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EFFICACY OF PLANT PRODUCTS AND INSECTICIDAL DUSTS ON THE BRUCHID [*CARYEDON SERRATUS* (OLIVIER)] INFESTING STORED GROUNDNUT PODS

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ABSTRACT

A few plant powders and insecticidal dusts were tested for their efficacy in protecting stored groundnuts against *Caryedon serratus* Olivier. Deltamethrin (10g/kg pod) recorded no weight loss and zero pod damage to stored groundnut after nine months. Deltamethrin (5g/kg pod) was also effective to control the bruchid showing very low weight loss (0.14%) and pod damage (1.54%). Among plant powders, black pepper powder at an application rate of 15 g/kg pod was effective to check weight loss (0.24%) and pod damage (3.54%) in stored groundnut. *Azadirachta indica* A. Juss seed kernel powder (20 g/kg pod) was also effective against the bruchid evincing a weight loss of 3.10 per cent and pod damage of 40.59 per cent. Contrarily, *Pongamia glabra* seed powder (10, 15, and 20 g/kg) was not effective even after 24 hourr of treatment application; rather, the weight loss and damage were higher than that recorded in control.

Key words: *Caryedon serratus*, plant powders, weight loss, adult pod damage, insecticidal dusts, stored groundnuts

Groundnut (*Arachis hypogea* L.) commonly stored for 6– 9 months is susceptible to invasion by insect pests during storage, which reportedly cause an average of 6–10 per cent damage to stored groundnut (Srivastava, 1970). *Caryedon serratus* Olivier (Bruchidae: Coleoptera) is an important pest and is a potential threat to stored groundnut (Mital, 1991). Prophylactic treatment with contact insecticides and the remedial practice of fumigation are usually followed to check the insect damage in storage. Only a few insecticides (malathion, dichlorvos, deltamethrin) are permissible for use on or near storage commodities in India. The protection of stored products by the use of plant materials is also a common practice among farmers. Repellent, anti–feeding and insecticidal properties have been identified in a large variety (as many as 2121) of plant species (Jacobson, 1990; Dhaliwal and Arora, 1998). The plants, *Lippia multiflora* Hochst, *Eupatorium odoratum* L., *Ocimum canum* L., *Nicotiana tabacum* L. and *Chenopodium ambrosioides* L. (Delobel and Malonga, 1987) and the insecticidal dust aldrin, a cyclodiene compound with high persistence (Ghanekar *et al*., 1996), are generally used by farmers to protect groundnuts and other commodities against *C. serratus*. The toxicity of plants, *Azadirachta indica* A. Juss, *Piper nigrum* L., *Pongamia glabra* L. and *Annona squamosa* L. were earlier tested against *Callosobruchus maculatus* F. and *C. chinensis* (Khanna, 1995**;** Rajapakse, 1996; Sundria *et al.,* 2002**)**. The present study was conducted to find out the relative efficacy of neem (*A. indica*), black pepper (*P. nigrum*), karanj (*P. glabra*), custard apple (*A. squamosa*), deltamethrin and malathion against *C. serratus* as manifested on the basis of per cent weight loss and pod damage to stored groundnut pods.

MATERIALS AND METHODS

The study was conducted at the Stored Product Section of Division of Entomology, IARI, New Delhi during 2002–2003. The test insect obtained from the trader's godown was identified as *Caryedon serratus* Olivier at the Insect Taxonomy Section, Division of Entomology, IARI, New Delhi. The culture of this bruchid was maintained on unshelled groundnut in the storage laboratory at room temperature. Groundnut pods, procured from the market, were cleaned of inert material and then subjected to a temperature of 50±2 ^{o}C overnight to eliminate possible hidden insect infestation. The nucleus culture of *C. serratus* was obtained from a single pair and further multiplication was carried out by releasing 30 pairs of 1–day–old adults in rearing glass jars (25 cm x 10 cm dia.) containing 150 pods. The adults released were removed from glass jars after 5 days. The jars were covered with muslin cloth and fastened with rubber band. Pupae formed in jars were separated from the culture and placed in petridishes. In order to get a continuous supply of insects for experimentation, the culture was maintained releasing insects at regular intervals in different jars. To

avoid any kind of contamination, care was taken not to handle the pods and insects with naked hands. During experimentation, forceps, camel hair brush and aspirator were used for transferring the insects.

Four plant materials *viz*., black pepper, *neem*, *karanj*, custard apple seed and two insecticidal dusts *viz*., malathion (5%), deltamethrin (0.2%) were evaluated for their efficacy against *C. serratus*. The seeds of plant materials collected from fields were shade dried and after drying were powdered in an electric grinder. Proper care was taken to clean the bowl of grinder before grinding each plant material. The different doses of plant materials and insecticidal dusts used are tabulated (Table 1).

For each dose of plant material and insecticidal dust cylindrical plastic containers (3–kg capacity) were taken. Each container was filled with 700g of disinfested groundnut pods and then treated with the different doses of plant materials and insecticidal dusts as mentioned in Table 1 and thoroughly mixed. Untreated disinfested pods were kept in separate containers that served as control.

For the evaluation of efficacy, 50g pods in 3 replicates from each jar were taken and transferred into small plastic containers (500 g capacity). One pair of the adult bruchid (0–24 hrs old) was released into each small plastic container to the 24–hour, 3–, 6–and 9–month old treated groundnut pods, individually. Thereafter, the treatment jars were left

Table 1: Plant powders and insecticidal dusts used against *C. serratus* in stored groundnut pods

Common name	Scientific name	Family	Plant parts used	Doses (g/kg)
A. Plant products				
Neem (NSKP)	*Azadirachta indica* (A.) Juss	Meliaceae	Seed powder	10 g
				15 g
				20 g
Black pepper (BPP)	*Piper nigrum* L	Piperaceae	Drupe powder	5 g
				10 g
				15 g
Karanj (KSP)	*Pongamia glabra* (L.)	Leguminasae	Seed powder	10 g
				15 g
				20 g
Custard apple (CASP)	*Annona squamosa* (L.)	Annonaceae	Seed powder	10 g
				15 g
				20 g
B. Dusts				
Malathion 5 %				5 g
				10 g
Deltamethrin 0.2 %				5 g
				10 g

undisturbed for the bruchid to grow and develop into adults. Observations were taken on adult emergence, fecundity, pod damage and weight loss after the specified period of storage. The per cent loss in weight was calculated as per formula given herewith:

$$\text{Per cent weight loss} = \frac{\text{Initial weight of pods} - \text{Final weight of pods}}{\text{Final weight of pods}} \times 100$$

To determine the pod damage, the total number of pods and damaged pods were counted in each container after complete emergence. The per cent damage was calculated as per formula given by Adams and Schulten (1978).

RESULTS AND DISCUSSION

All the four plants have biologically different active components that showed varying effects on the test insect. Among the plant powders tested, black pepper powder (15g/kg) treated pods had no egg laying without any damage up to 6 months of storage; however, after 9 months, the fecundity was 21.87 and the damage 8.78 per cent (Table 2). Practically no weight loss and zero damage were recorded after 24 hours, 3, 6 and nine months when the

Table 2. Effect of plant powders on the fecundity and adult emergence of C. *serratus* at different periods of storage

Treatments	After 24 hrs*		After Three months*		After six months*		After nine months*	
	Fecundity	Adult emergence (%)	Fecundity	Adult emergence (%)	Fecundity	Adult emergence (%)	Fecundity	Adult emergence (%)
NSKP 10 g	13.64 (3.76)	7.29 (15.73)	41.36 (6.47)^{f}	27.93 (31.93)^{c}	60.03 (7.78)^{b}	36.14 (36.98)^{c}	61.91 (7.90)^{ab}	39.32 (38.86)^{a}
NSKP 15 g	5.60 (2.47)	0.00 (1.28)	23.22 (4.87)^{g}	14.59 (22.49)	49.63 (7.08)^{c}	30.08 (33.29)^{d}	61.59 (7.88)^{ab}	37.61 (37.85)^{ab}
NSKP 20 g	2.96 (1.86)^{b}	0.00 (1.28)	19.21 (4.44)^{gh}	0.00 (1.28)	35.26 (5.98)^{d}	22.67 (28.46)^{e}	57.26 (7.60)^{bc}	34.50 (35.99)^{b}
BPP 5 g	1.93 (1.56)^{b}	0.00 (1.28).	18.77 (4.39)^{h}	0.00 (1.28)	31.65 (5.67)^{de}	22.57 (31.71)^{d}	51.34 (7.20)^{c}	34.16 (35.79)^{b}
BPP 10 g	0.00 (0.71)	0.00 (1.28)	0.00 (0.71)	0.00 (1.28)	19.93 (4.52)	21.98 (27.99)^{e}	32.91 (5.78)	26.30 (30.88)
BPP 15 g	0.00 (0.71)	0.00 (1.28)	0.00 (0.71)	0.00 (1.28)	0.00 (0.71)	0.00 (1.28)	21.87 (4.73)^{d}	8.78 (17.28)
KSP 10 g	61.12 (7.85)^{a}	40.17 (39.36)^{a}	62.23 (7.92)^{abc}	42.51 (40.72)^{b}	64.62 (8.07)^{a}	47.64 (43.67)^{a}	62.54 (7.94)^{ab}	40.67 (39.62)^{a}
KSP 15 g	63.66 (8.01)^{a}	37.61 (37.86)^{a}	68.39 (8.30)^{a}	48.36 (44.09)^{a}	66.58 (8.19)^{a}	40.31 (39.44)^{bc}	68.89 (8.33)^{a}	41.43 (40.07)^{a}
KSP 20 g	60.65 (7.82)^{a}	39.73 (39.11)^{a}	60.96 (7.84)^{bc}	44.69 (41.98)^{ab}	61.91 (7.90)^{ab}	42.14 (40.51)^{b}	64.95 (8.09)^{ab}	39.59 (39.02)^{a}
CASP 10 g	34.31 (5.90)	29.35 (32.83)	56.65 (7.56)^{cd}	34.70 (36.12)	60.97 (7.84)^{b}	41.25 (39.99)^{b}	63.98 (8.03)^{ab}	40.40 (39.49)^{a}
CASP 15 g	23.90 (4.94)	23.59 (29.09)^{b}	51.34 (7.20)^{de}	30.13 (33.32)^{c}	59.25 (7.73)^{b}	40.59 (39.61)^{bc}	60.34 (7.80)^{b}	39.35 (38.87)^{a}
CASP 20 g	18.25 (4.33)	21.08 (27.36)^{b}	46.97 (6.89)^{ef}	26.53 (31.04)^{c}	51.34 (7.20)^{c}	38.92 (38.63)^{bc}	58.64 (7.69)^{bc}	37.31 (37.67)^{ab}
Control	65.76 (8.14)^{a}	41.96 (40.41)^{a}	66.90 (8.21)^{ab}	46.55 (43.05)^{ab}	63.98 (8.03)^{ab}	42.92 (40.96)^{ab}	64.62 (8.07)^{ab}	40.89 (39.75)^{a}
S. Em. ±	0.12	1.29	0.15	1.25	0.12	1.37	0.17	1.23
P= 0.05	0.33	2.63	0.44	2.54	0.33	2.78	0.49	2.51

* Mean of three replications; Figures in parentheses are Ö n+ 0.5 transformations; Figures in parentheses are arc sine value; Treatment means with same letters are statistically at par

pods were treated with deltamethrin at 10g/kg (Table 3). Deltamethrin (5 g/kg), malathion (10 g/kg) and black pepper powder (15 g/kg) effectively checked the weight loss and damage even after nine months; while, custard apple seed powder (10 &15 g/kg) and *A. indica* seed kernel powder (10 g/kg) were ineffective after six months of storage. Similarly, *A. indica* seed kernel powder (15 & 20 g/kg) and custard apple seed powder (20 g/kg) were ineffective after nine months of storage and happened to be at par with control. On the contrary, *P. glabra* seed powder (10, 15, and 20 g/kg) was not effective even after 24 hours of treatment; besides, it was observed that weight loss and damage were higher than that in control (Table 3). Earlier reports indicate that deltamethrin provided complete protection of groundnut (Lafleur, 1994) and was highly toxic to adults (Daglish *et al.,* 1992). Similarly, the synthetic pyrethroid, fenvelerate (4 g/kg) showed quick action and killed *Caryedon* larvae and adults, and gave protection to groundnut up to 180 days (Ghanekar *et al.,* 1996; Cardet *et al.,* 1998). Similarly, Kumari *et al*. (1998) observed that malathion (15 g/kg) was effective to give full protection (100%) to groundnut up to four months; besides, they recorded that NSKP and CASP at 25 g/kg was ineffective to check *C. serratus*. Pandey and Verma (1997) reported that custard apple seed powder provided complete protection to gram against bruchids. Juneja and Patel

Table 3. Efficacy of plant powders and insecticidal dusts against *C. serratus* at different periods of storage

Treatments	After 24 hrs*		After Three months*		After six months*		After nine months*	
	Weight loss	Damage (%)	Weight loss	Damage (%)	Weight loss	Damage (%)	Weight loss	Damage (%)
NSKP 10 g	0.15 (2.58)	2.66 (9.48)	0.90 (5.59)^{cd}	15.22 (23.22)	3.68 (11.06)^{abc}	46.36 (42.94)^{b}	3.80 (11.31)^{ab}	50.43 (45.28)^{ab}
NSKP 15 g	0.00 (1.28)	0.00 (1.28)	0.53 (4.36)^{d}	6.68 (15.04)	2.32 (8.86)^{cd}	29.69 (33.05)	3.63 (11.05)^{ab}	48.39 (44.11)^{ab}
NSKP 20 g	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)	1.24 (6.51)^{ef}	15.91 (23.55)^{c}	3.10 (10.22)^{ab}	40.59 (39.61)^{cd}
BPP 5 g	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)	1.33 (6.75)^{def}	17.45 (24.73)^{c}	2.72 (9.59)^{b}	34.96 (36.28)^{d}
BPP 10 g	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)	0.68 (4.92)^{f}	8.82 (17.33)^{d}	1.33 (6.76)^{c}	18.31 (25.37)^{e}
BPP 15 g	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)	0.24 (3.09)^{de}	3.64 (11.07)^{fg}
KSP 10 g	3.80 (11.32)^{a}	48.61 (44.23)^{a}	4.17 (11.86)^{a}	52.00 (46.29)^{b}	4.78 (12.70)^{a}	54.36 (47.53)^{a}	3.94 (11.52)^{ab}	50.46 (45.29)^{ab}
KSP 15 g	3.69 (11.15)^{a}	45.54 (42.47)^{b}	4.93 (12.89)^{a}	58.20 (49.75)^{a}	4.04 (11.66)^{ab}	54.03 (47.34)^{a}	4.49 (12.30)^{a}	54.86 (47.82)^{a}
KSP 20 g	3.78 (11.29)^{a}	46.53 (43.04)^{ab}	4.21 (11.91)^{a}	53.75 (47.15)^{b}	4.20 (11.90)^{a}	51.62 (45.96)^{ab}	4.04 (11.67)^{ab}	52.34 (46.37)^{ab}
CASP 10 g	1.54 (7.24)	19.75 (26.42)	2.52 (9.22)^{b}	38.58 (38.43)	3.89 (11.45)^{ab}	50.37 (45.24)^{ab}	3.95 (11.53)^{ab}	51.07 (45.64)^{ab}
CASP 15 g	0.89 (5.56)^{b}	11.31 (19.70)	1.98 (8.19)^{b}	28.64 (32.39)	3.68 (11.14)^{abc}	48.19 (43.99)^{ab}	3.81 (11.33)^{ab}	49.16 (44.55)^{ab}
CASP 20 g	0.59 (4.59)^{b}	8.67 (17.18)	0.97 (5.80)^{c}	22.31 (28.22)	2.66 (9.47)^{bc}	39.76 (39.09)	3.44 (10.77)^{ab}	47.28 (43.47)^{bc}
Malathion 5 g	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)	0.61 (4.66)^{f}	7.96 (16.45)^{d}	1.40 (6.91)^{c}	18.10 (25.22)^{e}
Malathion 10 g	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)	0.40 (3.86)^{cd}	5.34 (13.43)^{f}
Deltamethrin 5 g	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)	0.14 (2.46)^{de}	1.54 (7.25)^{g}
Deltamethrin10 g	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)	0.00 (1.28)^{e}	0.00 (1.28)
Control	4.29 (12.02)^{a}	47.72 (43.72)^{ab}	4.68 (12.57)^{a}	55.52 (48.20)^{ab}	4.49 (12.31)^{a}	52.32 (46.36)^{ab}	4.03 (11.65)^{ab}	52.43 (46.42)^{ab}
SEm ±	0.63	0.63	0.63	1.06	1.13	1.79	1.12	1.99
P= 0.05	1.28	1.28	1.25	2.14	2.29	3.64	2.27	4.05

Mean of three replications; Figures in parentheses are arc sine value; Treatment means with the letter in common are statistically at par

(1994) reported that black pepper and custard apple at 5 parts/100 parts of green gram (w/w) gave cent per cent adult mortality and completely prevented the females from laying eggs. Dhaliwal and Arora (1998) reported that black pepper contains piperine and other amides that produce oviposition deterrents and have a toxicant effect against *Helicoverpa zae* Boddie and *Anthonomus grandis* Boheman. Sundria *et al.* (2002) demonstrated that black pepper powder was the best grain protectant showing zero percent damage even after four months of storage against *C. chinensis*, which was followed by NSKP (20 g/kg).

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