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STUDIES ON THE EFFECT OF GROWTH REGULATORS ON SESAME*

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The use of growth regulators having selective gametocidal action for inducing male-sterility finds application in hybridization programmes. This method has been tried in a number of plants with encouraging results (Rhem 1952, Eaton 1957, Singh and Jose 1967, Kaul and Singh 1967). In sesame, though growth regulators caused male sterility, it was accompanied by deleterious side effects also (Kumar and Singh 1963). The present experiment was designed to study the effects of two growth regulators with selective gametocidal properties viz. Sodium 2, 3-Dichloroisobutyrate (F, W-450) and 2, 4-Dichlorophenoxy acetic acid (2, 4-D) on the growth, flowering, pollen and ovular sterility and fruit set in sesame.

Material and Methods

'Onattukara Black' a local variety of sesame planted in pots was used in these studies. Each growth regulator was used at four graded concentrations.

The chemicals were applied as aqueous foliar sprays ten days prior to flowering, at the time of flowering and ten days after flowering. Each treatment (including a control of no treatment and another control treated with distilled water) was replicated thrice.

Pollen viability was studied by germination tests in a medium containing 20 percent sucrose and 50 ppm boric acid and also by crossing normal plants with pollen from treated plants. Ovular sterility was tested by crossing treated plants With pollen from normal plants.

Histological studies were made from sections of vegetative buds and young anthers stained with safranin-fast green.

Results and Discussion

Results are given in Tables 1 and 2

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Table I

Effect of growth regulators on plant characters of sesamum (mean values)

Growth regulator and concentration (ppm)	Height of plants (cm)	Number of flowers	Fruit set (percent)	Pollen sterility (percent)
Control (no treatment)	99.99	80.33	86.00	5.34
Control (distilled water)	93.58	79.11	83.00	8.22
F, W - 450				
1500	99.00	54.22	84.00	31.31
2000	103.76	71.44	88.00	39.78
2500	105.89	103.78	77.00	52.11
3000	103.60	121.11	90.34	68.00
2, 4 -D				
50	81.44	51.56	47.34	43.22
100	85.11	41.11	43.34	51.89
150	67.99	27.33	50.67	67.11
200	60.77	28.89	9.00	94.11

General growth and height of plants. F, W-450 at 3000 ppm showed treatment shock as manifested by marginal scorching of the leaves and general drooping of the plants but they recovered fully in two days; the lower concentrations of the chemical did not produce any such effects. 2, 4-D in all the concentrations proved toxic to the plants resulting in the curling of the plants, the stem becoming hard and brittle, formation of characteristic galls at soil level and the leaves turning thick, leathery and brittle.

F, W-450 was very effective in increasing the height of plants. This appeared to he a typical hormonal effect. This was contrary to the reports of Meyer *et al* (1958), Pundir and Singh (1965) and Singh (1964) that there was a decrease in plant height. 2, 4-D treated plants were crippled and the mean height of plants was less than that of the control plants.

Flowering and fruit set. F, W-450 at 2500 ppm and 3000 ppm induced increased flower production. Three flowers were formed in each axil while the normal plant had only one flower per axil. This chemical thus showed a definite morphogenic effect in increasing the number of flowers. Treatments with 2, 4-D on the other hand had a depressing effect on flower formation and the number decreased with increase in concentration of the chemical. The final fruit set was seen to be highest in F, W-450 treated plants, but their capsules were smaller in size or half filled. Fruit set was low in 2, 4-D treatments and the frequency of empty capsules and seeds was very high. This was due to decreased flower production and high pollen and ovular sterility induced by the chemical.

Table 2

Effect of crossing growth regulator treated and untreated sesamum on percent fruit set

Growth regulator and concentration (ppm)	Percent Fruit set	
	Normal flower X treated pollen	Treated flower X normal pollen
Control (No treatment)	93.33	96.66
Control (Distilled water)	95.33	95.33
F, W-450		
1500	75.34	95.33
2000	69.00	77.76
2500	47.00	51.00
3000	22.34	27.00
2, 4 -D		
50	29.00	38.00
100	20.34	18.00
150	9.34	0.00
200	0,00	0.00

Sterility. Pollen sterility was greater in plants treated with 2, 4-D than in those treated with F, W-450. The intensity was directly proportional to the concentration of the chemicals. When normal plants were crossed with pollen from growth regulator treated plants there was no

fruit set in 2, 4-D at 200 ppm (Table 2). For F, W-450 at 3000 ppm the sterility was high (22.34 % fruit set) and it decreased with decreasing concentraction. Ovular sterility was much less in F, W-450 treatments than in 2, 4-D treatments. Different levels of sterility were observed andthey included abortion of entire anthers or parts of them, and production of empty and half filled anthers and indehiscent anthers, in addition to pollen and ovular sterility referred to above. These effects were more pronounced in the case of 2, 4-D; they being absolute at the higher concentrations.

Sections of vegetative buds showed no symptoms of damage in tissues of treated plants. Sections of young anthers showed hypertrophied and collapsed tapetal cells. The empty, shrivelled up, partly disintegrated microspores and sporogenous cells were seen in the centre of the anther cavity. Pollen sterility was thus due to inhibition in its development. Kumar and Singh (1963) had reported that microspore aberration following hypertrophied tapetal cells formation occurred as a result of gametocide action.

Summary

Studies were made on the effects of foliar application of F, W-450 (1500-3000 ppm) and 2, 4-D (50-200 ppm) as male gametocides in sesame.

F, W-450 at 3000 ppm caused treatment shock but the plants recovered in two days. All the plants treated with F, W-450 showed increased growth and increased number of flowers; plant height also increased by this treatment. 2, 4-D was highly toxic to the plants.

Both the regulators caused pollen sterility in sesame, 2, 4-D producing higher sterility (up to 97.34 per cent) than F, W-450 (up to 70 per cent). Male sterility was manifested by fully or partly aborted anthers, empty or half-filled anthers, indehiscent anthers and nonviable pollen grains. Some ovular sterility was also caused by F, W-450. 2, 4-D caused high ovular sterility.

Histological studies showed that pollen abortion was caused by hypertrophied tapetal cells which blocked the normal development of the sporogenous cells.

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