Mitotic and Meiotic Effects of Trifluralin on Vicia faba

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INTRODUCTION

The hebicide trifluralin (a, a, a, trifluoro -2, b - dinitro - N - N - dipropyl toluidine) is used as a weed control in cotton. It is a soil active compound. Growth and physiological effects of the herbicide were studied by Kempen (1965), Standifer and Thomas (1965), Nègre et al (1968) and Schultze et al (1968). Mitotic effects were studied by Bayer et al (1967) on cotton, and Hackmylo and Amato (1968), on corn and cotton.

In this study mitotic and meiotic effects of trifluralin on Vicia faba were experimented.

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MATERIAL and METHODS

Seeds of Vicia faba (Var. Giza I) were used in this test. For mitotic studies roots 4 days old were dipped in well aerated experimental solutions (0.1, 1, 10, 100 and 500 ppm.) for 24 and 72 hours. Tap water was used in control experiments. All observations were made from Feulgen permenant r root tip squash preparations. For meiotic studies two types of treatments were carried on:-

1. Flower buds were directly treated with an equeous solution of trifluralin (500 ppm.) using moisted piece of cotton for 3 hours, buds were garthered 24 hours after treatment. Moisted piece of cotton with tap water was used for controls.

2. Soil treatment, seeds were sawn in pots and as shoot sprouts, they were irrigated regularly with the herbicide solution (10 ppm.) until flowering when flower buds were collected. Tap water was used for irrigating control plants. Pollen mother cells were examined from permenant preparations using aceto-carmine

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smear method.

Stainability of pollen grains with aceto-carmine was taken as an index for determining pollen sterility.

Length of pollen grains was accurately measured by occular micrometer.

RESULTS and DISCUSSION

The intibiting mitotic effects of trifluralin (Table I) agree with those observed by Tablert (1965), 1966 Bayer et al (1967) and Mačkaylo and Amato (1968).

After 24 hours treatments the percentage of metaphases increased gradually on the expence of prophases, while after 72 hours treatments the percentage of metaphases increased markedly on the expense of both prophases and ana-telophases (table I). Generally the total percentage of abnormal cells increased with increase of time of treatment and concentration (table I). Stickness was a common abnormality in 72 hours treatment. Accumillation of metaphases may be attributed to different degrees of spindle distrubances shown in the presence of prophase-

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metaphases, ball and star-shaped metaphases, lagging chromosomes and scattering of all the chromosomes all over the cell (Fig. 1-2-3-4). Prophase-metaphases has been observed by many outhers after treatment of colchicine (barber and callan 1942), ethylene glycol (D'amato 1948) chromosomes remain nearly in their arrangement as they were during prophase due to inhibition of spindle formation. Amer (1965) considered star-metaphase type as a fore-step of complete disturbance of the spindle. Barthelness (1977) attributed the phenomenon of lagging chromosomes to the adhesion of the centromeres of one or more chromosomes to the outer layer of plasma while other chromosomes continue moving to the equatorial plate.

Anaphase abnormalities were: sticky anaphases with a bridge, c-anaphases and tetripolar anaphases (Fig. 5, 7) which ensure evidences of spindle disturbonces. The polyploidising action of the herbicide is indicated by the presence of tetroplaid and polyploid cells resulting in giant nuclei and restitution nuclei (Fig. 7,8). Multipolarity resulted in polynucleate cells. (Fig. 6) Most of the above observations agree with those of Bayer et al (1967) on the effect of trifluralin on cotton. These abnormalities ensured that

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Kinese is connected here with stathmokinese, that
ultipolarity represented in multipolar anaphases
ultinucleate cells are found together with c-meta
anaphases, polyploid cells and restitution nuclei.

The most common meistic abnormalities were stick-
and sticky bridges (Fig. 9). After direct
tment these abnormalities are obviously higher in
first division than the second division, Table II.
temporary effect of triflaralin on meiosis agree
the assumption of Amer and Ali (1968) that meiotic
kness induced by external agents seems to be temporary.
s II shows also that in case of soil treatment the
entage of abnormalities in the first and second
sion did not show much variation. This may lead
o believe that the induced abnormalities after soil
tment may be the result of changes in the ionic
oroment and metabolic activities thus leading to
ndary effects such as those observed.

Table II shows also that direct treatment of buds
9 ppm.) had no effect on either fertility of length
ollen grains, while soil treatment (10 ppm) induced
sterility and mild abnormal effect on pollen grains

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shown in the increase in their length. These results strengthen the assumption that meiotic treatments with external agents exert temporary effects.

Comparing mitotic and meiotic effects of trifluralin it is observed that most of the mero-stathmokinetic abnormalities of the herbicide in mitosis disappeared during plant growth and were not traced during meiosis.

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TABLE (I)

MITOTIC INDEX, TOTAL PERCENTAGE OF ABNORMALITIES AND PERCENTAGE OF DIFFERENT PHASES IN TREATED VICIA ROOT CELLS

Concentration	Mitotic Index		Total % of abnor.		Prophase %		Metraphase %		Ana-telophase %	
	24 h	72 h	24 h	72h	24h	72h	24h	72h	24h	72h
Control	82±3.3	79±5.1	-	-	32.8	32.9	24.4	25.2	42.6	41.7
0.1 ppm.	64±12	64±11.2	4.7	21.8	25	35.9	31.1	31.2	42.2	34.3
1 ppm.	64±9.4	65±4.4	12.3	75.3	23.4	21.6	39.1	53.9	37.3	24.6
10 ppm.	66±4.8	61±15.2	10.6	90.1	19.7	19.6	39.4	65.5	40.9	14.7
100 ppm.	65±13.2	54±15.5	12.2	79.2	24.6	24.1	30.7	53.7	41.5	22.2
500 ppm.	48±9	Toxic	29.1	Toxic	22.9	Tox.	39.5	Tox.	37.5	Tox.

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TABLE (II)

PERCENTAGE OF ABNORMALITIES, POLLEN STERILITY AND LENGTH OF POLLEN GRAINS, OF TREATED VICIA PLANTS AFTER SOIL AND DIRECT TREATMENT

Type of	No. of counted cells	Total% of abnorm	1st Division			2nd Division			Pollen Steri-lity	Length of p.g. in micr.
			Diak.& met.	Ana-teloph.	Total% of abnorm.	met.	ana-telo phase	Total% of abnorm		
Control	2129	3.8	3.5	2.5	2.9	2.2	3.01	2.4	2.4	38.5
Soil	1101	19.6	38.5	15.1	26.1	25.7	11.5	19.3	4.1	55.65
Direct	1553	20.2	24.8	23.4	29.1	13.4	5.9	8.01	2.7	39.60

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