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Epipyrops eurybrachydis, the ectoparasitoid and *Tetrastichus krishnaiahi*, the superparasitoid in the biology of the plant pest, *Eurybrachys tomentosa* (Fab.) (Homoptera : Fulgoridae) : A case study

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ABSTRACT : The plant bug, *Eurybrachys tomentosa* (Fab.) is reported to be a vector of spike disease in sandal plants and as a minor pest of more than twenty plants of economic value. While studying the biology of *E. tomentosa*, the larvae of *Epipyrops eurybrachydis* (Lepidoptera : Epipyropidae) were found to be the ectoparasitoid of *E. tomentosa*, and *Tetrastichus krishnaiahi* (Hymenoptera : Eulophidae) as superparasitoid on *E. eurybrachydis*. Larvae of *E. eurybrachydis* appeared regularly during collection, only in the female insects of *E. tomentosa*. The fifth instar nymphs were also found to be parasitized. Usually one larva was found to parasitize the fulgorid, but rarely more larvae were attached especially to the tegmen of the host. The ectoparasitoid's larval period ranged around 13.5 days. Pupation was observed on the food plant of the host. The pupal period lasted for 8 days. The ectoparasitoid used to feed on the haemolymph of the host by its labium which remains buried inside the host tissue. A well developed circular abdominal sucker helps the larvae to cling to the host tightly. The parasitized female was found to lay no eggs and its reproductive system was seen with slender ovarioles without any oocytes. *E. eurybrachydis* was observed to be a major parasitoid of *E. tomentosa*. The emergence of eulophid superparasitoid *T. krishnaiahi*, from the cocoons of epipyropid moths, *E. eurybrachydis* has also been reported as a rare kind of superparasitism. It was found that eulophids (superparasitoids) attacked the larvae of the ectoparasitoids before they abandoned their host (*E. tomentosa*) for pupation.

The plant bug, *Eurybrachys tomentosa* (Fab.), has been reported earlier as a vector of spike disease in sandal plants, and as a minor pest of more than twenty different species of plants of economic importance (Chatterjee, 1933). First report of an ectoparasitoid on the fulgorid, *Eurybrachys tomentosa*, was documented by Fletcher (1917) in Coorg, India. Earlier, Bowring (1850) reported a similar ectoparasitoid, *Epipyrops anomala* on a fulgorid bug, *Fulgora candelaria*. However, a brief description on the biology of Bowring's specimen, was made by Westwood (1876), who subsequently described other specimens of epipyropids (Westwood, 1877). Preliminary report on the biology of epipyropids was

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given by Dyar (1902) and Perkins (1905). The salient feature of Epipyropidae is that their larvae are external parasitoids on members of the Fulgoroidea (Marshall, 1970). From India, only a brief report on *Epipyrops eurybrachydis* as an ectoparasitoid of *E. tomentosa,* is available (Fletcher, 1917). Success in biological control is possible, in case intricate interactions between the organisms, involved both harmful and beneficial, are thoroughly understood. Basic studies on the systematics, biology and ecology of pests and their natural enemies are, therefore, an integral part of any programme related to biological control (Rosen, 1985). Equally important is a thorough knowledge of the effect of superparasitism on the development of a parasite/parasitoid on a host, in such programmes (Nadarajan and Jayaraj, 1977). These considerations necessitated to investigate the relationship between the host plant/pest (*Eurybrachys tomentosa*) and an ectoparasitoid (*Epipyrops eurybrachydis*) and superparasitoid (*Tetrastichus krishnaiahi*).

MATERIALS AND METHODS

Specimens of *Eurybrachys tomentosa* were collected at weekly intervals from *Calotropis gigantea* in the Bharathiar University campus, Coimbatore, India. Infected adult insects were maintained in the laboratory on freshly cut branches of *C. gigantea.* Larvae of *Epipyrops eurybrachydis* were allowed to remain on the adults of *E. tomentosa* indefinitely, for observing its larval life and population process.

For morphological studies of the mouth parts, and the ventral abdominal suckers and their hooks, permanent mounts of the fifth instar larvae of *E. eurybrachydis* were made. The detachment of ectoparasitoid from the host, the method of formation of cocoon, the pupal period, and the adult emergence were also observed during this investigation. The cocoons of the ectoparasitoid present in the field on plants of *Calotropis gigantea* and *Cassia occidentalis* were also collected and observed daily for recording the emergence of the superparasitoids. They were studied by mounting them in polyvinyl lactophenol.

OBSERVATIONS AND DISCUSSION

Ectoparasitoid

Larvae of *Epipyrops eurybrachydis* appeared regularly during the collection of *Eurybrachys tomentosa* from June to December. From the collection it was noted that parasitisation occurred only on adult females, at a time that coincided with the depletion of normal fertile females from the population. No male was found to be parasitised. On two occasions, the fifth instar nymphs were also found to be parasitised by the ectoparasitoid, but attempts to collect such instars proved futile due to their quick movement.

Usually, only one larva was found to parasitise (Fig. 1) a single female fulgorid, but very rarely up to four larvae were also found on a single female host. In such cases, the younger instars of the parasitoid remain attached to the inner surface of tegmen or corium of the host (Fig. 2) as well as hind wings. The duration of the larval life of the parasitoid on the host, from the time of the attachment of first instar till it abandoned its host at the fifth instar (prepupa stage) was around 13.5 days. All stages of larvae were

identified during collection and they varied from 3.5-12 mm (Fig. 3) in length. The mature larvae usually leave the host and pupate on the stem or underneath the food plant of *E. tomentosa*. During laboratory rearing, they pupated on the sides of the plastic containers. The pupal period lasted for 8 days.

The head capsule of the larva was sclerotised and as it grew older, the sclerotisation became less pronounced. The larva during its life span on its host, usually fed on the vital fluid of the host by its long sucking tube (labium) (Fig. 4) which remained buried inside the host tissue. It's head was invariably directed posteriorward, closely approximating the genital segments of the host. The larva clings on to the abdominal segments of the host tightly by means of a pair of well developed circular suckers (29-33 hooks per sucker) found on its abdominal segments 2, 3, 4, 5 and 8 (Figs. 5, 6). The fifth (last) pair of semicircular suckers on the eighth abdominal segment is designated as the anal sucker with about 15 hooks per sucker.

During the parasitic life, the body of the larva was completely heaped with wax filaments secreted by the host itself, affording a kind of protection to its parasitoid. The cocoon was formed within this covering of these wax filaments. Thus, the secretion of the white waxy filament as the fluffy mass by the host used to protect the egg mass of the host at the region of the abdomen became almost negligible as the larva deserted its host. The parasitised female was found never to lay eggs during the period of parasitisation. In most cases, after the detachment of the parasitoid, the host insect died within six days. Dissections of such parasitised females showed the reproductive systems without slender ovarioles with any oocyte nodules.

The mature larva (prepupa) hardly took an hour for completing the cocoon (Fig. 7). During spinning of the cocoon, it turned its head and body both sides and finished formation of cocoon. The size of the larva and the size of the cocoon are indicators for the determination of the sex of the adult moth. Females emerged from larger cocoons, whereas male from smaller cocoons. A transverse slit like opening (Fig. 8) at the anterior end of the cocoon predetermined a weak seam along which the split occurred and opened to release the moth (Fig. 9).

Mating occurred immediately after the emergence of adults. The eggs were laid in batches within two hours after mating. The eggs are round and dark brown. The eggs laid by the moths under laboratory conditions failed to hatch.

The incidence of superparasitism

The cocoons of epipyropid moths were collected from *Calotropis gigantea* and *Cassia occidentalis* (the latter is a new host record for *E. tomentosa* in this region) found in and around Bharathiar University campus, Coimbatore, (India) and the cocoons were kept under laboratory conditions.

Emergence of the eulophid superparasitoid, *Tetrastichus krishnaiahi* Saraswat from such cocoons was observed (Figs. 10, 11). This type of parasitisation on a host by more parasitoids of a given species is known to be superparasitism (Rosen, 1985).

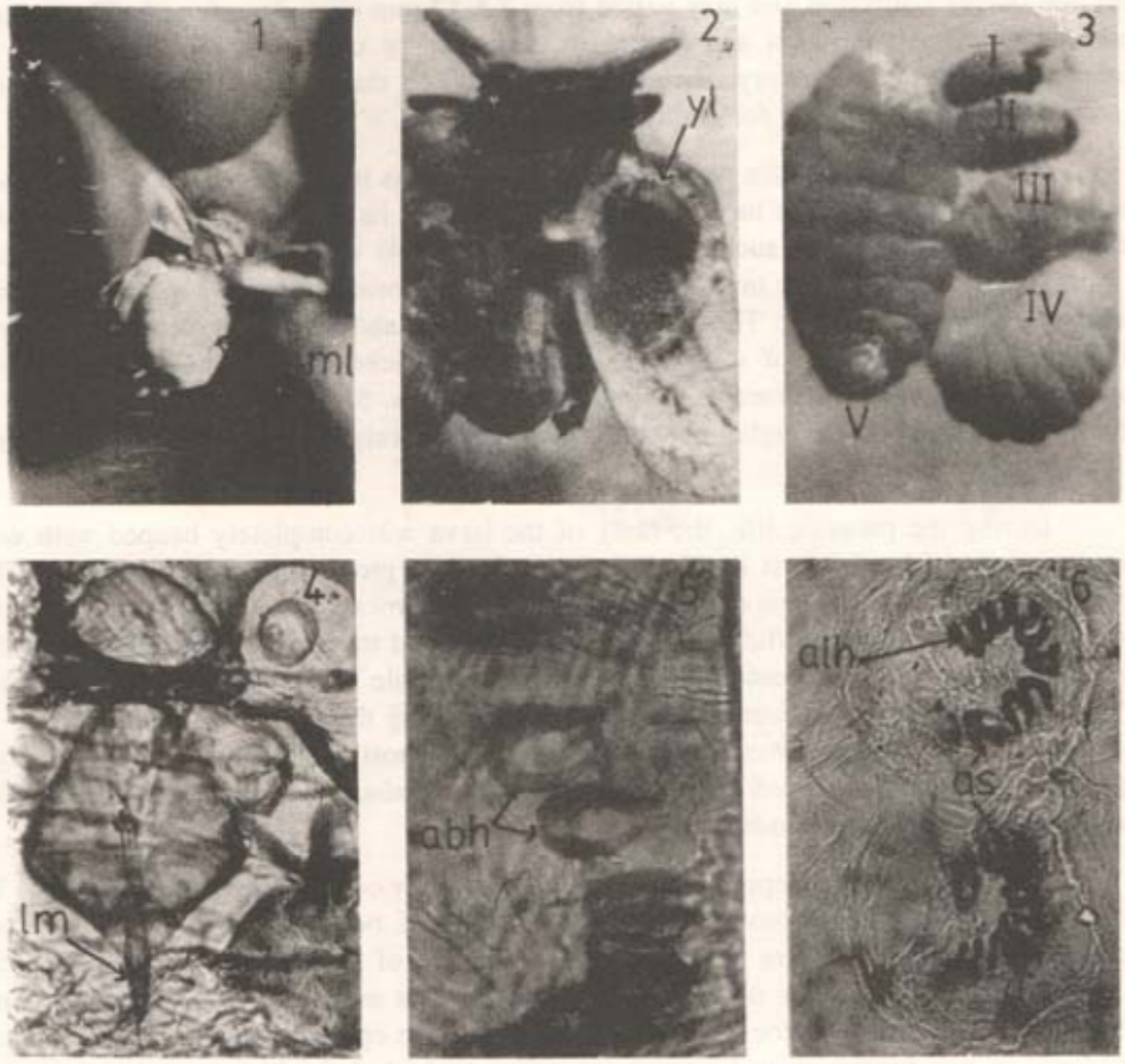

Fig. 1. Final instar larva of *Epipyrops eurybrachydis* attached to the abdomen of the host, *Eurybrachys tomentosa.*

Fig. 2. Young larva (y1) of *Epipyrops eurybrachydis* attached to the corium of the host (inner view) (20×).

Fig. 3. Larval stages of *Epipyrops eurybrachydis* (20×).

Fig. 4. Less sclerotized head capsule of the mature larva showing its sucking tube, the labium (1m) (10× 20×).

Figs. 5 & 6. Magnified (10× 40×) view of the abdominal hooks (abh) and the semicircular arrangement of the hooks (alh) of the anal suckers (as) (10× 20×).

The cocoons collected from June to October were not at all affected by this superparasitoids, whereas the cocoons collected during November-December alone were found to be invariably parasitised. This suggested that there is certain cyclicity in superparasitoid attack, probably influenced by meteorological factors.

Also, the superparasitoids attacked the larvae of the epipyropid moths long before they abandoned their host (*E. tomentosa*) for pupation. Superparasitisation was observed

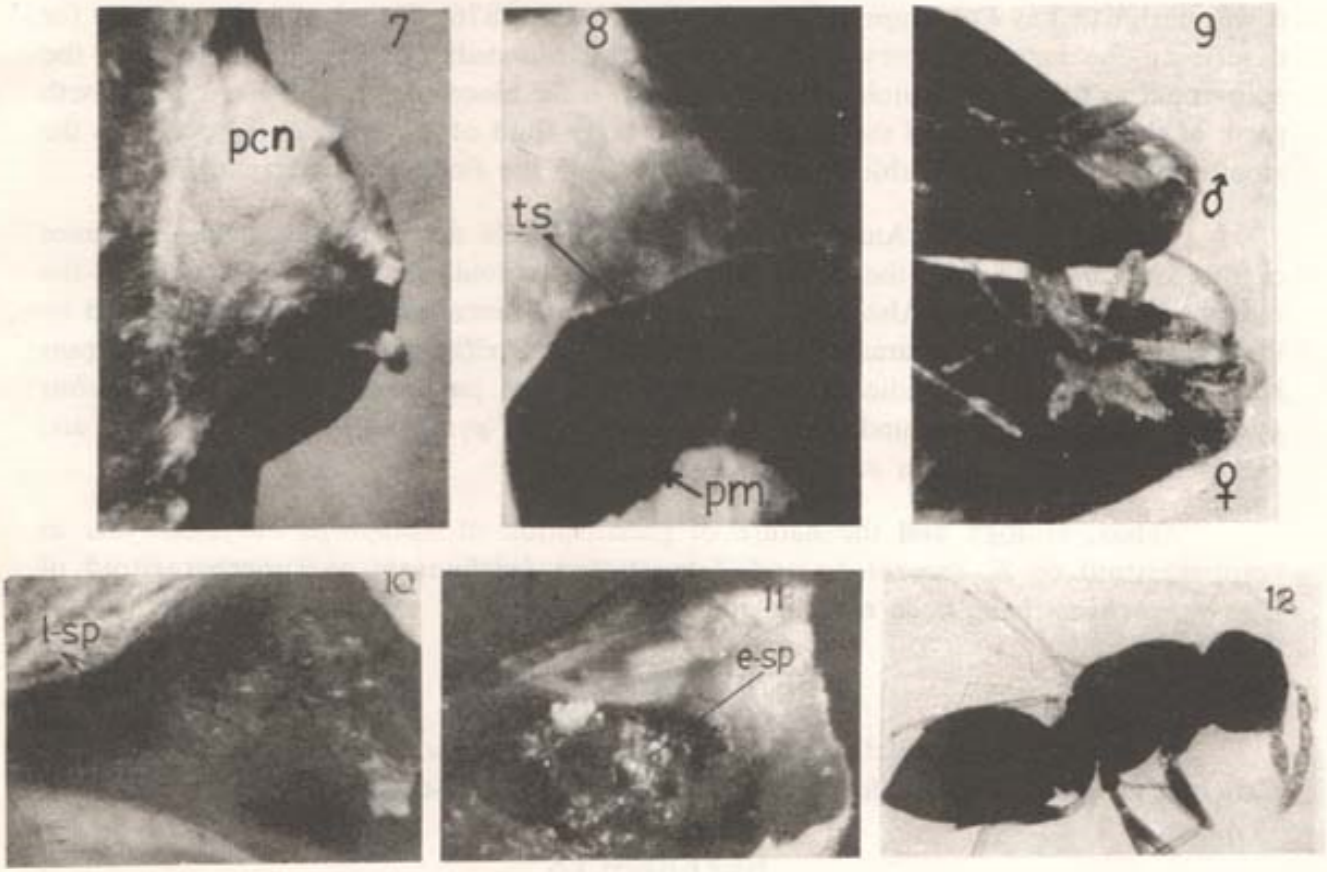

Fig. 7. *Epipyrops eurybrachydis* pupal cocoon (pcn). (20×).

Fig. 8. The empty cocoon showing the pupal moult (pm) and the emergence pore as a transverse slit (ts) at its cephalic end (20x).

Fig. 9. Adult male and female of *Epipyrops eurybrachydis* (20×).

Fig. 10. Cocoon of the ectoparasitoid split open to expose the superparasitoid (1. sp.) *Tetrastichus krishnaiahi* larvae (20×).

Fig. 11. The same showing the exuviae of *T. krishnaiahi* (20×).

Fig. 12. *T. krishnaiahi,* adult female (10× 10×).

equally in the cocoons of epipyropids present on both *C. gigantea* and *C. occidentalis.* Comparatively, more number of parasitoids emerged from the cocoons of *Epipyrops* originating from *E. tomentosa,* feeding on *C. occidentalis.* The size of the cocoons collected from *C. occidentalis* was larger.

The adult superparasitoid (Fig. 12) is pisceous. They commenced mating immediately after emergence from the host cocoon. The males chase the females and out run them, vibrate their wings and attain connection. The females laid their eggs within an hour after emergence. When fed on 5% sucrose solution, they remained alive for 2-6 days.

Evidently, *Epipyrops eurybrachydis* is a major parasitoid of *E. tomentosa* that feeds on the haemolymph and to a certain extent, on the subcuticular fat body of the host.

Bowring (1850) discovered an epipyropid ecto-parasitoid, *Fulgora candelaria* and it was designated as *Epipyrops anomala* by Westwood (1876). It took almost a century for describing the natural history of this species by Marshall (1970) who considered the epipyropid as the ectoparasitoid, feeding mainly on the blood of *F. candelaria.* The mouth parts of the larva indicated that it sucked the body fluid of the host by piercing and the structure is the modified labium, thus corroborating the findings of Marshall (1970).

Swaminathan and Ananthakrishnan (1982), while describing the natural enemies of this bug reported only the hymenopteran ectoparasitoid, *Dryinus* sp. parasitising the nymphs of *E. tomentosa.* Also, adults of *E. tomentosa* were reported to be parasitised by the larval mermethid ectoparasites. In Fulgoridae, the *Pyrilla* spp. and *Nilaparvata lugens* have been extensively studied for their hymenopteran parasitoid, mainly *Tetrastichus pyrillae* (Narayanan and Kundanlal, 1953); *Lestodryinus pyrillae* (Subba Rao, 1957), and *Gonatopus cerus* by Bentur *et al.* (1982).

Thus, biology and the nature of parsitisation of *Epipyrops eurybrachydis* as ectoparasitoid of *E. tomentosa* and *Tetrastichus krishnaiahi* as superparasitoid of *E. eurybrachydis* have been reported for the first time.

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