

**BRACHYCORYPHUS NURSEI (CAMERON) (HYMENOPTERA :  
ICHNEUMONIDAE), A PARASITOID OF OPISINA  
ARENOSELLA WLK. ON COCONUT IN KERALA, INDIA\***

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ABSTRACT

The cotton boll worm parasitoid *Brachycoryphus nursei* (Cameron) has been observed to occasionally parasitise the prepupae and pupae of the coconut leaf eating caterpillar *Opisina arenosella* Wlk. in coconut gardens around Kayangulam, Kerala State. This Indo-Pakistani species of solitary ectoparasitoid shows some peculiarities in host acceptance, oviposition and development. It attacks the larvae, prepupae and pupae, always deposits numerous eggs on the host, eventually to produce only one individual parasitoid. Occasionally, it develops internally in the host pupae. It has high fecundity but possesses low searching ability, thereby causes only negligible percentage parasitism in *O. arenosella*. Eggs are laid after keeping the ovipositor touching the paralysed host. Feeding on the host's haemolymph is observed throughout the long life span of the female parasitoid. The larvae of *B. nursei* are cannibalistic. This parasitoid produces more female progeny than males in the field. The females are polyandrous and males are very vigorous. Method of rearing, oviposition, development and life cycle of the parasitoid are discussed.

INTRODUCTION

*Brachycoryphus nursei* (Cameron) (= *Melcha nursei* Cam., *Goryphus nursei* Cam.) (Hymenoptera : Ichneumonidae) was reported parasitising the pre-pupae of *O. arenosella* Wlk. (*Nephantis serinopa* Meyr.) in Kerala by Nirula et al. (1955). This species is an important parasitoid of cotton boll worms in India. It is an oligophagous species and its hosts include *Earias fabia* Stoll., *E. insulana* Boisd. in Punjab (Hussain and Mathur, 1924), *E. cupreoviridis* Walker in Punjab (Khan and Verma, 1946), *E. vitella* F. in

Maharashtra (Basarkar and Nikam, 1982), *Sylepta derogata* F. in Punjab (Anonymous, 1936), *Eublemma scitula* Ramb. in Bihar (Grover, 1939), the lymantrid *Perina nuda* Fabr. on fig trees (Cherian and Israel, 1939) and the psychid *Cryptothelea* (= *Clania*) *cramerii* (Westw.) in Coimbatore, TamilNadu (Brahmachari, 1938) and in Karachi, Pakistan (Hamid, Samad and Qadri, 1969).

*B. nursei* is distributed only in India and Pakistan. Although the larvae of the parasitoid show cannibalistic beha-

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viour, two individuals may sometimes succeed in completing their development on a single host (Ahmad and Ullah, 1945). It is a high fecund species; 56-150 hosts are paralysed (Pruthi, 1939) and a maximum of 164 eggs are laid (Pruthi, 1940). The present investigation was undertaken with a view to assessing the suitability of the parasitoid as a biocontrol agent of the coconut leaf eating caterpillar, *O. arenosella* Wlk. A technique for rearing this parasitoid in the laboratory was developed and additional information on its oviposition, development and biology were collected. These are presented in this paper.

#### MATERIALS AND METHODS

##### *Method of rearing*

The initial breeding stock of the parasitoid was obtained from the field-collected cocoons of *B. nursei* during 1983 and 1984. Twelve females and six males emerged from 24 cocoons collected from *Opisina* infested coconut gardens formed the nucleus stock culture. The adult parasitoids were caged in glass bottles, 18 cm × 9 cm, containing undiluted honey provided as droplets on wax-coated paper as feeding material.

Four to five fully grown *O. arenosella* caterpillars were placed inside petridishes (10 cm diameter) and kept undisturbed for one to two days, so as to allow them to spin cocoons for pupation. Some of them may undergo pupation in the meantime and the remaining ones will be in the prepupal phase. One to two females of *B. nursei* were introduced into the petridish for egg

laying. After oviposition the adult female parasitoids were again transferred to glass bottles.

##### *Mating and oviposition behaviour*

Mating and oviposition behaviour were studied using a stereoscopic microscope. The life history was studied under a temperature range of 22-30°C and 45-80% RH in the insectary.

#### RESULTS

##### *Oviposition behaviour*

The female parasitoid stands over the cocoon, and thrusts its powerful ovipositor, into the host to paralyse it. Then the ovipositor is withdrawn and the parasitoid remains there for some time. If the host is still in the larval stage, it may try to escape, tearing the cocoon. The larva will quite often succeed in moving out of the cocoon, but sometimes the female parasitoid prevents it from escaping by guarding at the exit points and biting the larva when it tries to crawl out. In two to three minutes of receiving the ovipositor thrust, the larva will be paralysed. The larvae escaped from the silken cocoon will be paralysed in the petridish. The escaped larvae or the paralysed larvae found outside the cocoons within the petridishes are not selected for oviposition.

Although a solitary species of parasitoid, *B. nursei* lays numerous eggs on a paralysed host, even when suitable hosts are available nearby. Eggs are laid inside the cocoon on any part generally away from the host. Eggs are placed without

touching each other. Sometimes, eggs laid first are destroyed with the ovipositor and fresh eggs laid.

Adult females feed on the host's haemolymph almost throughout their long life span. Feeding is done from both larvae and pupae and such hosts are badly disorganised. Eggs are also laid on such hosts, but the developing parasitoid larvae will not attain the normal size and develop only as under-sized adults.

Pupae of *O. arenosella* are also punctured and internal organs lacerated before oviposition. This prevented further development and the host pupa becomes soft for the feeding of the hatching parasitoid larvae. Eggs are usually laid outside the host pupae and on hatching they feed externally.

*B. nursei* prefers to oviposit on prepupae of *O. arenosella*. Pruthi (1939) has also observed the same in the case of *E. fabia*, while Hamid et al. (1969) noted it attacking the fourth to sixth instar larvae of the case worm *Cryptothelea cramerii*. However, Basarkar and Nikam (1982) found it as a pupal parasitoid of *E. vitella*.

Larvae of the case worms collected from coconut were also exposed to the adults of *B. nursei*. They were paralysed easily. The parasitoid fed on the host's haemolymph and deposited eggs, which developed into adults.

*B. nursei* cannot distinguish its own progeny. When exposed, it killed its own larvae and deposited eggs on them.

It does not also utilise its reproductive potential judiciously. Khan and Verma (1946) reported that the eggs were not evenly distributed among the available hosts, some receiving none, while others received several. With regard to its oviposition behaviour, Ahmed and Ullah (1945) noted it stinging and paralysing a large number of hosts before ovipositing in some of them. The present authors observed as many as eight eggs laid on a single prepupal caterpillar of *O. arenosella*. Hamid et al. (1969) observed it laying 14 eggs on the larvae of *C. cramerii* in a day.

#### Development

The entire development of the parasitoid takes place inside the cocoon spun by the host caterpillar. The newly hatched parasitoid larvae are mobile. They locate the host easily and feed on them. They consume the host contents quickly. Only one larva will survive and the remaining ones are killed. Normally the feeding phase will be completed in 3-4 days, a cocoon is spun in a day and pupation takes place in another 2-3 days. In hosts such as *Earias* spp. and the case worm *C. cramerii*, two individuals may occasionally succeed in completing their development (Ahmad and Ullah, 1945; Hamid et al., 1969). However, this does not happen in the case of *O. arenosella*.

Nirula et al., (1955) provided an account on the development of *B. nursei* in *O. arenosella*. According to them, the female parasitoid oviposits on the prepupa; the parasitoid larva hatches after two days; it penetrates into the pupa,

feeds internally and emerges out for spinning cocoon for pupation. But the present observations reveal that the parasitoid never oviposits on host without paralysing it and the paralysed prepupa will not pupate. Newly hatched larvae of *B. nursei* are not observed to penetrate into the host pupae of *O. arenosella*. Attempts to induce them to enter into the host pupae through holes made on them were unsuccessful. However, *B. nursei* occasionally develops as an endoparasite in the host pupae. Those larvae developing internally do not come out for pupation, but spin cocoons inside the pupal case and pupate. Hussain and Mathur (1924) have observed it depositing eggs externally on the host, but the hatching larvae developed internally or externally. According to Clausen (1940), this course of events appears to be improbable and requires further verification. However on rare occasions, *B. nursei* develops internally. It is not certain whether the female parasitoid lays eggs inside the pupae in such cases or the hatched parasitoid larvae penetrate into the pupae through the punctures made by the parasitoid with its ovipositor. Three adults of *B. nursei* emerged in the laboratory from the field-collected pupae of *O. arenosella* had developed internally.

Emergence of adult parasitoid takes place in the morning hours.

#### Mating

The female parasitoid is polyandrous and sexually mature when emerged. It mates immediately with the earlier emerged males. Males are sexually very

vigorous. Female does not resist for the first mating, but subsequent matings occur after a brief resistance only. The following events lead to mating :

1. Male sways in the presence of virgin female, moves quickly and mounts on the female, strokes the female's antennae with the antennae of male and rapidly taps on the thorax of the female with the mouth parts and fans its wings.
2. The male bends its abdomen, locates the genital pore of the female, raises the abdomen of the female and mates.
3. Slow antennal contact and fanning of wings are continued by the male. It may also keep its mouth parts touching the thorax of the female.

Mating lasts for only 13-35 seconds. Virgin and mated females may mate even after two or three months of emergence.

#### Life cycle

Preoviposition period : one day;  
Egg period : 25 h 45 min. to 29 h;  
Larval period (a) On hosts not fed by female parasitoid : 6-8 days; (b) On hosts fed by female parasitoid : 9-12 days;  
Pupal period : 6-9 days; Longevity of adults fed with undiluted honey : 1-4 months; Sex ratio: 1 female: 8 males in the lab culture and 2 females : 1 male in the field.

Egg to adult stages of *B. nursei* are completed in 13-21 days. Majority of the adults emerged in 14 to 17 days.

*Immature stages*

*Egg*

Creamy, elongate and curved, anterior end slightly broader, chorion smooth and without sculpture. During hatching, the young larva applies pressure and the chorion in the anterior end breaks, the head begins to protrude and the chorion slightly glides backwards. Hatching larvae take about 45 minutes to wriggle out of the chorion.

*First instar larva*

Creamy, broad head with two appendages and distinct body segments. The body tapers progressively towards the proximal end.

*Mature larva*

Head small without any appendages, creamy.

*Cocoon*

White when spun, cylindrical with tapering ends.

DISCUSSION

This Indo-Pakistani species is more abundant in the northern tracts of India than in the South (Ahmad and Ullah, 1945). Being a parasitoid of the economically important cotton boll worms in India, it has been subjected

to detailed studies by various workers. In northern parts of the country its life cycle ranged from 10 days in the summer to 86 days in the winter and the parasitoid overwintered both in the larval and adult stages (Khan and Verma, 1946). Its peak activity is in the winter months, from October onwards and it is rarely met with in the summer (Ahmad and Ullah, 1945).

It is easy to rear this parasitoid in the laboratory, but it produces more number of male progeny. However this does not happen in the field, where the females outnumber the males. It has high fecundity with a long life span of 1-4 months. It wastes its reproductive potential by depositing numerous eggs on a host ultimately to produce only one progeny. This can perhaps be the factor which prevents the rapid build up of the parasitoid even during favourable season. It was also observed in the laboratory that the adult female parasitoids were not able to recognise even their own progeny and that they were also killed. Its searching ability appears to be low, as a result of which it fails to make any marked impact on the population of *O. arenosella*. Inundative releases of the lab reared females of *B. nursei* are also not practicable in view of the fact that majority of the adults emerging in the laboratory culture are males.

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