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BIOLOGY OF PULSE BEETLE (*CALLOSOBRUCHUS CHINENSIS* LINN., COLEOPTERA:BRUCHIDAE) AND THEIR MANAGEMENT THROUGH BOTANICALS ON STORED MUNG GRAINS IN ALLAHABAD REGION

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ABSTRACT

Callosobruchus chinensis **is a major stored pest of pulses in India. Biology of pulse beetle was studied during 2005-2006 in the laboratory. The average incubation period, larval + pupal period, and adult longevity of male and female were 4.0, 16.4, 11.0 and 9.6 days respectively. The average of total developmental period (egg to adult) was 25.2 days, and pre-oviposition, oviposition and post-oviposition period were 0.4, 8.0 and 2.2 days, respectively. The average fecundity of the females was 85.6 eggs and its viability 94% during its life time. The effect of seven botanicals at 4.0 and 8.0 % w/w/100 grams of mungbean on mortality of *Callosobruchus chinensis* Linn. were also studied. Observations were taken on 2, 4 and 6 days after treatment. The seven plant materials, *viz.* neem leaf, chilli, NSK, tulsi leaf, nerium leaf, lantana leaf, Tobacco leaf including control were evaluated for their effects against pulse beetle. Among all these plant products, neem leaf (8 gm) was found more effective with 38.33 % mortality whereas nerium leaf (4 gm) was found least effective with 5.70 % mortality.**

Key words : *Callosobruchus chinensis,* Pulse beetle, Green gram.

INTRODUCTION

Callosobruchus chinensis is a common and major pest of stored legumes. Prefered hosts are *Vigna radiata* (mungbean), *Pisum sativum* (pea), *Vigna unguiculata* (cowpea), *Cajanus cajan* (pigeonpea), *Vigna unguilaris* (adzuki bean), *Lens culinaris* (lentil). It is distributed throughout the tropics and subtropics. It is dominant pest species on legumes in Asia. It was first described from China in 1758 due to which the name chinensis was given to the species. Synonyms of *C. chinensis* are *Mylabris chinensis* and *Bruchus chinensis* and common English names are Chinese bruchid, Oriental cowpea bruchid and Adzuki bean weevil. About 15 per cent damage to gram grain is estimated to be caused by these beetles, *Bruchus chinensis* and *Bruchus theobroma,* which while feeding scoop out the contents of grains. The pulse beetles assume serious proportions usually during July-August in the stores.

Biology of pulse beetle in different pulses were reported by Vyas and Motka (2005), Singh and Rina Kumari (2000), Chiranjeevi and Sudhakar (1996) and Prabha and Sehgal (1990). But the development in mung bean at Allahabad climatic condition is lack of evidence. All the varieties of different pulses have been reported to be infested by this beetle (Singh *et al.*, 1980 and Rajapakse and Senanayake, 1997).

Fig. 1. Adult of Pulse Beetle

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Indiscriminate use of synthetic organic insecticides leads to several health hazards to human being and development of resistance against pesticide is alarming. Therefore, there has been an increased need to explore suitable alternative methods of pest control. A number of plant derived products are potential candidates. Plant products as insecticides will be eco-friendly and biodegradable. Because of universal compatibility, non-residual and non-toxic nature, it finds a key role in IPM.

Bajya (2002), Sundria *et al.* (2001), Reddy, *et. al.*(1994), and Pandey *et. al.*(1986) studied the efficacy of plant products as grain protectant against *C. chinensis* on different pulses.

With this view, the present experiment was carried out to study the biology of pulse beetle and the efficacy of different botanicals in management of pulse beetle (*Callosobruchus chinensis* Linn.) in stored condition.

MATERIAL AND METHODS

The biology of *Callosobruchus chinensis* was studied during 2005-2006, in the laboratory of Department of Plant Protection, Allahabad Agricultural Institute- Deemed University, Allahabad. To maintain culture, the adults were collected from a separate culture raised from a single pair of *C. chinensis* on gram. Twenty five pairs of zero to one day old adults were released for egg laying in plastic bottles containing 100 grams of grains. The grains containing eggs were collected on next day morning. To observe the developmental period, one egg on each grain, while others were removed with the help of a needle and kept in glass vial. Like that 100 eggs were kept separately in glass vials under lab conditions. Observations were recorded on hatching of eggs, larval-pupal and adult period.

Newly emerged adults were released in pairs to record the pre-oviposition, oviposition, post-oviposition and longevity period. The male beetle were distinguished with the female ones by antenna i.e. male having pectinate antenna whereas females having serrate antenna. The number of eggs laid by each female during life time was observed to study the fecundity recorded. The grains with eggs were replaced daily by healthy grains and the number of eggs laid by an individual was recorded till the female died.

The treatment included were dried leaf powders of neem leaf, tulsi leaf, nerium leaf, lantana leaf, tobacco leaf, fruits of chilli and neem seed kernel. A control without any admixtures was also taken. The plant products dried under shade, powdered in electric mixer, sieved and then mixed with clean and sterilized seeds of mung bean at 55° C for 4 hrs. to remove insect hidden infestation, if any, with two doses (4.0 gm and 8.0 gm/100 gms of grains). All the treatments were replicated thrice including the untreated grain samples of 100 gms were kept to separate plastic containers. Ten pairs of freshly emerged (0-24 hrs old) adults of *C. chinensis* were released in each container and covered with muslin cloth on the top tied with rubber bands including the control. The bottles were suitably labeled and kept in incubator at a temperature of 28±1° C and 70±5 relative humidity. Observations were recorded after 2, 4 and 6 days after treatment. The data obtained were statistically analysed by adopting suitable transformation.

RESULTS AND DISCUSSION

Egg period : Eggs were cigar shaped and shiny bright yellow. They were attached singly to developing pea pods, often with several eggs on each pod. Eggs hatched within 3-5 days with an average of 4.0±1.0 days. The viability of eggs was 94 per cent. This result corporated with the results obtained by Singh and Rina Kumari (2000) who reported egg period as 4 to 5 days.

Larval and Pupal Period : The larvae passed through at least 4 instars in which all were creamy coloured 'C' shaped, scarabeiform larva. Pupa was obtect type and also creamy coloured. The larva and pupal stages were passed inside the seed. The larval and pupal period was varied from 13-20 days with average of 16.4±2.07 days. Raina (1970) and Singh and Rina Kumari (2000) were also reported the pupal period of pulse beetle around 18.20 days (Table 1).

The total developmental period was calculated from the day of oviposition to adult emergence. It was varied from 22-28 days with an average of 25.2+2.59 days. Singh and Rina Kumari (2000) observed the development of this pest as 17.41 days.

Table 1. Biology of pulse beetle under laboratory conditions.

	Stages of the insect	Minimum	Maximum	Av.+S.d.
1.	Egg period	3	5	4.0±1.0
2.	Larval period+ pupal period	13	20	16.4±2.07
3.	Total life period (egg to adult)	22	28	25.2±2.59
4.	Adult period			
	(i) Male	9	14	11.0±1.87
	(ii) Female	9	12	9.6±1.14
5.	Pre-oviposition period (days)	0	1	0.4±0.55
6.	Oviposition period (days)	6	10	8.0±1.58
7.	Post-oviposition period (days)	1	3	2.2±0.84
8.	Fecundity	75	95	85.6±8.47

*Mean of 20 observations.

Adult : Adult beetles were chunky, 5 mm long, brownish beetles flecked with black, grey and white patches. The tip of the abdomen extended beyond the hard wing covers. The portion of the abdomen that was visible, white in colour and marked with two black oval spots. The male was different from female ones by having pectinate type of antenna whereas females having serrate antenna and male lived longer than female.

Longevity of adults for males ranged 9-14 with average of 11.0±1.87 days and for females was ranged 9-12 days with an average of 9.6±1.14 days. Almost similar observations of male and female longevity as 9.76 and 9.44 days were also reported by Raina (1970).

The pre-oviposition, oviposition and post-oviposition periods of pulse beetle were 0.4, 8.0 and 2.2 days, respectively. The findings are supported by Prabha and Sehgal (1990) as 0.4, 7.8 and 1.4 days.

The average number of eggs laid by a single female 85.6 eggs which varied from 75-95 eggs laid/female. Raina (1990) also found that females laid an average of 78 eggs laid/female.

Sex Ratio : 90 pupae kept for taking observation of sex ratio. After emergence, out of which were 36 males and 54 females. Male to female sex ratio was 1:1.50.

Table 2. Relative efficacy of different plant products on *C. chinensis* on green gram.

Name of Plant products (powders)	Doses (g/100 g grains)	Mean percent Mortality* (Days after treatment)			
		2 DAT	4 DAT	6 DAT	Pooled
Neem leaf	8.0	27.50 (31.52)	35.81 (36.66)	51.67 (45.96)	38.33 (38.04)
Neem leaf	4.0	25.81 (30.43)	26.66 (31.08)	44.17 (41.75)	32.21 (34.42)
Chilli	8.0	9.04 (17.39)	10.63 (18.98)	11.90 (19.64)	10.52 (18.67)
Chilli	4.0	7.91 (15.31)	8.73 (17.10)	9.00 (17.44)	8.55 (16.61)
NSK	8.0	21.04 (27.48)	21.22 (27.73)	23.22 (28.87)	21.83 (28.03)
NSK	4.0	19.01 (26.07)	20.04 (26.55)	21.04 (27.25)	20.03 (26.62)
Tulsi leaf	8.0	17.81 (24.84)	19.01 (25.84)	19.09 (26.06)	18.64 (25.58)
Tulsi leaf	4.0	13.30 (21.11)	16.65 (24.05)	17.01 (24.59)	15.65 (23.25)
Nerium leaf	8.0	6.00 (11.11)	6.18 (14.51)	7.63 (16.02)	6.60 (13.88)
Nerium leaf	4.0	5.00 (17.71)	5.88 (13.76)	6.21 (14.89)	5.70 (15.45)
Lantana leaf	8.0	34.81 (35.86)	35.66 (36.43)	36.42 (37.07)	35.60 (36.45)
Lantana leaf	4.0	27.08 (31.51)	23.96 (29.09)	24.97 (29.77)	25.34 (30.12)
Tobacco	8.0	14.04 (22.23)	15.37 (23.30)	16.79 (24.08)	15.20 (23.20)
Tobacco	4.0	11.91 (19.64)	12.90 (20.53)	15.08 (22.49)	13.30 (20.89)
Control	–	0.00	0.00	0.00	0.00
c.d	–	1.98	2.27	2.13	2.12
cv	–	5.31	5.86	5.08	5.42

*Mean of three replications.

In management aspect, all the seven plant products tested in this study significantly caused adult mortality of the pulse beetle 6 days after treatment in comparison to control at 4.0 and 8.0 gm/100 gms grains. The per cent adult mortality after 2, 4 and 6 days after treatment increased with increase in the level of doses of each powder. The maximum adult

mortality was recorded in the treatment of neem leaf powder (38.33 %) at all the three doses. Our observations confirmed to the findings of Sundria *et al* (2001), Rao *et al.* (1993) and Jacob (1990) reported significant mortality of Pulse Beetle with neem leaf powder. Singh *et al.*, (1980) reported that Tulsi leaf powder having minimum controlling effect in *C. chinensis*.

The efficacy, in a decreasing order was as Neem leaf (8gm) >Lantana leaf (8gm) > Neem leaf (4gm) > Lantana Leaf powder (4gm) >NSK (8gm) >NSK (4gm) >Tulsi Leaf (8g) > Tulsi leaf (4g) > Tobacco (8g) > Tobacco (4gm) > Chilli (8 gm) > Chilli (4 gm) > Nerium leaf (8 gm) > Nerium leaf (4 gm) > Control (Table 2).

Thus, it is concluded from the present studies that, locally available plant materials like shade dried leaf powders of neem, lantana, tulsi, tobacco, nerium and fruits of chilli and neem seed kernel were effective in reducing ovipostion and give protection to mung bean against the pulse beetle, *C. chinensis* L in Allahabad region.

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