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Studies on the management of red flour beetle, *Tribolium castaneum* (Herbst) in groundnut by using plant parts of milkweed plant *Calotropis gigantea* R.Br.

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Abstract : Laboratory experiment was conducted to evaluate the insecticidal activity of *Calotropis gigantea* R.Br. plant part powders against red flour beetle, *Tribolium castaneum* (Herbst) on groundnut. The *C. gigantea* plant parts such as leaf, flower, root and stem were collected, shade dried and made in to powder form. Insecticidal activity of milkweed plant was tested against the red flour beetle on 3, 5, 7 and 9 days after treatment. The results revealed that *C. gigantea* whole plant powder treatment was found to be very effective causing maximum mortality at 10g dosage. Leaf, flower, stem and root powders followed the whole plant powder treatment respectively.

Key words : Milkweed plant, plant part powder, red flour beetle, groundnut, mortality.

Introduction

The red flour beetle, *Tribolium castaneum* (Herbst) is one of the most important pests of stored groundnut seeds (Wight man and Ranga Rao, 1993). The insecticides have been found very promising in suppressing this pest, but they are hazardous to mammals. Their use results in the development of high degree of resistance in insects. In the recent past, the use of indigenous plant materials had acquired an important position in the modern approach to pest control as they are comparatively safer to mammals due to their rapid biodegradable nature (Ram Singh *et al.*, 2001). It was therefore, planned to screen the milkweed plant *Calotropis gigantea*, R.Br. (Fam: Asclepiadaceae) for its insecticidal efficacy against the red flour beetle, *T. castaneum*.

Materials and Methods

The test insect *T. castaneum* was cultured in wheat flour in the laboratory. Fresh *C. gigantea* plants were collected and they were shade dried for three months. Different plant parts such as leaf, flower, stem and roots were separated and made in to powder form with the help of willey mill. The whole plant powder was prepared by mixing leaf, flower, stem and root powders in equal proportions.

Five doses (2,4,6,8 and 10 g) of C. gigantea plant parts (Leaf, flower, stem, root and whole plant) powder were mixed with 100g of healthy seeds of groundnut separately in a plastic jars. These jars were shaken in an electric shaker for about 2 hrs so that entire surface of each seed could get uniform coating of the protectants. Each treatment was replicated four times.

One day old 20 adult beetles of both the sexes were released in each jar, 24 hrs after mixing the various doses of different protectants. The jars were covered with muslin cloth, which were fastened with rubber bands. Mortality count in each jar was made at intervals of 3, 5, 7 and 9 days after release of test insects. The experimental data were processed statistically by adopting the technique of analysis of variance of factorial randomized block design (Snedecor and Cochran, 1968).

Results and Discussion

Three days after treatment, the whole plant powder proved their superiority over other plant

Table 1. Per cent mortality of T. castaneum in groundnut seeds treated with C. gigantea plant part powders at 3 and 5 DAT

Table 1. Per cent mortality of T. castaneum in groundnut seeds treated with C. gigantea plant part powders at 3 and 5 DAT

Calotropis gigantea Plant part powders	3 DAT							5 DAT						
	Doses (g / 100 g of seeds)							Doses (g/100 g of seeds)						
	2.0	4.0	6.0	8.0	10.0	Control	Mean	2.0	4.0	6.0	8.0	10.0	Control	Mean
Leaf powder	-	2.50 (6.46)	5.00 (12.92)	15.00 (22.65)	30.00 (33.17)	-	8.75 (12.53)	3.75 (9.69)	5.00 (12.92)	15.00 (22.65)	30.00 (33.17)	45.00 (42.12)	-	16.45 (20.09)
Flower powder	-	2.50 (6.46)	3.75 (9.69)	10.0 (18.15)	27.50 (31.31)	-	7.29 (10.97)	3.75 (9.69)	3.75 (9.69)	10.00 (18.15)	27.50 (31.51)	40.00 (39.22)	-	14.17 (18.04)
Stem powder	-	3.75 (9.69)	5.00 (12.92)	10.0 (18.15)	20.0 (26.48)	-	6.46 (11.21)	3.75 (9.69)	5.00 (12.92)	10.00 (18.15)	20.00 (26.48)	35.00 (36.25)	-	12.2 (17.25)
Root powder	-	0.0 (0.0)	2.50 (6.46)	10.0 (18.15)	15.00 (22.65)	-	4.58 (7.88)	2.50 (6.46)	3.75 (9.69)	5.00 (12.92)	15.00 (22.65)	30.00 (33.17)	-	9.38 (15.02)
Whole plant powder	-	3.75 (9.69)	10.0 (18.15)	20.0 (26.48)	35.00 (36.25)	-	11.46 (15.09)	3.75 (9.69)	10.00 (18.15)	20.00 (26.48)	35.00 (36.25)	50.00 (45.00)	-	19.79 (22.59)
Mean	-	2.50 (6.46)	17.50 (24.53)	13.00 (20.71)	25.50 (30.01)	-	-	3.50 (9.04)	5.50 (12.67)	12.00 (12.67)	25.50 (30.01)	40.00 (39.15)	-	-

	SED	CD (0.05)
Treatment (T)	1.08	2.14
Dose (D)	1.18	2.35
TxD	2.65	5.26

	SED	CD (0.05)
Treatment (T)	1.13	2.25
Dose (D)	1.24	2.46
TxD	2.78	5.51

Figures in the parentheses are arcsine-transformed values

Each value is a mean of 4 replications

DAT - Days after treatment

Table 2. Per cent mortality of *T. castaneum* in groundnut seeds treated with *C. gigahtea* plant part powders at 7 and 9 DAT

Calotripis gigantea Plant part powders	7 DAT							9 DAT						
	Doses (g / 100 g of seeds)							Doses (g/100 g of seeds)						
	2.0	4.0	6.0	8.0	10.0	Control	Mean	2.0	4.0	6.0	8.0	10.0	Control	Mean
Leaf powder	5.00 (12.92)	15.00 (22.65)	30.00 (33.17)	45.00 (42.12)	60.00 (50.79)	-	25.83 (26.94)	15.00 (22.65)	30.00 (33.17)	45.00 (42.12)	60.00 (50.79)	75.00 (60.06)	-	37.50 (34.79)
Flower powder	5.00 (12.92)	10.00 (18.15)	27.50 (31.51)	40.00 (39.22)	55.00 (47.88)	-	22.92 (24.95)	10.00 (18.15)	25.00 (29.94)	40.00 (39.22)	55.00 (47.88)	70.00 (56.83)	-	33.33 (32.00)
Stem powder	5.00 (12.92)	10.00 (18.15)	20.00 (26.48)	35.00 (36.25)	50.00 (45.00)	-	20.00 (23.13)	10.00 (18.15)	20.00 (26.48)	35.00 (36.25)	50.00 (45.00)	65.00 (53.76)	-	30.00 (29.94)
Root powder	5.00 (12.92)	10.00 (18.15)	15.00 (22.65)	30.00 (33.17)	45.00 (42.12)	-	17.50 (21.50)	10.00 (18.15)	15.00 (22.65)	30.00 (33.17)	45.00 (42.12)	65.00 (50.79)	-	26.67 (27.81)
Whole plant powder	10.00 (18.15)	20.00 (26.48)	35.00 (36.25)	50.00 (45.00)	65.00 (53.76)	-	30.00 (29.94)	25.00 (29.48)	35.00 (36.25)	50.00 (45.88)	65.00 (53.76)	80.00 (63.52)	-	41.67 (37.50)
Mean	6.00 (13.97)	13.00 (20.71)	25.50 (30.01)	40.00 (39.15)	55.00 (47.91)	-	-	13.00 (20.71)	25.00 (29.69)	40.00 (39.15)	55.00 (47.91)	70.00 (56.99)	-	-

7 DAT	SED	CD (0.05)	9 DAT	SED	CD (0.05)
Treatment (T)	0.69	1.37	Treatment (T)	0.74	1.48
Dose (D)	0.76	1.50	Dose (D)	0.82	1.62
TxD	1.70	3.37	T x D	1.83	3.63

Figures in the parentheses are arcsine-transformed values

Each value is a mean of 4 replications

DAT - Days after treatment

parts and this was followed by leaf powder (Table 1). Though leaf, flower and stem powder differed significantly as compared to the untreated control, there was no significant difference among themselves. Among the doses, whole plant powder at 10g gave maximum mortality percentage (35.0) followed by leaf, flower, stem and root powders respectively.

Five days after treatment, the maximum mean mortality percentage was given by whole plant powder. Though leaf, flower, stem and root powders significantly differed as compared to the untreated control, there was no significant difference among themselves. Among doses, 10g of all the plant parts gave higher mortality percentage followed by 8g. The whole plant powder at 10g dosage gave higher mortality percentage (50.0) followed by leaf, flower, stem and root powders (Table 1).

Seven days after treatment, the whole plant powder gave higher mean mortality percentage followed by leaf and flower powders. There was no significant difference between flower and stem powders. Root powder showed least mean mortality percentage. Among doses, 10g of whole plant powder gave high mortality percentage (65.0) followed by leaf, flower, stem and root powders (Table 2).

Nine days after treatment the whole plant powder proved it's superiority by giving higher mean mortality percentage followed by leaf, flower, stem and root powders. Among doses, l0g of all plant part powders showed maximum mortality percentage. The whole plant powder at l0g dosage gave higher mortality percentage (80.0) followed by leaf, flower, stem and root powders respectively (Table 2).

The results of present investigation were similar to the report of Maheswari and Dwivedi (1996) who reported dry leaf powders of *cassia occidentalis, Tephrosia appolinea, Calotropis procera, Datura metel* and *Croton bonplandianum* at 5 and 10 per cent (w/w) concentration significantly reduced the adult emergence of T. castaneum in comparison with the untreated control.

The per cent mortality of T. castaneum adults was tested by treating the groundnut seeds with the C. gigantea plant part powders such as leaf, flower, stem, root and whole plant powders. The different doses used were 2,4,6,8 and 10g/ 100g of groundnut seeds and mortality count was taken on 3, 5, 7 and 9 days after treatment. Among the five plant parts tested, *C. gigantea* whole plant powder was found to be superior to the rest of the plant part powders. The 10g dosage of whole plant powder caused 80.0 per cent mortality on 9 days after treatment. This was followed by leaf and flower powders, which caused mortality to a maximum of 75 and 70 per cent at 10g dosage on nine days after treatment respectively. Mortality response was directly proportional to the increase in dosage of different treatments with the advancement of time.

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