

A NEW PLANT EXTRACT TO SUPPRESS THE POPULATION BUILD-UP OF Tribolium castaneum (Herbst)

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Introduction

The losses and damage caused by the insects in stored commodities are diverse and intense. Being one of the major stored product pests, T. castaneum causes serious losses in stored wheat flour and grains, dried fruits, nuts, spices and other food products. One of the major approaches of chemical control has been to check the reproducibility of insects. The hazardous nature of the chemicals employed for control of insect pests has prompted several workers to screen plants for sterilant (Saxena *et al.*, 1977; Tikku *et al.*, 1978; Mathur *et al.*, 1980; Singh and Krishna, 1980; Auger and Thibout, 1981; Fagoonee and Umrit, 1981; Gajendran and Gopalan, 1981 and Whitehead, 1981), toxic and other actions. In the present investigation the effects of a new plant extract of the flowers of Delonix regia Raf. (Fam: Leguminosae) on the reproduction of T. castaneum have been evaluated.

Materials and Methods

The flowers of the ornamental tree D. regia were collected from the University Campus during the month of May and dried in shade under electrical fan. 65 g of the 40 mesh powder was extracted in a Soxhlet for 8 hours over a mantle heater at 50°C temperature using acetone as solvent. After complete evaporation of the solvent, the residue of the extract represented 8% of the total dry weight of plant powder. The extract was then formulated in acetone and mixed in 80 mesh wheat flour so as to give the concentrations of 1, 2 and 4% (W/W). The solvent was allowed to evaporate for 24 hours.

T. castaneum was reared in the laboratory in sterilized glass jars on wheat flour plus 5% powdered yeast at a temperature of $30 \pm 2^\circ\text{C}$ and relative humidity $65 \pm 5\%$. The pupae were sorted out of culture and sexed. Newly emerged adults were treated by feeding method. One pair of adult was kept in a plastic vial containing 500 mg of food and ten such replica were run for each concentration of the extract. Controls, with acetone mixed food, were also run simultaneously. The eggs were sorted out of food on every alternate day using an 80 mesh sieve and were allowed to hatch. The experiment was continued until all the adults died. The pre-oviposition, oviposition and post-oviposition periods were recorded. The average number of eggs laid per female and percent egg hatching were also calculated. The percent corrected sterility was determined following the method suggested by Chamberlain (1962). The data were analysed statistically and significant levels were determined.

Results and Discussion

On treating the red flour beetle with the extract of the flowers of D. regia, the following adverse effects have been observed: egg laying is suppressed, egg hatching is reduced, the pre-oviposition period is prolonged, oviposition and post-oviposition periods are shortened. The data presented in Table 1 show that the average number of eggs laid per female treated with the flower extract at 1, 2 and 4% concentrations comes to 30, 25 and 15 respectively as compared to 95 eggs laid per female in control. The fall in egg laying is significant ($P = 0.001$).

Further the egg-hatching is also adversely affected as at the same level of concentrations of the extract the percent corrected sterility stands to 59.18, 76.47 and 82.35%, respectively. The extract also prolongs the pre-oviposition period and shortens the oviposition and post-oviposition periods significantly ($P = 0.001$). The extract, thus, causes considerable reduction in reproducibility of red flour beetles.

The fall in the reproducibility of T. castaneum may be attributed to the disturbance caused by the extract in the pool of hormones responsible for regulation of reproduction. It is further suggested that the extracts may also cause an interference in the morphogenesis during egg development and that the metabolic disturbances may result in poor egg development in the ovarioles. Earlier Tikku *et al.* (1978) observed disturbance in the differentiation of follicular epithelium and resorption of the oocytes from the terminal ends towards germarium in Trogoderma granarium due to treatment with the vapours of Acorus calamus oil. They interpreted the action to the imbalanced hormonal interplay of neurohormonal complex, corpora cardiaca and corpora allata. Saxena and Srivastava (1972) observed adverse effects of oil vapours of A. calamus on the hatching in eggs of Dysdercus koenigii. Singh and Krishna (1980) observed a complete failure in egg laying in T. castaneum on feeding certain oil seeds.

Failure in hatching of eggs laid by treated females is further indicative of the blockage in supply of chitin during egg development as a similar fall in the fertility of the eggs of T. castaneum due to treatment with chitin inhibitor compounds penfluron and difluron has been reported by Saxena & Mathur (1981). It is, therefore, concluded that the extract of the flowers of D. regia suppresses fecundity and fertility in T. castaneum which in turn leads to a numerically poor F_1 generation. The studies with regard to the precise mode of action and the active ingredients of the extracts are in progress and will be reported as soon as data are collected and analysed.

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Table 1 - Effects of the extract of flowers of Delonix regia on reproducibility of Tribolium castaneum

Plant Extract	Concentrations* (%)	Total Number of eggs laid by 10 females	Mean number of eggs laid per female	Percent egg hatching	Percent corrected sterility	Pre-oviposition period	Oviposition period	Post-oviposition period
<u>D. regia</u> (Flowers)	1	304	30.4 ± 0.15	30.0	59.18	7.9 ± 0.19 ^a	43.1 ± 1.4 ^a	11.0 ± 1.7 ^a
	2	251	25.1 ± 0.26	20.0	76.47	8.4 ± 0.25 ^a	38.4 ± 2.4 ^a	8.1 ± 1.4 ^a
	4	150	15.0 ± 0.25	15.0	82.35	12.2 ± 0.28 ^a	30.0 ± 2.7 ^a	7.3 ± 2.8 ^b
Control	-	950	95.0 ± 0.70	96.0	-	4.5 ± 0.27	64.0 ± 3.7	18.0 ± 1.9

* Ten replica of one pair were treated by feeding method at each concentration.

a Significant difference at $P < 0.001$

b Significant difference at $P < 0.02$

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