ISSN 0971-930X
Journal of Biological Control
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Journal of Biological Control, 26 (3): 217–221, 2012

Research Article

Two new species of *Trichogrammatoidea* (Hymenoptera: Trichogrammatidae) from Bangalore, India

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ABSTRACT: Two new species of *Trichogrammatoidea, Trichogrammatoidea ruficolorata* and *T. brevicaudata* are described from Bangalore, India. The males are morphologically similar to *T. armigera* and *T. fulva*, respectively. The relative lengths of ovipositor to hind tibia are markedly different in both pairs of species serving to differentiate between these species pairs. Females have therefore been designated as holotypes.

KEY WORDS: *Trichogrammatoidea ruficolorata, Trichogrammatoidea brevicaudata*, cryptic species

(Article chronicle: Received: 29-12-2011 Revised: 8-9-2012 Accepted: 12-9-2012)

INTRODUCTION

Eight of the eleven species of Oriental *Trichogrammatoidea* (Hymenoptera: Trichogrammatidae) are known to occur in India (Nagaraja, 1978; Noyes, 2012; Yousuf and Hassan, 2006). Two new species of *Trichogrammatoidea, viz*., *Trichogrammatoidea ruficolorata* and *T. brevicaudata* are now being described from Bangalore, S. India. The former species was associated with *T. armigera* Nagaraja in the eggs of *Lampides boeticus* (L.) (Lepidoptera: Lycaenidae) while, the latter was associated with *Trichogrammatoidea fulva* Nagaraja in the eggs of *Cryptophlebia ombrodelta* (Lower). Since the newly collected *T.* are similar in their male genitalic characters to species described earlier from here, limited crosses were conducted to establish their specific status. Female characteristics have additionally been used to distinguish between these species.

MATERIALS AND METHODS

Regular surveys for the collection of lepidopterous eggs parasitized by trichogrammatids were made around Bangalore and elsewhere in Karnataka. Collections were also made sporadically from Chennai (Tamil Nadu) and New Delhi. *Trichogrammatoidea* emerging from parasitized eggs were isolated and cultures established on the laboratory host *Corcyra cephalonica* Stainton (Lepidoptera, Pyralidae). These cultures were used for conducting crossing experiments with laboratory cultures of closely allied species.

Limited crosses were conducted between *T. ruficolorata* and *T. armigera* as well as between *T. brevicaudata* and *T. fulva* since these species pairs were very similar in their male genitalic structures.

Mean measurements of adult size and various morphological parts were taken from 12-40 specimens depending on the clarity of the specimens on microscopic slides.

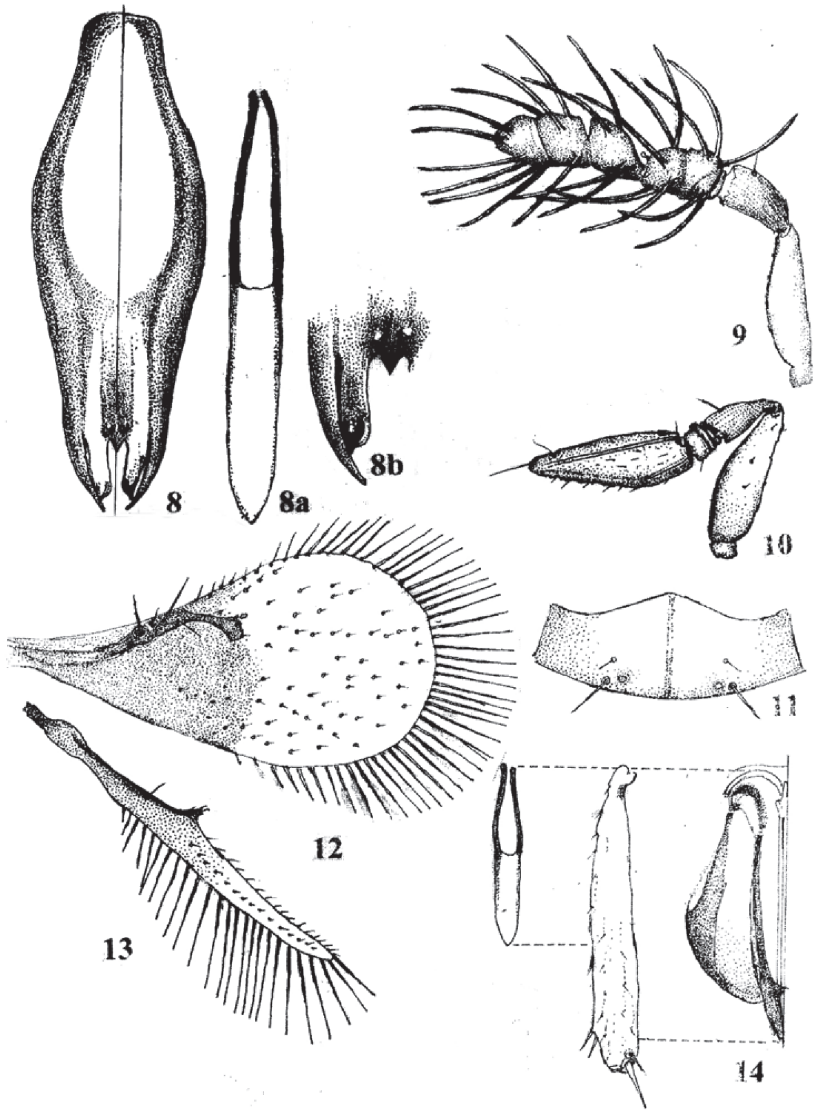
Trichogrammatoidea ruficolorata Nagaraja & Prashanth n.sp. (Figs. 1–7)

Female : Length 0.43 mm, width across head 0.19 mm.

Head dull ochreous yellow with ocelli and compound eyes bright crimson red. Antennae ochreous yellow. General body colour light red with prothorax, mesoscutum, parapsides, and scutellum blackish. Abdominal terga with blackish sides. Legs ochreous yellow.

Antennal – scape, pedicel, funicle and club – ratios 0.076, 0.033, 0.035 and 0.067, respectively. Antennal hairs moderately long, longest being x 2.1 the maximum width of flagellum. Forewing with width slightly less than 0.5 the length; fringe setae long, longest on the tornus, measuring about 0.36 the width of the wing. Hind wing with median row of setae and fringe setae slightly longer than those of forewing.

Scutellum, transverse, width x 2 the length with long posterior bristles and very short anterior bristles, each of



Figs 1–7. ***Trichogrammatoidea ruficolorata*** **Nagaraja & Prashanth sp. nov. 1. Genital capsule 1a. Aedeagus; 1b. Gonoforceps and chelate structures; 2. Antenna (male); 3. Antenna (female); 4. Scutellum with bristles; 5. Forewing; 6. Hind wing; 7. Relative lengths of ovipositor, hind tibia and aedeagus**

the latter measuring about 0.25 the former; and a pair of sensillae between the posterior bristles.

Genitalia – Length, x 3 the width; CS close to GF; Median cleft (MC) at 0.17 the length of genital capsule; MVP absent, base of the MC highly chitinized on either side; lateral tubercles faint on either side of MC. Aedeagus x 1.087 the length of apodemes; both together 0.84 of the GC, the ratio being 1.00 : 1.21; and 0.79 the hind tibia, the ratio being 1.00 : 1.25.

Male : Length 0.48 mm; width 0.19 mm. Head, thorax and abdomen light red in colour; eyes and ocelli bright crimson red; frons, prothorax and mesoscutum with blackish shade; antennae and legs ochreous yellow. Abdominal terga with light blackish or grey shade, especially along the sides.

Antennal – scape, pedicel, funicle and club – ratios 0.076, 0.033, 0.035 and 0.067, respectively. Fore and hind wings as in male. Ovipositor long, about x1.57 the length of hind tibia.

Holotype : Female ex. eggs of *Lampides boeticus* on *Crotolaria mucronata*; outskirts of Bangalore, 2007. H.Nagaraja, P. Mohanraj & M. Muniswamy coll.

Paratypes : Females and Males same details as above. Specimens were also collected from the same host and host plant from Chennai (1987) and Kamalashile (Udupi,

Karnataka). Holotype deposited at N.B.A.I.I., Bangalore. Paratypes Females and Males deposited in the above museum and the National Pusa Collection (NPC), I.A.R.I., New Delhi.

Comments: *T. ruficolorata* is found mostly in association with *T. armigera* attacking the eggs of *L. boeticus* on flowers, buds and tender shoots of *C. mucronata*.

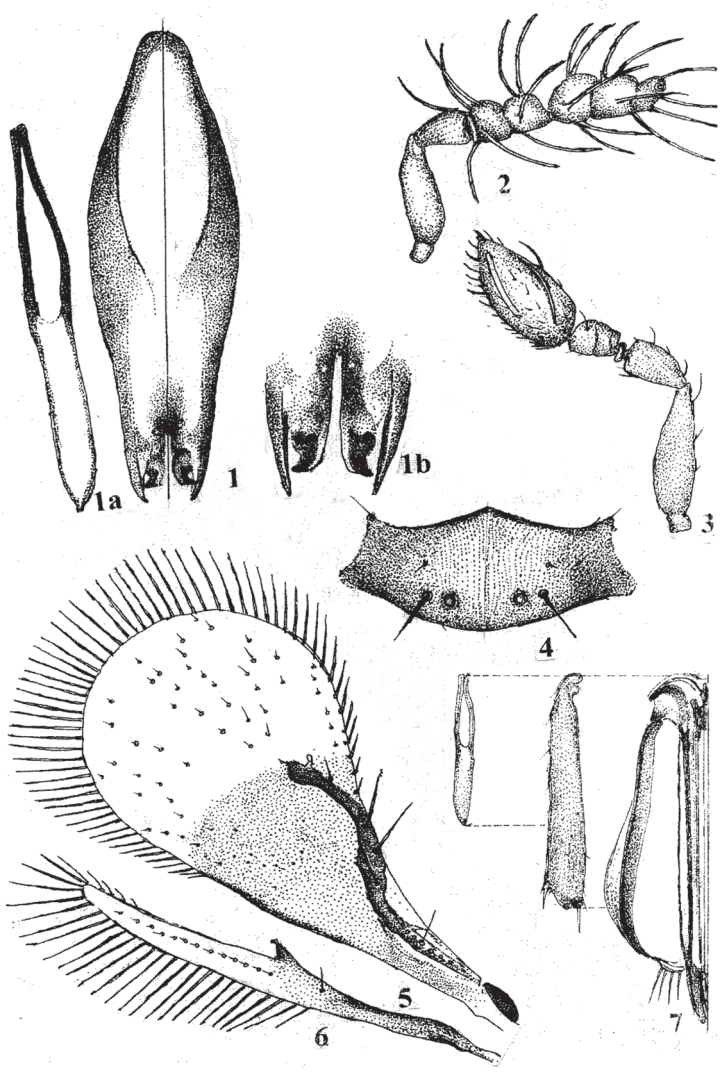
Etymology: The specific name of *T. ruficolorata* is derived from the reddish body colour of this species.

Trichogrammatoidea brevicaudata Nagaraja & Prashanth n.sp. (Figs. 8 – 14).

Male : Length 0.521 mm; Width across head 0.194 mm.

General body colour dull yellow; frons blackish, antennal segments with blackish shade. Thorax dull yellow with blackish shade.

Antennal – scape, pedicel, funicle & club – ratios 0.376, 0.157, 0.175 and 0.292, respectively. Hairs, uniformly thick or cylindrical, short, the longest being x 2.1 the width of the flagellum. Forewing width about 0.47 its length. Basal infuscation distinct, reaching the level of stigma with a distinct convex border. Fringe setae on tornus slightly longer, and about 0.38 the width of the wing. Hind wing with infuscation up to frenulum; wing disc with a single line of setae. Fringe setae starting from



Figs 8–14. ***Trichogrammatoidea brevicaudata*** **Nagaraja & Prashanth sp. nov. – 8. Genital capsule; 8a. Aedeagus; 8b. Gonoforceps and chelate structures; 9. Antenna (male); 10. Antenna (female); 11. Scutellum with bristles; 12. Forewing; 13. Hind wing; 14. Relative lengths of ovipositor, hind tibia and aedeagus**

2/3 of the distal part of wing till the apex, longest being slightly longer than those of forewing.

Scutellum transverse, width more than x 2 the length, with two long posterior and two short anterior setae, each of the latter measuring 0.33 of the former and a pair of sensillae between the posterior bristles.

Genitalia with genital capsule (GC) over x 3 the width. CS very close to but not reaching the tips of GF. Median cleft (MC) with MVP at x 0.14 the length of GC. MVP short and pointed; lateral tubercles below the MC, one slightly above the other; the region of the MC more chitinized, extending anteriorly. Aedeagus slightly longer than apodemes, the ratio being 1.14: 1.00. Aedeagus + Apodemes 0.86 the length of GC, the ratio being 1.00 : 1.16, and 0.6 the length of hind tibia, the ratio being 1.00 : 1.68.

Female: Length 0.50 mm; Width across head 0.19 mm.

Colour as in male except that thorax and abdomen light yellowish with darker shades.

Antennal – scape, pedicel, funicle and club – ratios 0.387, 0.162, 0.070 and 0.380, respectively. Forewing and hind wing as in male. Ovipositor short, 0.905 of hind tibia.

Holotype: Female ex. eggs of *Cryptophlebia ombrodelta* on pods of *Tamarindus indicus*, outskirts of Bangalore; July, 2006.

Paratypes: Males and Female: same particulars as above and also from unidentified lepidopteran eggs on *Cassia auriculata*, Hessaraghatta, near Bangalore in 2007 and 2008. Holotype deposited at N.B.A.I.I., Bangalore. Paratypes Females and Males deposited in the above museum and the National Pusa Collection (NPC),I.A.R.I., New Delhi.

Comments: The male genitalic characters are similar to *T. fulva* Nagaraja. This species was first collected on eggs of *C. ombrodelta* on tamarind pods. At times it was found along with *T. fulva* on the same host. *T. brevicaudata* was also collected from the eggs of another lepidopteran host on *C. auriculata*. *T. fulva* was not however reared from this host.

Etymology: *T. brevicaudata* is named after its short ovipositor which is shorter than the hind tibia.

CROSSING EXPERIMENTS

Limited crosses were conducted with available virgin individuals between the new and previously described species which they closely resemble. *T. ruficolorata* was thus crossed with *T. armigera* and *T. brevicaudata* with *T. fulva* to determine reproductive compatibility (Table 1).

The results of the crosses indicate total reproductive isolation in cross 2 while negligible gene exchange was evident in cross 1. As observed earlier (Nagaraja, 1973) hybrid females were short lived and did not survive long enough to determine their ability to parasitize the laboratory host on which the parental cultures were maintained.

DISCUSSION

The two newly described species are distinct from all known species. In *T. ruficolorata* the ovipositor is over x1.5 the length of the hind tibia, while it is only slightly longer than the hind tibia in *T. armigera* (Nagaraja, 1978), the species that resembles it the most. These two species as stated earlier are closely associated in attacking a common host, *L. boeticus* on a common host plant *C. mucronata*. In *T. brevicaudata*, the ovipositor is slightly shorter than the hind tibia as compared to *T. fulva*

Table 1. Production of female progeny in crosses between *Trichogrammatoidea ruficolorata / T. armigera* and *T. brevicaudata / T. fulva*

Crosses	Parental species			F1 generation	
	Male		Female	Male	Female
1	5 *T. fulva*	x	5 *T. brevicaudata*	50	1
	2 *T. brevicaudata*	x	1 *T. fulva*	31	1
2	20 *T. armigera*	x	5 *T. ruficolorata*	191	0
	10 *T. ruficolorata*	x	7 *T. armigera*	172	0

in which the ovipositor is slightly longer than the hind tibia (Nagaraja, 1973). *T. brevicaudata* appears to have a wider host range than *T. fulva*.

The crossing experiments between *T. ruficolorata* / *T. armigera* and *T. brevicaudata* / *T. fulva*, the two pairs of closely resembling species, show that they are reproductively isolated. Although fresh adults available for conducting crosses were few, especially between *T. fulva* x *T. brevicaudata*, the results indicate reproductive incompatibility. Gene exchange was minimal in this cross.

Apparently each of the species pairs *T. armigera* / *T. ruficolorata* and *T. fulva* / *T. brevicaudata* are cryptic species. The common hosts and host plants of the above pairs of species strengthen our conclusion in this regard.

With the addition of these two species the total number of Oriental species of *Trichogrammatoidea* goes up to thirteen, of which ten occur in India. Of the three extra Indian species, *T. cojuangcoi* Nagaraja (Hainan, Philippines) and *T. nodicornis* (Westwood) (Sri Lanka) appear to be island endemics while *T. thoseae* Nagaraja (Malaysia) is confined to a small continental area. It should also be noted in this context that *T. eldanae* Viggiani and *T. lutea* Girault have been reported wrongly as occurring in India (Noyes, 2012).

ACKNOWLEDGEMENTS

We are very grateful to R. J. Rabindra, former Director, NBAII for encouragement and to Sunil Joshi for digitizing and skilfully enhancing the figures.

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