II. Studies on the effect of herbicides on meiosis, size of pollen grains and pollen viability.

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The present study aimed to compare the effect of eight organic herbicides on percentage of meiotic abnormalities, size of pollen grains as well as pollen viability of Vicia faba plants. The herbicides used are : 2,4 - D amine, Dalapon, Eptam, Cotoran, Linuron, Simazine, Treflan and Gramoxone.

Material and Methods

Vicia faba plants (Var Giza[1]) were subjected to two types of treatments :

1. Direct treatment :

Flower buds were directly treated with herbicide solution. For water soluble herbicides as treflan, dalapon, gramoxone and 2,4-D amine solutions 500ppm were used. For slightly soluble herbicides concentrations used were : 375 ppm for eptam, 90 ppm for cotoran, 75 ppm for linuron

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and 5 ppm for simazine. Treatment was applied on buds by a moisted piece of cotton for 3 hours during that time buds were protected by sulphane bags. For control experiments tap water was used.

2. Soil treatment:

(For herbicides used as soil sterilants.)

Seeds were sown in pots and as shoot sprouts they were irrigated with the herbicide solution, until the total holding capacity of the soil. Concentrations applied were: IO ppm for treflan, eptam, linuron, and cotoran. For simazine 5 ppm was used. For controls tap water was used. Such low concentrations were chosen for soil treatment as the herbicide solution will remain for a long time in contact with plant roots until flowering when buds were collected. Examination of P.M.Cs and P.Gs. was carried out using permenant aceto-Carmine smear method. Stainability of P.Gs was taken as an index for pollen viability. P.Gs. that were shrunk, and could not stain were calculated as abortive. Size of P.Gs. was recorded by an accurately standerdized occular micrometer.

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Results and Discussion

Comparing the effects of direct and soil treatment on meiotic abnormalities (Table I), it is obvious that soil treatment affected the percentage of abnormalities more than direct treatments. Simazine 41.1, eptam 33.9, Treflen gave nearly the same percentage of anomalies in the two treatments (20.2,19.6).

Stickiness and sticky bridges were the most dominating abnormalities (plate I). Other abnormalities such as multipolarity and multinucleate P.M.Cs were also common.

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Table I.

Percentage of meiotic abnormalities, average length of pollen grains and percentage of acortivness in treated Vicia after direct and soil treatment

Herbicide	No. of examined P.M.Cs.	% of abn.	No. of examined P. Gs.	Mean size of P. Gs. in microns	% of abortivness
Direct treatment					
Control	I997	2.6	2500	38.50	2.3
2,4-D amine	I355	9.2	I532	46.20	5.I
Dalapon	II68	I.9	2709	42.35	4.3
Eptam	2I27	7.6	2463	46.I5	2.9
Linuron	I4I3	I0.4	I796	44.00	6.I
Cotoran	I526	6.09	2I52	42.90	0.97
Simazine	II68	I4.9	I838	46.75	7.3
Treflan	I554	20.2	2650	39.60	2.7
Gramoxone	I630	3.4	2050	40.I5	5.4
Soil treatment					
Control	2I29	3.8	2500	38.0	2.3
Eptam	653	33.9	I787	50.60	II.5
Linuron	II96	5.4	I896	44.00	59.9
Simazine	505	[illegible]	2I47	36.00	5.6
Treflan	II0I	I9.6	20I3	55.65	4.I
Cotoran	toxic	toxic	toxic	toxic	toxic

Examination of size of pollen grains proved also that soil treatment had a stronger effect on pollen grains than direct treatment. Soil treatment with Treflan and simazine (55.65, 50.60) showed marked increase in size of pollen grains. Soil treatment with simazine gave beside the enlarged P.M.Cs and P.Gs. a number of small sized ones (Plat I), this plenomenon was accompanied by contraction of chromosomes.

Said and El-Hakim (1955) attributed the increased size of pollen grains after colchicine treatment of Luffa plants to the storage or accumulation of a greater amount of hormone or its precursor in such grains than in controls. Such hormonal accumillation might induce increase in size of P.Gs.. probably by increasing the plasticity of the wall. Hakeem (1968) after studying the effect of Podophyllin suspensions on P.Gs. of Vicia Faba and Luffa Cylindricafound increase in size of P.Gs.

Generally speaking the eight herbicides were not so effective on pollen viability in direct treatments. In soil treatments linuron gave marked decrease in pollen viability (59.5), with many small sized. non stanable. P.Gs. Eptam could be considered as pollen sterilizer. Simazine and treflan are nearly non-effective in either treatments (Table I).

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It is noteworthy to report here that Linuron which proved to be the most effective pollen steriliser in soil treatment nearly gave no change in percentage of abnormalities or size of pollen grains. Simazine which gave a considerable percentage of abnormal P.M.Cs. in soil treatment was not effective on pollen viability.

Plate I

Shows 18 normal and treated P.M.Cs with different herbicides having the same (X). Figs 6-11 showed enlarged P.M.Cs., Figs 12-18 show contracted P.M.Cs.

1,2 Normal P.M.Cs of Vicia plant.

3 chains of bivalents in treated P.M.C with simazine (5 ppm) after soil treatment.

4,5 Sticky bridges with fragments in treated P.M.Cs. with treflan (500 ppm) after direct treatment.

6,7 Disturbed on a phases in treated P.M.Cs. with 2,4-D amine (500 ppm) after direct treatment.

8,9 lagging chromosomes at 2nd meta and telophase in treated P.M.Cs. with 2.4-D amine (500 ppm) after direct treatment.

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I0 Disturbed 2nd telophase in treated P.M.Cs. with 2,4-D amine (500 ppm) after direct treatment.

II Penta-nucleate P.M.C. treated with 2,4-D amine (500 ppm)

I2,I3,I4 Severe stickiness in Ist metaphases with contracted chromosomes and P.M.Cs. treated with simazine (5 ppm) after soil treatment.

I5,I6,I7 Severe stickiness in 2nd metaphases with fragments in treated P.M.Cs. with simazine (5 ppm) after soil treatment.

I8 Penta-nucleate and small size of pollen mother cell treated with simazine (5 ppm) after soil treatment.

X = 900

(8)

Plate I

Thus there is no correlation between ability of herbicide to produce meiotic abnormalities and its effect on pollen viability.

Thus although the eight herbicides were nearly identical in their action on types of meiotic abnormalities yet they differed from each other in their end effect on P.M.Cs. and only eptam and linuron were effective on pollen viability.

Kuratle (I969) reported that the primary mode of action of linuron is probably inhibition of Hill's reaction. Craft (I966) showed that eptam is an effective fumigate and inhibits the release of oxygen in the process of photosynthesis.

There may be some internal physiological disturbances, such as those found by the above authors which are beyond these cytological aspects which may have caused pollen sterility.

Summary

I. The effects of 8 herbicides : 2,4-D amine, dolopon, eptam, ectoran, linuron, simazine, treflan and gromoxone were recorded on; meiotic abnormalities, size of pollen grains, and pollen viability of Vicia Faba .

2. Two types of treatments were carried; direct treatment of buds and soil treatment with experimental solutions.

3. The induced types of abnormalities were stickiness and sticky bridges.
4. Soil treatment was more effective than direct treatment.
5. There was no correlation between pollen sterility and percentage of abnormalities (exception eptam), Linuron which in soil treatment was the most effective pollen sterilizer (59.9) was less effective on percentage of abnormalities .
6. Simazine which gave the highest percentage of abnormal P.M.Cs (41.1) could not affect pollen viability.
7. In the two types of treatment treflan affect the percentage of anomolies (20.2, 19.6) , but proved to be the most effective herbicide on size of P.Gs (55.65)/

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References

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