

frequent variation in pigmentation occurs in *Azolla* under field conditions according to light intensity, temperature and nutrient availability except *A. pinnata* isolate from Vietnam (no. 14) which remained green when water temperature was high during summer and was also found to tolerate low temperature at Cuttack¹³. The sporophyte of *Azolla* is heterosporous, since both mega and microsporocarps are produced on the same plant, except in *A. pinnata* green isolate where only microsporocarps are formed^{2,14}. Formation of sporocarps in *A. pinnata* isolates, *A. filiculoides* and *A. mexicana* is reported at Cuttack conditions where the latter species sporulate throughout the year³. The present observations show that all the species could grow in net house conditions; however, only *A. pinnata* (nos. 1–22) and *A. mexicana* (no. 254) sporulated during the period of experimentation. It is necessary to screen *Azolla* resistant/tolerant species/varieties for its pests. Singh³ reported Bangladesh isolate of *A. pinnata* as tolerant to pests in comparison to other isolates. The success of *A. caroliniana* multiplication throughout the year in field is perhaps due to its less susceptibility to pests including snails and diseases besides its tolerance to high and low temperatures.

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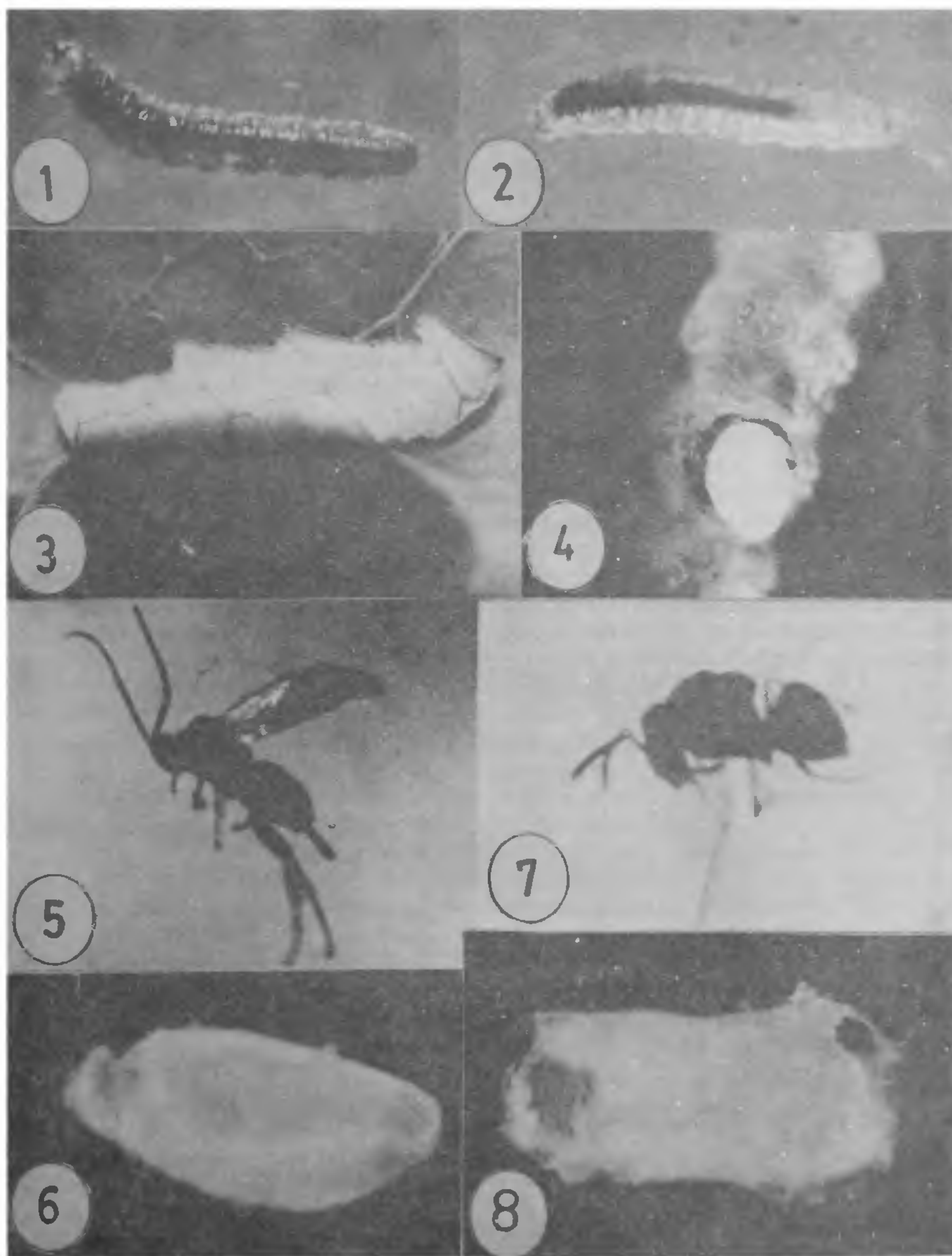
A NEW HOST RECORD OF A HYPERPARASITE, *PERILAMPUS* SP. (PERILAMPIDAE : HYMENOPTERA) ON *APANTELES ARISTAEUS* (NIXON.) (BRACONIDAE : HYMENOPTERA)

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TEA is made from the young leaves and unopened buds of the tea-plants, *Camellia sinensis* (L.) O. Kuntze¹. A number of pests cause considerable damage to these plants^{2,3}. The insect pest causing heavy economic loss is the larva of the moth, *Cydia leucostoma* (Meyr.)⁴. The larvae are usually called 'flushworms'. They were parasitized by a number of insect parasites⁵. *Perilampus* sp. (tristis group) was the hyperparasite of flushworm and larval parasite of *Bracon* sp.⁵. The present investigation revealed that the *Perilampus* is also a larval parasite on *Apanteles aristaeus* (Nixon.). The presence of *Perilampus* on *A. aristaeus* is a new host record.

Several hundreds of flushworm-infested shoots were collected in and around Kil-Kotagiri, Nilgiris, Tamil Nadu (4800' to 5500' above MSL) throughout the years from 1982 to 1986. The pest larvae were separated from the infested shoots and reared in transparent plastic containers. The normal larva is pinkish or brownish (figure 1) while the infected one has a translucent body with a conspicuous longitudinal red mark middorsally (figure 2). The latter ones



Figures 1–8. 1. The normal larva; 2. The infected larva showing longitudinal red-mark in middorsal region; 3. Marginal fold of the tea-leaf covering the flushworm; 4. Emerging final instar larva of *Apanteles aristaesus*; 5. Adult of *A. aristaesus*; 6. Puparium of *A. aristaesus*; 7. Adult of *Perilampus* sp.; 8. Puparium of *A. aristaesus* from which *Perilampus* sp. emerged.

were segregated and reared separately. The infected larva was dissected and it was found that the alimentary canal was filled up with reddish fluid, easily mistaken for dorsal blood vessel, from outside look. It was also observed that the larva of *A. aristaeus* was present in the body cavity of flushworm. They pupated by folding the margin of the leaves over them (figure 3). On the third day of pupation, (while opening the leaf-fold), the final instar larva of the parasite, *A. aristaeus*, was found to emerge out from the body of flushworm (figure 4). It pupated in about 10–15 hours. Adults of *A. aristaeus* emerged out between 12 and 29 days after pupation (figure 5). The puparia are always oblong in shape with a circular hole at the top and a lid still attached to its side (figure 6). The unhatched pupae were kept in separate containers for further observations. The hyperparasites, *Perilampus* sp. emerged in about 28–65 days (figure 7). The puparia of *A. aristaeus* from which *Perilampus* sp. emerged are more or less cylindrical in shape with an irregular hole at the top and without a lid (figure 8). It was also found that the developing hyperparasite had changed the very structure and exit hole of the puparium in which it had undergone development. According to Chon⁶, the cocoon of this primary parasite is unknown. This is also a first report on the structure of the pupal case of the primary parasite.

The above observations reveal that *A. aristaeus* (Nixon.) is a primary parasite of the flushworm which confirms the findings of Rao⁷. In the light of the present observations *Perilampus* sp. is recorded as a parasite of *A. aristaeus*. The emerging hole of the adult *A. aristaeus* from the puparium is strikingly different from the emerging hole of the *Perilampus* sp. The mean pupal periods of the former and latter insects are 20.26 and 47.41 days respectively (table 1). The mean pupal period of the latter is roughly 2½ times longer than that of the former and the difference in period indicates the developmental period of *Perilampus* sp. within the body cavity of

A. aristaeus. The material from which the *Perilampus* sp. emerged, the way of emerging and the mean emerging period all fall in a line to prove that *Perilampus* sp. is a parasite of *A. aristaeus*.

The present investigation has revealed that the presence of *Perilampus* sp. on *A. aristaeus* is a new host record. The biology of the above hyperparasite of flushworm has not yet been established so far. Detailed studies on the biology of these hyperparasites are under investigation following earlier studies^{8–11}.

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Table 1 Emerging periods of *Apanteles aristaeus* Nixon and *Perilampus* sp.

Parasite/ Hyperparasite	No of specimens obtained	Range (days)	Mean (days)	S D ±
<i>Apanteles aristaeus</i>				
Nixon.	31	12–29	20.26	4.03
<i>Perilampus</i> sp.	29	28–65	47.41	7.91