

Streptovaricin-induced Sex Expression in Male and Female Plants of *Cannabis sativa* L.

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Sex expression in plants can be modified by thermal and photoperiodic induction, and by the endogenous level and exogenous application of growth regulators (Heslop-Harrison, 1957; Abeles, 1973). This change is accompanied by the synthesis of the protein characteristic of the male/female plant. A specific type of protein has been isolated from the female plants of *Mercurialis annua*, which is absent in the male plants (Durand and Durand-Rivieres, 1969). Slonov (1974) reports different endogenous levels of nucleic acids and proteins in male and female plants of *Cannabis sativa* during the growth phase. To the best of the authors' knowledge, there has been no direct report that an inhibitor of RNA synthesis such as streptovaricin (a complex) affects sex expression in higher plants. The present study was undertaken to observe whether streptovaricin had any effect on sex expression in flowers of *Cannabis sativa* L.

The plants of *Cannabis sativa* were raised in plastic pots (10 cm diameter) filled with garden soil. The sex of the plant was determined by observing the first few formed floral buds. The test solutions were sprayed to the point of run-off to batches of six plants. Triton AE (0.05 per cent) was used as a wetting agent. The experiments were performed in two sets, one with lower (5, 10 and 20 p.p.m.) and other with higher (50, 100, 200 and 400 p.p.m.) concentrations of streptovaricin. The percentage and sex ratio of male and female flowers were determined by examining the anthesized flowers up to 6 weeks after treatment.

Treatments with 5, 10 and 20 p.p.m. (Set I) caused an increased percentage of flowers over the control on the male plants. With 20 p.p.m. the increase was maximum, i.e. 9.17 per cent over the control (Table 1). A contrary result was observed in the female plants. The percentage of female flowers decreased over the control with increase in concentration of the test solution, and was 46.66 per cent with 20 p.p.m. (Table 1). In 3.75 per cent of the female flowers an 'anther like' structure was observed after 20 p.p.m. treatment in place of the two free styles in the control (Fig. 1A–C). This modified 'anther like' structure was full of pollen grains which were non-viable as assessed by staining with acetocarmine (Fig. 1D). Increased concentration (up to 400 p.p.m.) resulted in a reversed effect, i.e. an increase in female and decrease in male potentials (Set II, Table 1). Treatments of 400 p.p.m. caused a maximum to 69.62 per cent increase over the control in female flowers on the female plants and a maximum decrease to 10.29 per cent in the male flowers on the male plants. Table 2 reveals that the ratio of male to female flowers was increased with increase in concentration in Set I, but a decrease was observed in Set II.

A change in the morphology of sex organs in *Cannabis sativa* was observed by Mohan Ram and Jaiswal (1970, 1972a, b) with ethephon (ethyl hydrogen-1-propyl phosphonate) and gibberellic acid. The reversal of sex may be due to the evolution of ethylene inside

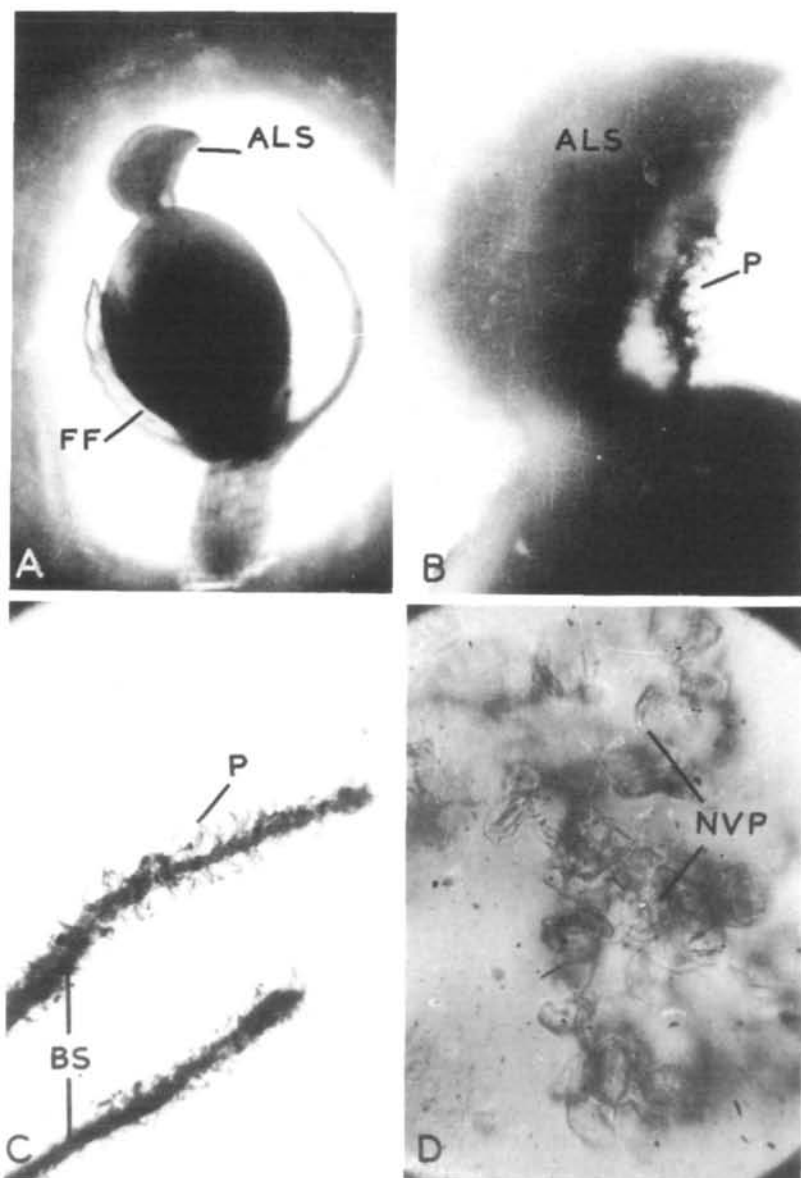


FIG. 1. Effect of streptovaricin on masculinization of female flowers of *Cannabis sativa* L. A, Female flower with 'anther like' structure $\times 25$. B, Enlarged view of 'A' to show the papillae $\times 350$. C, Bifid style of control with papillae $\times 350$. D, Non-viable pollen grains from 'anther like' structure $\times 1000$. (ALS, anther-like structure; BS, bifid style; FF, female flower, NVP, non-viable pollen; P, papillae).

the plant tissue caused by a change in auxin level (Abeles, 1973; Trewavas, 1968). Earlier reports of Mizuno and co-workers (1967) indicate that streptovaricin inhibits the initiation of RNA synthesis. Quintrell and McAuslan (1970) were of opinion that streptovaricin inhibits early mRNA synthesis, thus interfering with all subsequent events.

TABLE 1. *Effects of streptovaricin on the percentage of flowers on male and female plants. Data collected up to 6 weeks after treatment from six replicates of Cannabis sativa L.*

Set no.	Treat- ment (in p.p.m.)	Male % change over control	Female % change over control
I	5	+1.45	-6.52
	10	+6.78	-30.47
	20	+9.17	-46.66*
II	50	-2.32	+17.64
	100	-3.22	+24.53
	200	-9.07	+69.02
	400	-10.29	+69.62

* Some intersexual flowers were formed.

TABLE 2. *Effect of streptovaricin on the number of flowers per plant on male and female plants of Cannabis sativa L.*

Set no.	Treatment (in p.p.m.)	Number of male flowers	Number of female flowers	Ratio of male: female flowers
I	Control	82.0	18.5	1:4.43
	5	98.2	20.4	1:4.81
	10	127.4	18.7	1:6.81
	20	152.5	16.6	1:9.18
II	Control	122.5	16.1	1:7.60
	50	120.0	19.0	1:6.31
	100	80.4	13.6	1:5.91
	200	79.0	19.3	1:4.09
	400	64.7	20.1	1:3.21

in protein synthesis. Thus, on the above findings it can be conjectured that specific mRNA are differentially transcribed with changes in concentration of streptovaricin and ultimately translated for synthesis of specific proteins which are responsible for sex expression. A feedback regulation is indicated by the reversal of effects with increase in concentrations.

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