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Studies on the Biology of *Apanteles* sp. (nr. *nepitae* Wilkinson) (Hymenoptera : Braconidae), a Gregarious Endoparasitoid of *Amata passalis* (Fabricius) (Lepidoptera : Arctiidae)*

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ABSTRACT

***Apanteles* sp. (nr. *nepitae* Wilk.) an indigenous gregarious endoparasitoid of *Amata passalis* (F.) a polyphagous pest completed its life cycle in 16.57 ± 2.35 days with three larval instars. The incubation period of egg was 21.20 ± 2.48h. The developmental period of larva and pupa lasted on an average of 8.65 ± 2.19 and 6.43 ± 0.85 days, respectively. Female parasitoids were ready for mating immediately after their emergence. Unfertilized females gave rise to only male progeny. Females fed on 50 per cent honey laid on an average of 241.4 eggs. Adult parasitoids fed on raisin or 50 per cent honey lived significantly longer than those fed on water or starved. Sex ratio of the parasitoid was 1 male : 2.29 females.**

KEY WORDS : *Apanteles* sp. (nr. *nepitae*), biology, *Amata passalis*

Amata passalis (F.) is known to be a defoliator of several host plants like cowpea, *Vigna sinensis* Endl. (Pillai, 1921); Sandalwood, *Santalum album* Mathur and Singh, 1961) and pulses (Ramakrishna Ayyer, 1938). In the studies made on the natural enemies of *A. passalis,* it was found that *Apanteles* sp. (nr. *nepitae* Wilkinson) was an efficient larval gregarious endoparasitoid (Venkatesha and Gopinath, 1988). This paper provides information on the biology and the effects of variations in diets on the longevity of the parasitoid.

MATERIALS AND METHODS

The host larvae were first collected from the sandalwood stand in Mysore and reared in the laboratory in sterilized glass jars (4.0 x 7.50) on fresh sandalwood leaves. Adults that emerged were allowed to mate and lay eggs on blotting paper or stretched muslin inside the same jars. Newly emerged larvae were kept in petri dishes (3" in diameter) and fed with fresh succulent leaves of sandalwood.

Adults of *Apanteles* sp. (nr. *nepitae*) obtained from field-collected host larvae were maintained in glass jars (8x12)cm and fed with diluted honey (50 per cent in water) soaked in small cotton swabs. For further multiplication, age determined larvae of *A. passalis* were introduced into the glass jars which contained mated female parasitoids. Immediately after ovipositional strikes, host larvae were removed and reared individually (to prevent cannibalism) in a glass tube (4"x1") and were provided with fresh sandalwood leaves as food till required. The same jars were also utilised for isolation of virgin individual and for observations on mating and ovipositional behaviour of adults. Sex ratio of the parasitoid was also recorded.

Sixth stage larvae of *A. passalis* were exposed to a laying female parasitoid. Such parasitised host larvae were removed after 12, 16, 20 and 24 and every 24h thereafter, fixed in 70% ethanol and labelled for preservation. Later, these were dissected to follow the development of the immature stages. The

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number of larval instars and developmental period of each immature stage were recorded. Regular dissections of the host larvae offered to a single mated female were carried out to determine the fecundity of the parasitoid. The mated parasitoids were isolated into glass vials (6"x1") and the effect of food on longevity of adults was studied by feeding 20 males and 50 females on a diet comprising 50 per cent honey (diluted in water), raisins (pre soaked in water) and tap water. The effect of complete starvation was also recorded. The mortality of each sex was recorded every 24h.

Table 1. The life cycle of *Apanteles* sp. (nr. *nepitae*) in relation to temperature and humidity

Stage	Duration of development (days) (Average temperature °c)				Average relative humidity (%)
	Range	Mean ± SD	Maximum	Minimum	
Egg	18-24*	21.20 ± 2.48	28.88	24.44	60.75
Larva :					
I Instar	2.00-7.40	4.13 ± 1.55	27.87	24.25	63.33
II Instar	1.70-3.40	2.24 ± 0.51	27.22	23.88	60.75
III Instar	1.90-2.80	2.28 ± 0.54	28.00	24.14	64.81
Total Larval period	6.00-13.30	8.65 ± 2.19	27.86	24.26	63.13
Pupa	5.25-8.08	6.43 ± 0.85	28.08	23.86	65.70
Egg to adult	12.10-20.76	15.97 ± 2.41	27.91	24.01	62.97

* Duration of development in h

RESULTS AND DISCUSSION

There were three larval instars (Table 1) as in other species of *Apanteles* (Laing and Levin, 1982; Sathe *et al.* 1988). Dissections of parasitised larvae at regular intervals showed the parasitic eggs floating within the haemolymph of the host and after hatching, were not found feeding on vital organs of the host till they reached an advanced stage. The mature larvae emerged from either side of the ventrolateral region of the host larva nearly in equal numbers and immediately spun silvery white cocoons.

The adults emerged usually in the morning within two to three h of sunrise by first cutting a circular lid at the cephalic end of the cocoons as commonly observed in other *Apanteles* species. Both sexes invariably emerged simultaneously as in *Apanteles flavipes* (Cameron) (Arakaki and Ganaha, 1986). Wasps were positively phototactic as they tended to congregate towards the light source. The adult parasitoid exhibited a marked response to daylight for mating. The female wasps were receptive immediately after emergence as noticed in *Apanteles marginiventris* (Cresson) (Boling and Petre, 1970) and *A. flavipes* (Arakaki and Ganaha, 1986). Furthermore, several females oviposited immediately after emergence without mating or taking any food. A similar situation was reported by Subba Rao and Gopinath (1961) in *Apanteles angaleti* Muesebeck. In the vicinity of female wasps, males intensified the frequency of their wing vibrations and the process of copulation involved the male approaching the female from the rear and then mounting her for a fraction of a second during which insemination took place as in *A.marginiventris* (Boling and Petre, 1970). Males were polygynous, while females copulated only once in their life time as is common in hymenopterous insects and may be an effect either of an adequate store of sperm or of aging (Flanders, 1943). Adults were less active in cool, cloudy weather than in sunny weather as reported by Sato (1979) in *A. glomeratus* indicating that

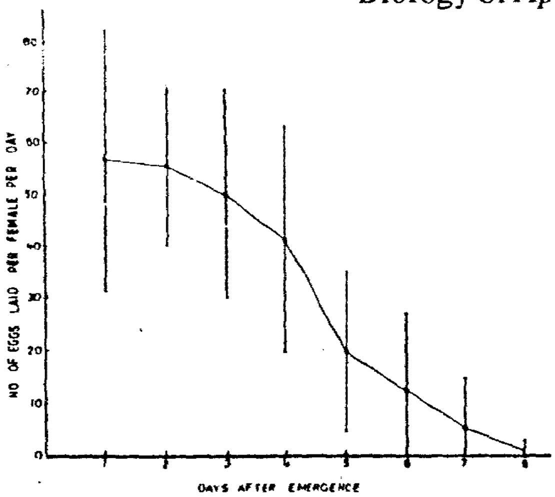

Fig 1. Mean daily egg production by gravid female *Apanteles* nr. *nepitae* (Vertical line indicates SD of mean number of eggs laid)

mating and parasitisation are under the influence of climatic factors.

The adult female wasp oviposited immediately after emergence for which later stages of the host were preferred while the first four stages were rejected. Imminence of an ovipositional strike could be made out when the laying female, on becoming aware of the presence of a suitable host, began to rub its hind legs against the tip of its abdomen and palpated the host by tapping the antennae on the host larva. When the host started moving, the female quickly settled on it and inserted the ovipositor on the dorsolateral aspect of the body. Successful oviposition strikes could be completed on an average in 11.75 seconds (SD ± 8.95, range 3-32, n = 16) and attempts at strike commenced only if the palpated host larva commenced to move. Generally female wasp rejected the immobile or dead hosts for oviposition. Schmidt (1974) and Wilson *et al.* (1974) reported that the movement of the host often appears to excite the parasitoid and thereby increases the ovipositional drive and acceptance.

Parasitoids deposited the highest number of eggs on the first day Fig. 1. This value then decreased as the female aged. The ovipositional behaviour of virgin females was identical to that of mated females. This egg production pattern is similar to what has been noticed by Cardona and Oatman (1975) in *Apanteles subandinus* Blanchard. *Apanteles* sp. (nr. *nepitae*) is an arrhenotokous species since virgin females produced male progeny. This seems to be a common phenomenon in

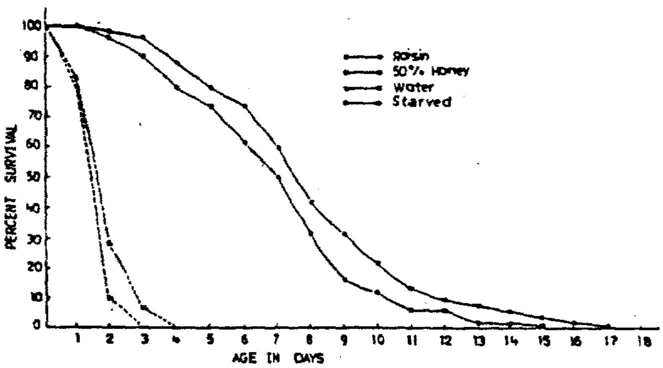

Fig 2. Longevity of mated female *Apanteles* (nr. *nepitae*) fed on different diets.

Table 2. Fecundity and reproductive period of *Apanteles* sp. (nr. *nepitae*)

Sample No.	No. of larvae parasitised	Total No. of eggs laid	Reproductive period (days)	Post oviposition period (days)
1	29	306	7	3
2	27	307	5	2
3	12	134	4	9
4	36	422	8	1
5	18	228	6	1
6	15	153	5	5
7	14	143	5	7
8	26	279	7	1
9	12	143	4	4
10	27	299	6	3
Average	21.60	241.40	5.70	3.60
Range	12-36	134-422	4-8	1-9

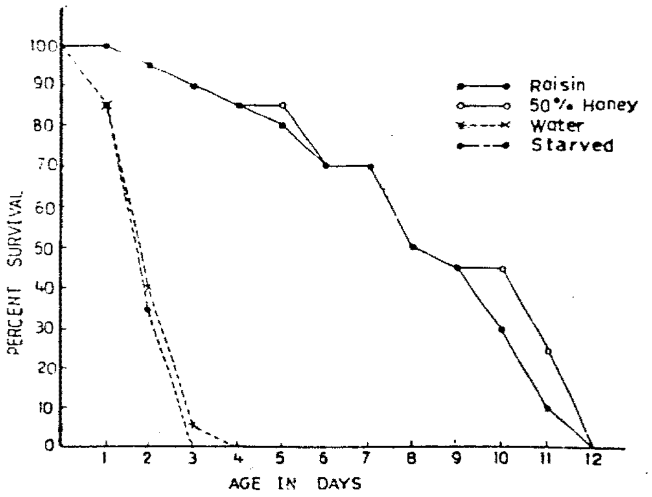

Fig 3. Longevity of mated male *Apanteles* (nr. *nepitne*) fed on different diets

hymenopterans (Flanders, 1943). Results on the total number of eggs deposited and the reproductive period are given in Table 1. The sex ratio of laboratory-bred adult parasitoids was found to be 1 male: 2.29 females. In gregarious *Apanteles* species, female biased sex ratio has been reported by various workers (Ikawa and Okabe, 1985; Arakaki and Ganaha, 1986).

None of the sources of nutrition had a noteworthy differential effect on longevity of male but, females fed on raisin lived longer than those fed on 50 per cent honey (Fig 2 and 3). Water alone did not significantly increase longevity over that recorded for starved wasps.

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