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Carabid beetle, *Omphra pilosa* Klug (Coleoptera : Carabidae) a Potential Predator on Termites

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ABSTRACT

A field study was conducted on the activity and distribution of *Omphra pilosa* Klug. Grubs and adults fed exclusively on all castes of termites. The adult fed on an average 15 workers and 2.1 alates per day. They had a preference to workers. The predatory consumption rate increased with increasing prey density. Grubs stored termites in their burrows. Both grubs and adults were more abundant and commonly associated in dryland crop ecosystem and lived under weed stubbles infested by termites.

Key Words : *Omphra pilosa,* termites, feeding potential, functional response

The carabid beetles have been recognised as most common and general predators present in most agricultural ecosystems. Many workers recorded carabids as predators on several crop pests in India (Fletcher, 1919; Andrewes, 1929; Kushwaha and Sharma, 1961; Rai *et al.,* 1969; David *et al.,* 1972; Misra, 1975; Singh and Sandhu, 1977; Samal and Mishra, 1978; Selvasundaram and Muraleedharan, 1987; Bharadwaj and Pawar, 1987; Bhat and Rajagopal, 1988, 1989; Rajagopal and Prasad Kumar, 1988a,b and Rajagopal *et al.,* 1990). The predatory behaviour of two arboreal carabid species viz., *Calleida splendidula* and *Parena nigrolineata* on coconut leaf eating caterpillar (*Opisina arenosella* Walk.) was studied by Mohamed *et al.* (1982). David *et al.* (1975) studied the feeding potential of *P. nigrolineata* on *O. arenosella.*

Some carabid beetles were recorded as predatory associates with termites. *Helluodes taprobanae* Westw. and *Luperca laevigata* F. are found in a termite mound. *Orthogonius acutangulus* Chaud, and *O. schaumi* Chaud, are in association with *Odontotermes redemanni* (Wasm.) *O. duplicatus* Wied. with *Eutermes biformis* (Wasm.) and *O. lucidus* Bates with *Odontotermes obesus* (Rambur) (Andrewes, 1929). Rajagopal (1984) reported for the first time *Omphra pilosa* feeding on termites (*Odontotermes wallonensis* (Wasmann) from South India. Later, Rajagopal and Prasad Kumar (1988b) recorded another carabid beetle, *Oxylobus dekkanus* Andrewes as a predator on termites from Karnataka.

Since not much information is available on the activity of soil inhabiting Indian carabid beetles in the agroecosystem, the present investigation was initiated to understand the feeding potential, functional response, feeding behaviour, feeding preference and abundance of *O. pilosa* in the crop ecosystem.

MATERIALS AND METHODS

The abundance, activity and predatory behaviour of both the grubs and adults of *O. pilosa* were recorded during 1987 to 1990.

The feeding potential of beetles was studied by providing 35 workers and five alates per day. The preference for two castes of termites *viz.,* soldiers and workers was studied by providing individual beetles with each caste separately and also in combination. The functional response was also studied with varying density of termites from 5 to 35.

A survey for the population density of *O. pilosa* in different crop fields was conducted at GKVK Campus from 1988 to 1989. Five habitats such as field crops (both dry and wet land), mango orchard, Eucalyptus plantation and mulberry garden were visited at fortnightly intervals during the period of investigation. Among the field crops, finger millet (*Eleusine coracana* (Linn.) groundnut (*Arachis hypogaea* Linn.) and soybean (*Glycine max* Linn.) were selected as dryland crops and paddy (*Oryza sativa* Linn.) as wetland crop. The total number of beetles collected at each interval was recorded. The number of beetles found under weed stubbles of both termite- infested and termite-free groundnut field was studied during 1988- 89 at GKVK to understand their association with termites.

RESULTS AND DISCUSSION

The observations revealed that *O. pilosa* was a commonly available predatory carabid in the study area. Both grubs and adults were found to feed exclusively on termites under field conditions. Sometimes adults were also noticed in the deserted termite mounds.

The adults were generally black in colour. The average length and width of body varied from 17.7 to 22.6 mm and 6.6 to 7.8 mm, respectively. These were nocturnal and active throughout the year with maximum population during April to October. The beetles lived for more than 300 days with food and for 28 days without food. The beetles did not exhibit any cannibalistic behaviour.

The grubs were campodeiform with different shades of black and reddish-brown. The grubs were diurnal and active only during rainy season from May to November. They moved freely on the roads and open grounds during morning hours. They made burrows to a depth of 5.0 - 7.5 cm in soil and stored the termites in them. These were also noticed to attack the foraging termites under wooden baits and heap the dead termites after paralysing. Each heap contained about 25-35 dead termites with more number of workers.

The beetle had a short life cycle, which lasted for 50 to 85 days, in the laboratory. Each female was noticed to reproduce four to six times a year with overlapping generations.

The adult beetles fed on all the castes of termites *viz.,* workers, soldiers and swarming alates under field conditions. The field-collected adults were dissected for gut content analysis and in most of them the gut contained termite mandibles and skin. The average rate of consumption by an individual beetle ranged from 9.8 to 20.4 termites. The minimum and maximum number of termites consumed by a beetle per day was 2 and 30, respectively. Rajagopal and Prasad Kumar (1988b) reported comparatively more number of termite consumption (45/day) by *Oxylobus dekkanus.* The adults of *O. pilosa* were noticed to feed on swarming alates near light source during their emergence. In the present investigation, the beetles fed at the rate of one to five alates, with a mean of 2.1 per day in the laboratory.

Feeding behaviour

Beetles recognised their prey with the help of antennae. When the prey tried to escape from them, they chased and captured by holding it in between mandibles. Maxillae and forelegs were used sometimes to hold the prey in correct position. The beetles squeezed the body with the help of mandibles and fed completely. In case of soldier termites, the beetles fed only the abdomen and thorax leaving the head region. They did not exhibit group feeding behaviour, but preferred to feed individually. The average time required for each beetle to consume a single termite was 45 seconds.

The average consumption of soldiers was 32.0 per cent, as against 92.0 per cent with workers, when they were provided separately which showed more acceptance of the latter. When workers and soldiers were provided in combination, there was a higher consumption of workers (77.2 per cent) than the soldiers (22.8 per cent), which further

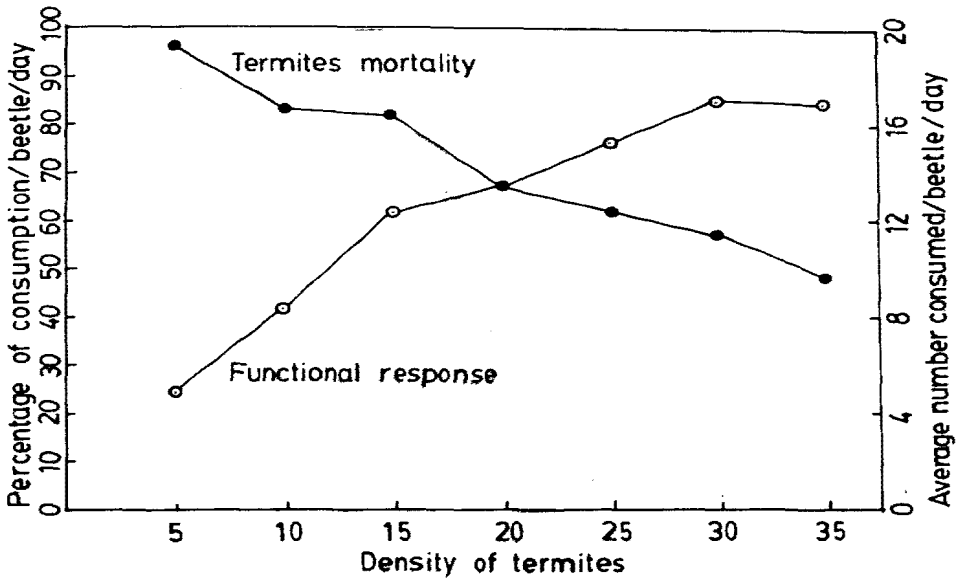

Fig 1. Functional response shown by *Omphra pilosa*

confirmed the preference of the beetle for workers. These observations are in conformity with the reports of Rajagopal and Prasad Kumar (1988b) in *O. dekkanus*.

The predatory consumption rate increased with increasing prey density (Fig. 1). The consumption of the prey was highest at a density with 30 termites and the beetle consumed the same number of termites when further increased to 35. This response of the predator at prey densities of 30 and 35 could be related to satiation reached by the predator. The percentage consumption of prey was maximum of 96 when the prey density was five and it decreased with further increase in the prey density and

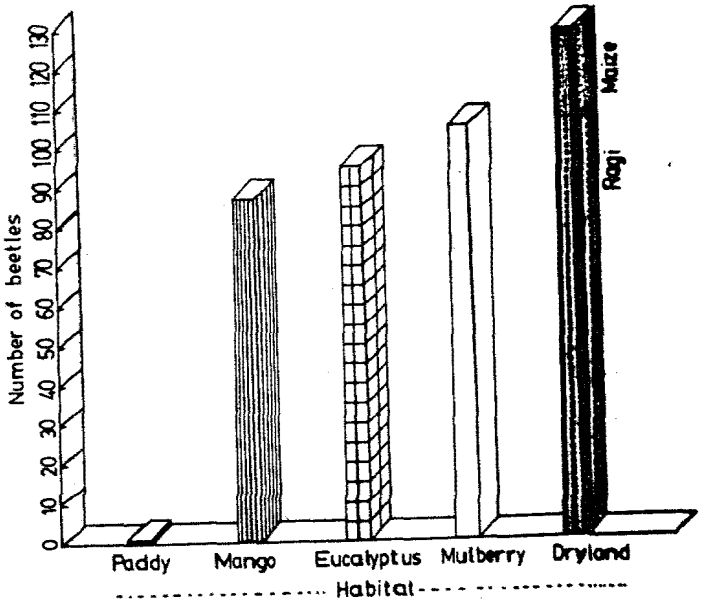

Fig 2. Abundance of *Omphra pilosa* in different crop fields.

reached minimum of 48 when the prey density was 35. The satiation point in *O. dekkanus* was reached when the prey density was increased to 70 (Rajagopal and Prasad Kumar, 1988b).

Both adults and grubs of *O. pilosa* were found distributed in all the agroecosystems surveyed except in wetlands (paddy fields). In maize field, the population was more, representing 24.2 per cent of the total population recorded followed by mulberry garden (19.7%), eucalyptus plantation (17.80%) and mango orchard (16.3%) (Fig. 2).

More number of beetles were collected from August to October in dryland crops. In mango orchard, beetles were found to be active from June to August and the number declined from September onwards. In mulberry and eucalyptus, the same trend was observed in distribution of the beetles during all the months, but recorded less number during October and November.

The number of beetles present under weed stubbles was directly related to the size of the heaps and presence of foraging termites. Normally, termite infested weed stubbles had more number of beetles, whereas stubbles without termite infestation had less number or no beetles. One to two, two to five, and four to nine beetles were present in five to fifteen, thirty to forty and thirty-seven to ninety sq cm area of heaps respectively.

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