. E. Schulz 224
Psilonema homalocarpum Fisch. & C. A. Mey. 207
Psilostachys gnaphalobryum Hochst. 139
Psilotrichum cordatum Moq. 139
Psilotrichum gnaphalobryum (Hochst.) Schinz 139, 141
Psoralea bituminosa L. 305
Psoralea flaccida Nábelek 308
Psoralea odorata Blatt. & Halb. 305
Psoralea palaestina Gouan 305
Psoralea plicata Delile 305
Pteranthus dichotomus Forssk. 90, 91
Pteranthus echinatus Desf. 90
Pteranthus trigynus Caball. 90
Pupalia distantiflora A. Rich. 138
Pupalia lappacea (L.) Juss. 138, 141
 var. *velutina* (Moq.) Hook f. 138
Pupalia velutina Moq. 138
Randonia africana Coss. 232, 235
RANUNCULACEAE 142
Ranunculus arvensis L. 147, 146
Ranunculus aschersonii Freyn 144
Ranunculus asiaticus L. 144, 146, 388
 subsp. *latilobus* Vierh. 144
 subsp. *tenuilobus* (Boiss.) Vierh. 144
Ranunculus bulbosus L. 144
Ranunculus fucoides Freyn 143
Ranunculus graecus Griseb. 145
Ranunculus guilelmi-jordanii Asch. 145
Ranunculus hierosolymitanus Boiss. 145
Ranunculus marginatus d'Urv. 145, 146
Ranunculus millefolius Banks & Sol. 145
 subsp. *hierosolymitanus* (Boiss.) P. H. Davis 145, 146
Ranunculus muricatus L. 145, 146
Ranunculus peltatus Schrank 143
 subsp. *fucoides* (Freyn) Muñoz Garm. 143
 subsp. *sphaerospermus* (Boiss. & Blanche) Meikle 144, 146
Ranunculus rionii Lagger 144, 146
Ranunculus saniculifolius Viv. 143
Ranunculus sceleratus L. 145, 146
Ranunculus sphaerospermus Boiss. & Blanche 144
Ranunculus trachycarpus Fisch. & C. A. Mey. 145
Ranunculus trichophyllus Chaix 144
 var. *rionii* (Lagger) Rikli 144
Raphanus lyratus Forssk. 219
Raphanus pinnatus Viv. 214
Raphanus pterocarpus Pers. 220
Raphanus raphanistrum L. 220, 222
 subsp. *raphanistrum* 220
Rapistrum orientale (L.) Crantz 217
Rapistrum rugosum (L.) All. 217, 216
Reseda alba L. 233
 subsp. *decursiva* (Forssk.) Maire 233
Reseda arabica Boiss. 234, 235
Reseda boissieri Müll. Arg. 234
Reseda cahirina Müll. Arg. 234
Reseda crispa Link 233
Reseda decursiva Forssk. 233, 235
Reseda gussonei Boiss. & Reut. 233
Reseda hexagyna Forssk. 237
Reseda linifolia Vahl ex Hornem. 237
Reseda lutea L. 233
Reseda luteola L. 233, 235
Reseda macrosperma Reichb. 234
 var. *orientalis* Müll. Arg. 234
Reseda maris-mortui Eig 234
Reseda muricata C. Presl 236
Reseda orientalis (Müll. Arg.) Boiss. 234, 235
Reseda pampaniniana Maire & Weiller 234
Reseda patzakiana Rech. f. 236
Reseda petrovichiana Müll. Arg. 233
Reseda phyteuma L. 236
Reseda pruinosa Delile 236, 235, 393
Reseda stenostachya Boiss. 236
Reseda subulata Delile 237
Reseda urnigera Webb 234
RESEDACEAE 231
Retama bovei (Spach) Webb 259
Retama duriaei (Spach) Webb 258
Retama monosperma (L.) Boiss. 259
 subsp. *bovei* (Spach) Maire 259
Retama raetam (Forssk.) Webb & Berthel. 258, 261, 395
 subsp. *raetam* 258
Rhodalsine geniculata (Poir) F. N. Williams 73
Rhynchosia elachistantha Chiov. 358

- Rhynchosia flavissima* Baker 358
Rhynchosia malacophylla (Spreng.) Bojer 358, 357
Rhynchosia memnonia (Delile) DC. 356
 forma *pulverulenta* (Stocks) Terracc. 356
Rhynchosia minima (L.) DC. 356
 var. *memnonia* (Delile) Cooke 356, 357
 var. *minima* 356
Rhynchosia pulverulenta Stocks 356, 357
Rhynchosia sennaarensis Schweinf. 358
Ricotia lunaria (L.) DC. 205, 206
Robbairea confusa Maire 82
Robbairea delileana Milne-Redh. 82
Robbairea major (Asch. & Schweinf.) Botsch. 82
Robeschia schimperii (Boiss.) O. E. Schulz 187, 189
Rocama prostrata Forssk. 49
Roemeria dodecandra (Forssk.) Stapf 161
Roemeria hybrida (L.) DC. 161, 163
 subsp. *dodecandra* (Forssk.) Maire 161
 subsp. *hybrida* 161
Roemeria orientalis Boiss. 161
Roemeria tenuifolia Pamp. 161
Rokejeka capillaris Forssk. 57
Roridula droserifolia Forssk. 177
Rorippa indica (L.) Hiern 193
Rorippa integrifolia Boulos 193
Rorippa islandica, sensu Täckh. 193
Rorippa nasturtium-aquaticum (L.) Hayek 192
Rorippa palustris (L.) Besser 193, 198
Rosa arabica Crép. 245
 ROSACEAE 244
Rosularia lineata (Boiss.) A. Berger 239, 241
Rubus sanctus Schreb. 245, 248
Rumex aegyptiacus L. 31, 33
Rumex bucephalophorus L. 34, 33
Rumex comosus Forssk. 31
Rumex crispus L. 32, 33
Rumex cyprius Murb. 34, 33
Rumex dentatus L. 31, 33
 subsp. *dentatus* 32
 subsp. *mesopotamicus* Rech. f. 32
 var. *pleiodon* Boiss. 32
Rumex lacerus Balb. 32
Rumex pictus Forssk. 32, 33
Rumex pulcher L. 32, 33
Rumex roseus Campd. 34
Rumex simpliciflorus Murb. 34, 33
Rumex spinosus L. 24
Rumex vesicarius L. 34, 33, 380
Sagina apelata Ard. 71
Sagina ciliata Fries 71
Sagina reuteri Boiss. 71
 SALICACEAE 13
Salicornia amplexicaulis Vahl 107
Salicornia cruciata Forssk. 108
Salicornia europaea L. 110, 109
 var. *fruticosa* 110
Salicornia fruticosa (L.) L. 110
Salicornia glauca Delile 108
Salicornia herbacea (L.) L. 110
Salicornia lignosa Woods 111
Salicornia macrostachya Moric. 108
Salicornia obscura P. W. Ball & Tutin 110
Salicornia perennis Mill. 111
Salicornia perfoliata Forssk. 107
Salicornia radicans Sm. 111
Salicornia strobilacea Pall. 108
Salix mucronata Thunb. 13, 15
Salix safsaf Trautv. 13
Salix subserrata Willd. 13
Salix tetrasperma Roxb. 13, 15, 377
Salsola aethiopica Botsch. 120
Salsola alopecuroides Delile 129
Salsola articulata Cav. 124
Salsola articulata Forssk. 126
Salsola baryosma (Roem. & Schult.) Dandy 118
 subsp. *gaetula* (Maire) Freitag 118
Salsola chaudharyi Botsch. 119
Salsola congesta N. E. Br. 120
Salsola cyclophylla Baker 120, 122
Salsola damascena Botsch. 118
Salsola delileana Botsch. 118
Salsola foetida Delile ex Spreng. 118
 var. *gaetula* Maire 118
Salsola forsskaolii Schweinf. 120
Salsola fruticosa (L.) L. 113
Salsola gaetula (Maire) Botsch. 118
Salsola imbricata Forssk. 118
 subsp. *gaetula* (Maire) Boulos 118
 subsp. *imbricata* 118
Salsola inermis Forssk. 119, 122
Salsola kali L. 119, 122
Salsola libyca Botsch. 118
Salsola longifolia Forssk. 121, 122
Salsola mandavillei Botsch. 118
Salsola mollis Desf. 113
Salsola mucronata Forssk. 125
Salsola muricata L. 106
Salsola oppositifolia Desf. 121
Salsola pachoi Volkens & Asch. 120
Salsola palaestina Botsch. 118
Salsola pentandra Botsch. 120
Salsola postii Eig 129
Salsola rosmarinus (Bunge ex Boiss.) Solms 123
Salsola schweinfurthii Solms 121, 122
Salsola sieberi C. Presl 121
Salsola sinaica Brullo 121
Salsola spinescens Moq. 120, 122
Salsola splendens Pourr. 114
Salsola tetragona Delile 120, 122
Salsola tetrandra Forssk. 120
Salsola vermiculata L. 118
 subsp. *villosa* (Schult.) Eig 118
 var. *villosa* (Schult.) Moq. 118

- Salsola villosa** Schult. 118
Salsola volkensii Schweinf. & Asch. 119, 122
Sanguisorba minor Scop. 246
 subsp. **verrucosa** (Link ex G. Don) Holmboe 246, 248
Sanguisorba verrucosa (Link ex G. Don) A. Braun & Bouché 246
 SANTALACEAE 20
Saponaria hirsuta Labill. 56
Saponaria hispanica Mill. 56
Saponaria oxyodonta (Boiss.) Boiss. 56
Sarcocornia fruticosa (L.) A. J. Scott 110, 109, 386
Sarcocornia perennis (Mill.) A. J. Scott 111
Savignya aegyptiaca DC. 221
Savignya parviflora (Delile) Webb 221, 222, 393
Schanginia aegyptiaca (Hasselq.) Aellen 112
Schanginia bacata (Forssk. ex J. F. Gmel.) Moq. 112
Schanginia hortensis (Forssk. ex J. F. Gmel.) Moq. 112
Schimpera arabica Hochst. & Steud. ex Endl. 196, 391
Schimpera persica Boiss. 196
Schouwia arabica DC. 221
Schouwia purpurea (Forssk.) Schweinf. 221, 222, 393
Schouwia schimperi Jaub. & Spach 221
Schouwia thebaica Webb 221
Sclerocephalus arabicus Boiss. 89, 91, 384
Scorpiurus acutifolius Viv. 300
Scorpiurus laevigatus Sm. 300
Scorpiurus muricatus L. 300, 304
 subsp. *laevigatus* (Sm.) Thell. 300
 subsp. *subvillosus* (L.) Thell. 300
 subsp. *sulcatus* (L.) Thell. 300
Scorpiurus subvillosus L. 300
Scorpiurus sulcatus L. 300
Securigera coronilla DC. 302
Securigera securidaca (L.) Degen & Dörfel. 302, 304
Sedum sempervivum, sensu Täckh. 239
Seidlitzia rosmarinus Bunge ex Boiss. 123, 122, 386
Senebiera didyma (L.) Pers. 227
Senebiera nilotica (Delile) DC. 227
Senna alexandrina Mill. 359, 360
Senna holosericea (Fresen.) Greuter 359, 360
Senna italica Mill. 359, 360, 400
Senna occidentalis (L.) Link 361, 360
Senniella spongiosa (F. Muell.) Aellen 100
 var. *holocarpa* (F. Muell.) Aellen 100
Sesbania aegyptiaca Poir. 319
Sesbania pubescens DC. 319
Sesbania sericea (Willd.) Link 319
Sesbania sesban (L.) Merr. 319, 317, 397
Sesuvium sesuvioides (Fenzl) Verdc. 46, 47
Sevada schimperi Moq. 116, 115
Silene aegyptiaca (L.) L. f. 65, 63, 382
Silene affinis Boiss. 66
Silene alexandrina (Asch.) Danin 67
Silene angustifolia Poir. 54
Silene apetala Willd. 67, 69
 var. **alexandrina** Asch. 67
 var. **apetala** 67
Silene arabica Boiss. 66, 69, 382
Silene armeria L. 67
Silene atocioides Boiss. 65
Silene atocion Jacq. 65
Silene behen L. 66, 69
Silene biappendiculata Rohrb. 70, 69
Silene bipartita Desf. 70
 var. *stenophylla* Boiss. 70
Silene burchellii Otth ex DC. 68, 69
 var. **schweinfurthii** (Rohrb.) Täckh. & Boulos 68
Silene calycina Salzm. ex Rohrb. 66
Silene canopica Boiss. 70
Silene colorata Poir. 70
 subsp. *oliveriana* (Otth) Rohrb. 70
 var. **colorata** 70
 var. *oliveriana* (Otth) Muschl. 70
 var. *stenophylla* (Boiss.) Dinsm. 70
Silene coniflora Nees ex Otth 65, 69
Silene conoidea L. 61, 63
Silene fruticosa L. 62, 63
Silene gallica L. 67, 69
Silene hussonii Boiss. 64
Silene ismailitica (Schweinf.) Botsch. 64
Silene leucophylla Boiss. 61, 63
Silene ligulata, sensu Täckh. 68
Silene linearis Decne. 64, 63
Silene longipetala Vent. 65, 63
Silene nocturna L. 68, 69
Silene odontopetala Fenzl 61
 var. **congesta** Boiss. 61
Silene oliveriana Otth 70
Silene oreosinaica Chowdhuri 62, 63
Silene palaestina Boiss. 70, 69
Silene pendula L. 71
Silene pseudoatocion Desf. 65
Silene rubella L. 66, 69
 var. **rubella** 66
Silene schimperiana Boiss. 62, 63
Silene schweinfurthii Rohrb. 68
Silene setacea Viv. 68
 var. *viscida* Boiss. 68
Silene sinaica Boiss. 61
Silene succulenta Forssk. 62, 63, 382
 subsp. **succulenta** 62
Silene tridentata Desf. 66, 69
Silene villosa Forssk. 62, 63
 var. **erecta** Täckh. & Boulos 64
 var. **graveolens** Sickenb. 64
 var. **ismailitica** Schweinf. 64
 var. **villosa** 64
Silene vivianii Steud. 68

subsp. *viscida* (Boiss.) Boulos 68
 subsp. *vivianii* 68
Silene vulgaris (Moench) Gärtcke 61, 63
Sinapis alba L. 213, 216
Sinapis allionii Jacq. 213, 216
Sinapis arvensis L. 213
 subsp. *allionii* (Jacq.) Baillarg. 213
 var. *arvensis* 213
 var. *orientalis* (L.) Koch & Ziz. 213
Sinapis bipinnata Desf. 218
Sinapis eruroides L. 210
Sinapis harra Forssk. 209
Sinapis hispanica L. 215
Sinapis juncea L. 212
Sinapis nigra L. 211
Sinapis orientalis L. 213
Sinapis philaena Delile 199
Sinapis turgida (Pers.) Delile 213
Sisymbrium aculeolatum Boiss. 191
Sisymbrium amphibium L. 193
 var. *palustre* L. 193
Sisymbrium erysimoides Desf. 185, 189
Sisymbrium filifolium Willd. 202
Sisymbrium indicum L. 193
Sisymbrium irio L. 186, 391
Sisymbrium murale L. 210
Sisymbrium nanum DC. 188
Sisymbrium orientale L. 186, 189
Sisymbrium persicum Spreng. 187
Sisymbrium polyceratium L. 186
Sisymbrium pumilum Stephan ex Willd. 191
Sisymbrium runcinatum Lag. ex DC. 186, 189
Sisymbrium schimperii Boiss. 187
Sisymbrium scorpiuroides Boiss. 191
Sisymbrium septulatum DC. 186
Sisymbrium simplex Viv. 210
Sisymbrium sophia L. 187
Sisymbrium torulosum Desf. 190
Sodada decidua Forssk. 171
Spartium bovei Spach 259
Spartium thebaicum Delile 253
Spergula diandra (Guss.) Murb. 80
Spergula fallax (Lowe) E. H. L. Krause 80, 79
Spergula jallui Maire 80
Spergularia atheniensis Asch. 80
Spergularia bocconii (Scheele) Graebn. 80, 79
Spergularia campestris (L.) Asch. 78
Spergularia diandra (Guss.) Boiss. 80, 79
Spergularia fallax Lowe 80
Spergularia flaccida Asch. 80
Spergularia marginata (DC.) Kittel 78
Spergularia marina (L.) Bessler 78, 79
Spergularia marina (L.) Griseb. 78
Spergularia maritima (All.) Chiov. 78
Spergularia media (L.) C. Presl 78, 79
Spergularia radicans C. Presl 78
Spergularia rubra (L.) J. & C. Presl 78
Spergularia salina J. & C. Presl 78

Sphaerocoma hookeri T. Anderson 89, 91
 subsp. *hookeri* 89
 subsp. *intermedia* J. B. Gillett 89
Stellaria media (L.) Vill. 76
 subsp. *pallida* (Dumort.) Asch. & Graebn. 76
Stellaria pallida (Dumort.) Murb. 76, 74
Stellaria pallida (Dumort.) Piré 76
Strigosella africana (L.) Botsch. 190
Suaeda aegyptiaca (Hasselq.) Zohary 112, 115
Suaeda altissima (L.) Pall. 114
Suaeda baccatta Forssk. ex J. F. Gmel. 112
Suaeda fruticosa (L.) Dumort. 113
 subsp. *vera* (Forssk. ex J. F. Gmel.) Maire & Weiller 113
Suaeda fruticosa Forssk. ex J. F. Gmel. 113
Suaeda hortensis Forssk. 112
Suaeda indica (Willd.) Moq. 114
Suaeda maritima (L.) Dumort. 114, 115
Suaeda mesopotamica Eig 113
Suaeda mollis (Desf.) Delile 113
Suaeda monodiana Maire 113
Suaeda monoica Forssk. ex J. F. Gmel. 112, 115, 386
Suaeda palaestina Eig & Zohary 114
Suaeda pruinosa Lange 113
Suaeda rosmarinus Ehrenb. ex Bross. 123
Suaeda salsa (L.) Pall. 114
Suaeda schimperii (Moq.) Martelli 116
Suaeda setigera (DC.) Moq. 114
Suaeda splendens (Pourr.) Gren. & Godr. 114
Suaeda vera Forssk. ex J. F. Gmel. 113, 115
Suaeda vermiculata Forssk. ex J. F. Gmel. 116
 var. *puberula* C. B. Clarke 116
Suaeda vermiculata Forssk. ex J. F. Gmel. 113, 115
Suaeda volkensis C. B. Clarke 113
Subularia purpurea Forssk. 221
Tapinostemma arabicum (Defl.) Tiegh. 21
Taverniera aegyptiaca Boiss. 337, 339, 399
Taverniera lappacea (Forssk.) DC. 337, 339
Telephium imperati L. 43
 subsp. *orientale* (Boiss.) Nyman 43, 42
 var. *orientale* (Boiss.) Boiss. 43
Telephium orientale Boiss. 43
Telephium sphaerospermum Boiss. 44, 42
Tephrosia apollinea (Delile) Link 318
Tephrosia ehrenbergiana Schweinf. 316
Tephrosia incana, sensu Baker 316
Tephrosia kassasii Boulos 318
Tephrosia leptostachya DC. 316
Tephrosia nubica (Boiss.) Baker 315, 317
 subsp. *nubica* 315
 var. *abyssinica* (Jaub. & Spach) Schweinf. 315
Tephrosia petrosa Blatt. & Hallb. 315
Tephrosia purpurea (L.) Pers. 316, 396
 subsp. *apollinea* (Delile) Hosni & El-Karemy 318

- subsp. **leptostachya** (DC.) Brummitt 316, 317
 var. **pubescens** Baker 316
- Tephrosia quartini** Cuf. ex Greuter & Burdet 315, 317
- Tephrosia uniflora** Pers. 315
 subsp. **petrosa** (Blatt. & Hallb.) J. B. Gillett & Ali 315
- Tephrosia vicioides* A. Rich. 315
- Tephrosia villosa** (L.) Pers. 316, 317
 subsp. **ehrenbergiana** (Schweinf.) Brummitt 316
 var. **incana**, sensu Taub. 316
- Tetragonolobus pseudopurpureus* Uechtr. 298
- Tetragonolobus purpureus* Moench 298
- Thesium humile** Vahl 20, 23, 378
 forma **maritima** N. D. Simpson 20
 var. **humile** 20
 var. **maritima** (N. D. Simpson) Sa'ad 20
 var. **maritima** N. D. Simpson, sensu Täckh. 20
- Thlapsi carneum* Banks & Sol. 225
- Thlapsi bursa-pastoris* L. 230
- Tilaea alata* Viv. 239
- Torularia aculeolata* (Boiss.) O. E. Schulz 191
- Torularia torulosa* (Desf.) O. E. Schulz 190
- Traganum nudatum** Delile 116, 115
- Trianthesa decandra* L. 49
- Trianthesa fruticosa* Vahl 88
- Trianthesa monogyna* L. 48
- Trianthesa pentandra* L. 49
- Trianthesa polysperma* Oliv. 46
- Trianthesa portulacastrum** L. 48, 47
- Trianthesa salsoloides*, sensu Täckh. 48
- Trianthesa triquetra** 48, 47
- Trichomanes divaricatum* Poir. 6
- Trifolium alexandrinum** L. 285, 287
- Trifolium angustifolium** L. 288, 287
- Trifolium argutum** Banks & Sol. 284
- Trifolium bicornis* Forssk. 282
- Trifolium campestre** Schreb. 284, 287
- Trifolium ciliatum* Poir. 284
- Trifolium clusii* Gren. & Godr. 282
- Trifolium curvisepalum* Täckh. 283
- Trifolium dasyurum** C. Presl 288, 287
- Trifolium desvauxii* Boiss. & Blanche 289
- Trifolium dichroanthum** Boiss. 288, 287
- Trifolium formosum* d'Urv. 288
- Trifolium fragiferum** L. 281, 287
 subsp. **bonanii** (C. Presl) Soják 281
- Trifolium galilaeum* Boiss. 283
- Trifolium glanduliferum** Boiss. 283
 subsp. **nervulosum** (Boiss. & Heldr.) Ponert 283
 var. **nervulosum** (Boiss. & Heldr.) Zohary 283
- Trifolium glaucescens* Hausskn. 284
- Trifolium incarnatum** L. 286
 var. **incarnatum** 286
- Trifolium lappaceum** L. 285, 287
- Trifolium melilotus-indica* L. 278
- Trifolium messanense* L. 277
- Trifolium moriferum* Boiss. 284
- Trifolium neglectum* C. A. Mey. 281
- Trifolium nervulosum* Boiss. & Heldr. 283
 var. **galilaeum** (Boiss.) Boiss. 283
- Trifolium nigrescens** Viv. 285
 subsp. **petrisavii** (Clem.) Holmboe 285
- Trifolium patens** Schreb. 283
- Trifolium philistaeum** Zohary 284
 var. **philistaeum** 284
- Trifolium procumbens* L. 284
- Trifolium pumilum* Hossain 284
- Trifolium purpureum** Loisel. 288, 287
 var. **desvauxii** (Boiss. & Blanche) Post 289
 var. **purpureum** 289
- Trifolium repens** L. 285
- Trifolium resupinatum** L. 281, 287
 var. **clusii** (Gren. & Godr.) Dinsm. 282
 var. **minus** Boiss. 282
 var. **resupinatum** 282
- Trifolium scabrum** L. 286, 287
- Trifolium segetale* Brot. 277
- Trifolium spadiceum* Thuill. 284
- Trifolium stellatum** L. 286, 287
- Trifolium stenophyllum* Boiss. 284
- Trifolium suaveolens* Willd. 281
- Trifolium tomentosum** L. 282, 287
 var. **chthonocephalum** Bornm. 282
 var. **curvisepalum** (Täckh.) Thiéb. 283
 var. **orientale** Bornm. 283
 var. **tomentosum** 282
- Trifolium velivolium* Paine 288
- Trifolium xerocephalum* Fenzl 284
- Trigonella anguina** Delile 264, 266
- Trigonella arabica** Delile 264, 266, 395
- Trigonella aschersoniana* Urb. 276
- Trigonella berythea** Boiss. & Blanche 264
- Trigonella cylindracea** Desv. 265, 266
- Trigonella glabra* Thunb. 265
- Trigonella hamosa** L. 265, 266
- Trigonella laciniata** L. 265, 266
- Trigonella maritima** Poir. 265, 266
- Trigonella media** Delile 265
- Trigonella monspeliaca* 275
 subsp. **subacaulis** Feinbrun 275
- Trigonella monspeliaca* L. 275
- Trigonella occulta** Ser. 264, 266
- Trigonella pinnatifida* Cav. 275
- Trigonella polyceratia* L. 275
- Trigonella schlumbergeri** Boiss. 267, 266
- Trigonella stellata** Forssk. 264, 266, 396
- Tripodion tetraphyllum* (L.) Fourr. 290
- Tristicha trifaria** (Bory ex Willd.) Spreng. 373, 374
- Tunica angustifolia* (Poir.) Briq. 54
- Tunica arabica* Boiss. 54
- Tunica compressa* (Desf.) Fisch. & C. A. Mey.

- Jmbilicus botryoides** Hochst. ex A. Rich. 240
Jmbilicus horizontalis (Guss.) DC. 242, 241
 var. **horizontalis** 242
 var. **intermedius** (Boiss.) D. F. Chamb. 242
Jmbilicus intermedius Boiss. 242
Jmbilicus lineatus Boiss. 239
Jmbilicus pendulinus DC. 240
 var. **horizontalis** (Guss.) Post 242
 var. **intermedius** (Boiss.) Post 242
Jmbilicus rupestris (Salisb.) Dandy 240, 241
Jrtica pilulifera L. 17, 19
Jrtica urens L. 17, 19
JRTICACEAE 16
Vaccaria hispanica (Mill.) Rauschert. 56, 55,
 381
 subsp. **hispanica** 56
 subsp. **oxyodonta** (Boiss.) Greuter & Burdet
 56
Vaccaria oxyodonta Boiss. 56
Vaccaria pyramidata Medik. 56
Vahlia dichotoma (Murray) Kuntze 243, 241
Vahlia digyna (Retz.) Kuntze 243, 241
Vahlia geminiflora (Delile) Bridson 244, 241
Vahlia ramosissima DC. 244
Vahlia silenoides DC. 243
Vahlia tomentosa DC. 243
Vahlia viscosa Roxb. 244
Vahlia weldenii Rehb. 244
VAHLIACEAE 243
Vella annua L. 221
Vicia agrestis Scheele 346
Vicia amphicarpa L. 344
Vicia angustifolia L. 344
Vicia articulata Hornem. 346
Vicia biflora Desf. 347
Vicia calcarata Desf. 347
Vicia cavanillesii Martinez 343
Vicia ciliaris Sm. 346
Vicia cinerea M. Bieb. 347
Vicia cordata Hoppe 344
Vicia cosentinii Guss. 343
Vicia cuneata Guss. 344
Vicia dasycarpa Ten. 347
Vicia ervilia (L.) Willd. 344, 345
Vicia globosa Retz. 343
Vicia heterophylla C. Presl 344
Vicia hirsuta (L.) Gray 346, 345
Vicia hirta DC. 343
Vicia hybrida L. 348
Vicia laevigata Sm. 343
Vicia leptophylla Raf. 344
Vicia lutea L. 343, 345
Vicia megalosperma M. Bieb. 344
Vicia microphylla d'Urv. 347
Vicia monantha Retz. 347, 345
Vicia multifida Wallr. 346
Vicia narbonensis L. 342, 345
 var. **narbonensis** 342
 var. **serratifolia** (Jacq.) Ser. 342
Vicia notata Gilib. 343
Vicia palaestina Boiss. 248, 345
Vicia parviflora Cav. 346
Vicia peregrina L. 344, 345
Vicia pilosa M. Bieb. 344
Vicia salamina Boiss. 347
Vicia sativa L. 343, 345
 subsp. **amphicarpa** (L.) Batt. 344
 subsp. **cordata** (Hoppe) Batt. 344
 subsp. **nigra** (L.) Ehrh. 344
 subsp. **sativa** 343
 var. **nigra** L. 344
Vicia serratifolia Jacq. 342
Vicia sinaica Boulos 347
Vicia smyrnaea Boiss. 346
Vicia spuria Rafin. 348
Vicia tetrasperma (L.) Schreb. 346, 345
Vicia torulosa Boreau 343
Vicia varia Host 347
Vicia vestita Boiss. 343
Vicia villosa Roth 347
 subsp. **microphylla** (d'Urv.) P. W. Ball 347
 subsp. **varia** (Host) Corb. 347
Vigna luteola (Jacq.) Benth. 355, 357
Vigna membranacea A. Rich. 355
 var. **membranacea** 355
Vigna nilotica (Delile) Hook. f. 355
Vigna unguiculata (L.) Walp. 355
 subsp. **sesquipedalis** (L.) Verdc. 355
Zaleya decandra (L.) Burin. f. 49
Zaleya pentandra (L.) C. Jeffrey 49, 47
Zilla biparmata O. E. Schulz 219
Zilla microcarpa (DC.) Vis. 218
Zilla spinosa (L.) Prantl 218, 392
 subsp. **biparmata** (O. E. Schulz) Maire &
 Weiller 219, 222
 subsp. **spinosa** 219, 222