SILICIFIED ROOT FRAGMENTS OF TAMARIX L. FROM THE PLEISTOCENE OF EL-FAYUM

BY

W. B. EL-SAADAWI, AFAF A. BADAWI, and A.A.EL-AWAMRI

Botany Department, Faculty of Science, Ain Shams University, Cairo

Received : 10.3.1979

SILICIFIED ROOT FRAGMENTS OF TAMARIX L. FROM THE PLEISTOCENE OF EL-FAYUM

By

W. E. EL-SAADAWI, AFAF A. BADAWI, and A. A. EL-AWAIRI

Botany Department, Faculty of Science, Ain Shams University, Cairo

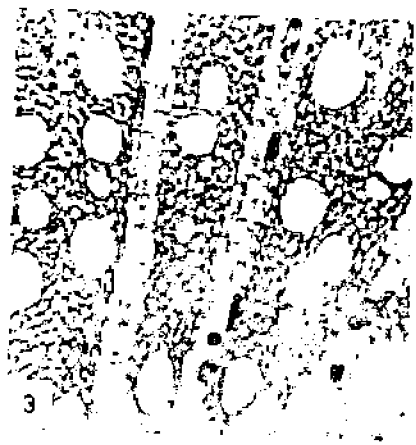
INTRODUCTION

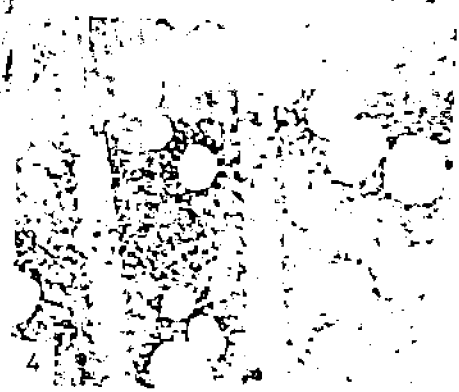
Literature on the geology (e.g. Blanckenhorn, 1901 ; Gardner, 1927) and geography (Butzer, 1959) of Egypt includes reference to the occurrence of fossil Tamarix in various places in the country especially in Pleistocene deposits of El-Fayum. This, however, is the first botanical work on fossil remains of Tamarix collected from that Province.

LOCALITY

Specimens of silicified roots of Tamarix were collected a few years ago from the Pleistocene diatomaceous earth at Dimai (Dimê), north of Lake Qarun in El-Fayum (see the Map in Fig. 1). The fossil roots were associated with silicified fragments of shoots of Phragmites (El-Saadawi et al (1975). Fossil diatoms also occur in the fossiliferous area (El-Saadawi et al 1979) which represents shore-line deposits of the old fresh water Pleistocene Moeris Lake (see the Map in Fig. 1).

PLATE III





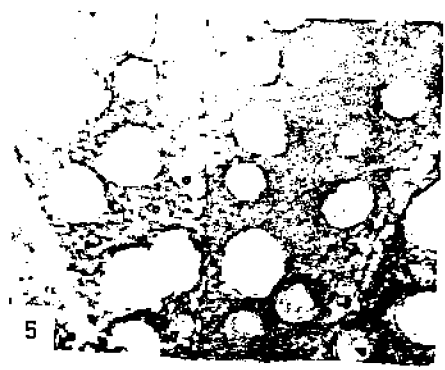


PLATE II

obtained are : T. amplexicaulis Ehrenb., T. aphylla (L.) Karst., T. arborea Bunge, T. nilotica (Ehrenb.) Bunge, and T. tetragyna Ehrenb. Transverse and tangential sections of roots of these species were prepared and stained as usual with living plant material.

DESCRIPTION AND COMPARISON

The fossil root fragments are small being a few centimeters long and about half a centimeter in diameter (Pl. II, Fig. 3). They are of whitish colour and radial vascular rays and feeble annual rings were easily seen by naked eye in transversely cut faces of the root fragments.

Data concerning the main anatomical features of the secondary xylem of roots of all Tamarix species studied are given in Table 1. Figures illustrating these main features of vessels and rays of secondary xylem of all species concerned are given on Plates II - IV. Reference to specific figures of each species is given also in the table.

The table shows that the anatomical features of the fossil root specimens are different from those of all other species. However, the extent of difference varies and is least toward the extant species T. aphylla. Concerning the dead specimens the least difference lies between them and the extant species T. nilotica . This means also that the fossil and dead specimens, though collected from one locality, yet they might belong to two different species.

TABLE 1

CHARACTERISTIC FEATURES OF ROOT SECONDRY XYLEM RECORDED FROM FOSSIL, DEAD, AND FIVE OF THE EXTANT TAMARIX SPECIES.

No.	Features \ Tamarix spp.	Fossil Tamarix	Dead Tamarix	T.aphylla	T.nilotica	T.arborea	T.amplexicaulis	T.tetragyna
1-	No. of vessels per sq. mm.	30 - 33	20 - 22	24 - 34	19 - 22	25 - 33	35 - 40	35 - 42
2-	Shape of vessels in transverse sections	circular &oval	circular, rarely oval	circular, rarely oval	circular, sometimes oval	oval& circular	oval & circular	circular & oval
3-	Arrangement of vessels	alternate and opposite	opposite&alternate or in single rows	alternate rarely opposite	alternate, sometimes opposite	alternate and opposite	alternate and opposite	alternate
4-	Radial diameter of vessels	36 - 127 µ	54 - 373 µ	36 - 108 µ	55 - 182 µ	36 - 109 µ	36 - 109 µ	36 - 73 µ
5-	Vessels united in 2	common	common	common	common	common	common	common
	Vessels united in 2	very rare	very rare	very rare	present	common	common	common
	Vessels united in 3	very rare	absent	absent	present	common	rare	common
6-	Seriation of rays	multiseriate (2-6)	multiseriate (2-6)	multiseriate (2-5)	multiseriate (2-10)	multiseriate (2-10)	multiseriate (2-5)	uni,&multiseriate (2-7)
7-	No. of xylem rays per sq.mm.	4 - 5	4	3 - 5	3 - 7	4 - 5	5 - 7	6 - 8
8-	Ray height in T.L.S.	0.45-1.73 mm.		.90-1.62 mm.	0.364-0.91 mm.	1.092-2.184 mm.	0.364-0.91 mm.	0.45-0.91 mm.
9-	Ray width in T.L.S	36 - 91 µ (Pl.II, Fig.4; Pl.IV, Fig.1)	36 - 73 µ (Pl.II, Fig.2; Pl.IV, Fig.2)	36-91 µ (Pl.II, Fig. 1; Pl.IV, Fig.4)	54 - 182 µ (Pl.II, Fig.5; Pl.IV, Fig.3)	36 - 182 µ (Pl.III, Fig.4)	36 - 91 µ (Pl. III, Figs. 1,5)	18 - 127 µ (Pl.III, Figs. 2,3)

DISCUSSION AND CONCLUSION

The comparisons show that neither the fossil nor the dead specimens are identical with any of the studied extant species. This, however, does not mean that two new species should be erected for the fossil and dead plants because the comparison is incomplete for the two following reasons :

1. Some of the extant species of Tamarix that grow in Egypt (T. effusa Ehrenb. and T. passerinoides Del. ex Desv.) have not been included in the comparison.

2. The range of variation of each of the studied characters should be verified by recording the extent of character variation in relation to changes in natural habitat conditions for each species.

Although many specimens of Tamarix (shoots and roots in each case) have been collected from various places in Cairo, Giza, and El-Fayum Provinces yet none of them proved to belong to T. effusa or T. passerinoides though carefully looked for. These two species are among the rare Egyptian Tamarix species Täckholm (1956, 1974). Herbarium specimens of these rare species,and indeed of all Tamarix species,include only parts of the shoot system but not the root.

It must be mentioned also that our present state of knowledge of the extant Egyptian species of Tamarix is far from complete and Täckholm (1974) stated that the whole genus is in need of a thorough revision. For example in 1889 Aschersen and Schweinfurth reported 8 species of Tamarix from Egypt, so also did Täckholm in 1956 but in 1974 she mentioned only 5 species and incorporated some of those mentioned earlier by her and by Aschersen & Schweinfurth in some others. For example T. arborea and T. nilotica which were first treated as two distinct species were later

treated as synonyms. The present study, however, shows that these two species, though close together yet they, are not identical concerning the studied root features. This means that they should perhaps be kept as two distinct species or as two varieties of a single species. The final answer to this, however, requires further investigations in the morphological and anatomical features of the various organs of these two plants. This in fact applies to all other species of the genus.

The above mentioned publications of Ascherson & Schweinfurth and Täckholm show also that there is controversy concerning the geographical distribution of the various Tamarix species within the Egyptian territory. Further collection and investigation of new and old collections is therefore still required.

It may be said in conclusion that although the present study has thrown more light on the extent of the problem of the taxonomy of the genus Tamarix yet it did not solve it and indeed it might have added to its complexity by introducing two new plants (fossil and dead) that still require taxonomic treatment. A more extensive study of the extant Egyptian species of Tamarix should, therefore, be started. A similar extensive study of the fossiliferous area at Dimai and elsewhere in Egypt, in search for more instructive remains of the fossil Tamarix, should also begin to find out whether the fossil Tamarix plant belongs to one of the extant species or to an extinct one.

ACKNOWLEDGEMENT

Thanks are due to Prof. Vivi Täckholm for kind permission to examine herbarium specimens of Tamarix deposited at the Botany Department of Cairo University.

SUMMARY

Anatomical features of silicified root fragments of Tamarix collected from Pleistocene diatomaceous earth in El-Fayum are described. Root specimens of dead Tamarix collected from the same locality and root specimens of five extant Tamarix species collected from various localities in Egypt are also described anatomically. Comparisons showed that the fossil specimens are not identical with any of the studied species. Further work on fossil and extant species of the genus is required to reach more definite conclusions.

REFERENCES

Ascherson, P. et Schweinfurth, G. 1889 : Illustration de la flore d'Égypte. Mém. Inst. Egypt. tome II, première partie.

Blanckenhorn, M. 1901 : Geologie Ägyptens, Führer durch die geologische Vergangenheit Ägyptens von der Steinkohlenperiode bis zur Jetztzeit.- Berlin.

Butzer, K. W. 1959 : Environment and human ecology in Egypt during Predynastic and Early Dynastic times. Bull. Soc. d'Égypte 82.

El-Awamri, A. A. 1976 : Studies on some Egyptian fossil plants. M. Sc. Thesis, Ain Shams University, Cairo.

El-Saadawi, W. E., Badawi, A. A., and El-Awamri, A. A. 1975 : On silicified rhizome fragments of Phragmites communis Trin. from the Pleistocene of El-Fayum, Egypt. Palaeontographica, Abt. B. 154 : 172-178.

———, ———, Shaaban, A. A., and El-Awamri, A. A. 1979 : Pleistocene diatoms from El-Fayum. (accepted for publication in "Proc. Egypt. Acad. Sci." on 6.3.1979).

Gardner, E. W. 1927 : The recent geology of the northern Fayum desert. Geol. Mag. (Great Britain) 64 : 386–410.

Joy, K. W., Willis, A. J., and Lacey, W. S. 1956 : A rapid cellulose peel technique in palaeobotany. Ann. Bot., N. S. 20 : 635–637.

Lacey, W. S. 1963 : Palaeobotanical techniques : View Points in Biology. (Editors J. D. Carthy and C. L. Duddington) 2 : 202–243.

Sass, J. E. 1940 : Elements of botanical microtechnique. First Edition pp.101.

Täckholm, V. in collaboration with Drar, M. and Fadeel, A. A. 1956 : Students' Flora of Egypt, Cairo.

----- 1974 : Students' Flora of Egypt. Second Edition, Beirut.

EXPLANATION OF PLATES

PLATE I

Fig. 1. *Tamarix* shrubs growing in desert area near Cairo.

Fig. 2. *Tamarix* shrubs fringing a small shallow pond thickly inhabited by *Phragmites*, in desert area near Cairo.

PLATE II

Fig. 1. Portion of a transverse section of root of *Tamarix aphylla*. x 130.

Fig. 2. Portion of a transverse section of dead root branch of *Tamarix*. x 60.

Fig. 3. Fragments of silicified root branches collected from Dimai area. x 1.

Fig. 4. Portion of a transverse section of a silicified root branch . x 140.

Fig. 5. Portion of a transverse section of root of *Tamarix nilotica* showing free and united xylem vessels. x 60.

PLATE III

Fig. 1. Portion of a tangential section of root of *Tamarix amplexicaulis*. x130.

Fig. 2. Portion of a tangential section of root of *Tamarix tetragyna* showing uni- and multiseriate rays. x 100.

Fig. 3. Portion of a transverse section of root of *T. tetragyna* showing free and united vessels. x 140.

Fig. 4. Portion of a transverse section of root of *Tamarix arborea* showing free and united vessels. x 125.

Fig. 5. Portion of a transverse section of root of *T. amplexicaulis* showing free and united vessels. x 120.

PLATE IV

Fig. 1. Portion of a tangential section of a silicified root branch. x 125.

Fig. 2. Portion of a tangential section of dead root of *Tamarix* sp. x 60.

Fig. 3. Portion of a tangential section of root of *T. nilotica*. x 80.

Fig. 4. Portion of a tangential section of root of *T. aphylla*. x 100.

PLATE I

1

2

Dry dead stumps of Tamarix trees and basal portions of Phragmites culms were observed, near the site of collection, projecting from sand in position of growth.

MATERIAL AND METHODS

The material investigated here includes not only the fossil root specimens but also (and for the purpose of comparison) specimens of roots of the dead Tamarix collected at the locality and specimens of roots of five of the extant Tamarix species collected where they grow wild in desert areas in Cairo (Pl. I, Figs. 1, 2), Giza, and El-Fayum. The dead and living root specimens were chosen from portions of the root system of the corresponding plants that are of similar size to the collected fossils.

Figure 3 of Plate II shows some of the many silicified fragments of Tamarix roots that were found loose at the locality. The specimens were examined superficially and by preparation of thin-ground transverse and tangential sections according to the method devised by Nicol and Sanderson and described by Lacey (1963) and El-Awamri (1976). Peel sections were less successful than thin-ground sections in showing fine details of root structure.

Specimens of dead Tamarix roots were resuscitated by boiling in soapy water for 3-5 minutes. Transverse and tangential sections from these specimens were prepared and stained according to the method described by Sass (1940).

The five extant species of Tamarix from which root specimens were

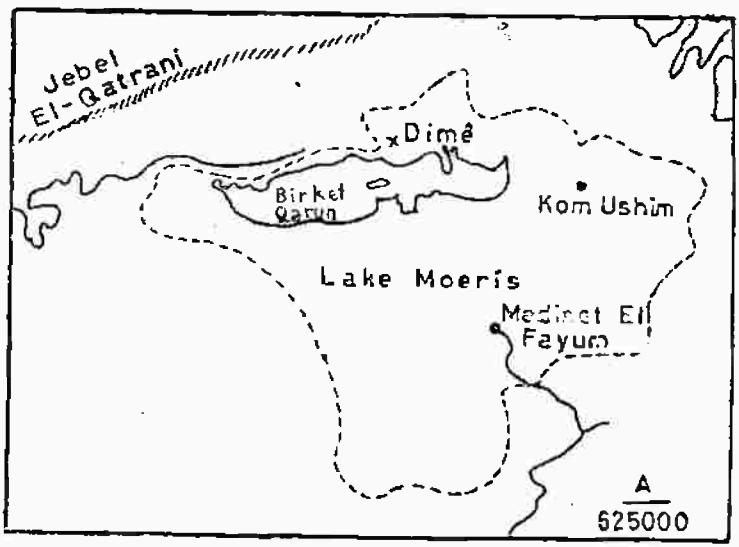


Fig. 1. Map of El-Fayum showing Lake Moeris, Lake Qarun and Dimê fossiliferous locality. After Beadnell, 1905.

PLATE IV

1

3

2

4

أجزاء من جذور أثل متحجرة من العصر البليستوسيني من الفيوم

للدكتور/ وجيه السعداوي ، الدكتورة/ عفاف بدوي ، السيد/ أحمد العزامي

ملخص

تم في هذا البحث وصف تشريحي لجذور نات أثل متحجرة تم تجميعها من أرض الدايتومات التي تنتمي إلى العصر البليستوسيني وكذلك تم وصف التركيب التشريحي لجذور مماثلة لنوع من نبات الأثل الميت الجاف من نفس المنطقة كما تم وصف التركيب التشريحي لجذور ستة أنواع مختلفة من جنس الأثل التي تعيش حاليا بمصر . وأثبتت المقارنة أن جذور النوع الحفري تختلف عن الجذور الأخرى وأنه لاستكمال البحث في أنواع هذا الجنس الحفرية والحية ضروري للوصول إلى نتائج أكثر تحديدا .