



Research Article

A new species of *Trichomalopsis* Crawford (Hymenoptera: Pteromalidae), hyperparasitoid of silkworm uzi fly, *Exorista bombycis* (Louis) (Diptera: Tachinidae), from Karnataka, India

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ABSTRACT: A new species of the genus *Trichomalopsis* Crawford (Hymenoptera: Pteromalidae) hyperparasitising the silk worm uzi fly, *Exorista bombycis* (Louis), on *Bombyx mori* Linn. is described from Karnataka, India. Affinities of the new species with the other known species discussed.

KEY WORDS: Pteromalidae, *Trichomalopsis*, New species, Hyperparasitoid, *Exorista bombycis*, *Bombyx mori*, Karnataka, India

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INTRODUCTION

Exorista bombycis (Louis) (Diptera: Tachinidae), commonly known as silkworm uzi fly, causes considerable damage to silkworm cocoon crop of *Bombyx mori* L. in the traditional silk producing states of south India. Besides, one more uzi fly species, *Blepharipa zebina* (Walker), is common in northern states of India causing damage to tasar silkworm, *Antheraea mylitta* Drury which happens to be a non-domesticated silkworm and reared out-door on the trees of *Terminalia arjuna*. Various control measures such as rearing of silkworms under nylon net enclosure, placement of yellow liquid trap, release of an ecto-pupal parasitoid viz., *Nesolynx thymus* (Girault) (Hymenoptera: Eulophidae), application of ovicidal formulation/uzicide etc. are advocated under IPM of the uzi fly, *E. bombycis* (Dandin and Giridhar, 2010). With regard to the other uzi fly, *B. zebina*, the recommended IPM package comprises of mechanical (destruction of uzi affected larvae and installation of sticky tap), chemical (application of 2% bleaching powder solution on silkworm body) and biological strategy involving release of *N. thymus* (Thangavelu and Singh, 1996).

In recent years, there have been substantial efforts made towards achieving biological control of the uzi flies in sericulture which have resulted in recording and conducting biological studies of their natural enemies. Although more than twenty species under five families of the order

Hymenoptera (Chalcididae, Diapriidae, Encyrtidae, Eulophidae and Pteromalidae) have been recorded as ecto/ endo-pupal, and solitary/gregarious parasitoids of the uzi flies in sericulture (Narayanaswamy and Devaiah, 1998; Singh and Maheshwari, 2002), only *N. thymus* is still ruling as a vital bio-control component under IPM of uzi fly. But, recently a new gregarious ecto-pupal parasitoid *Trichomalopsis* sp. is reported to be parasitizing pupae of the uzi fly, *E. bombycis* in Karnataka (Kumar *et al.*, 2014 communicated).

Trichomalopsis Crawford is a species rich genus of the family Pteromalidae, best known from the Holartic and Oriental regions, hosts of which are numerous and are gregarious parasitoids in the cocoons and pupae of various moths (Lepidoptera), in puparia of some Diptera, less frequently in egg sacs of spiders, cells of some Pompilidae (Hymenoptera) etc. (Boucek, 1988). Many species have been collected in marshy habitats (including rotting seaweeds) and grassy situations and some have been shown to parasitize as both primary host as well as its parasites (e.g. Tachinidae, Braconidae, Ichneumonidae) (Kamijo and Grissell, 1982). Currently the genus *Trichomalopsis* is composed of nearly 55 species worldwide largely Holartic and Oriental in distribution (Noyes, 2003). Graham (1969) provided an elaborate key to European and North American species (as *Eupteromalus*) Kamijo and Grissell (1982) studied the *Trichomalopsis* species associated with rice fields of Oriental Region. Sureshan and Narendran (2001) studied

the Indian species of *Trichomalopsis* with description of six new species from the country. Gibson and Floate (2001) provided an account of *Trichomalopsis* species associated with filth flies (Diptera: Muscidae) in North America.

Worldwide, the information available on important biological parameters, parasitization potential etc., of various species of *Trichomalopsis* is restricted only to filth flies such as house fly, stable fly, horn fly, face fly etc., and as hyperparasitoids of cocoons of few hymenopterans. Singh and Thangavelu (1996) reported *T. apanteloctena* in India for the first time on the pupae of Tasar silkworm uzi fly, *B. zebina* and subsequently they conducted studies on its biological characteristics as well as its bio-control potential against *B. zebina*. However, there are no reports on the said species attacking the pupae of *E. bombycis*. As a routine practice, Pest Management Laboratory, CSRTI, Mysore regularly collects old uzi pupae from the cocoon markets and observes the emergence of pupal parasitoids, if any. During the course of such an activity recently, from the pupae of *E. bombycis* on cocoons of *Bombyx mori*, which were collected from Ramanagram cocoon market (Karnataka), an interesting species of hyperparasitoid, has emerged. It proved to belong to an undescribed species of *Trichomalopsis* which is described here. The present species of *Trichomalopsis* could be successfully cultured / multiplied on the pupae of *E. bombycis* subsequently.

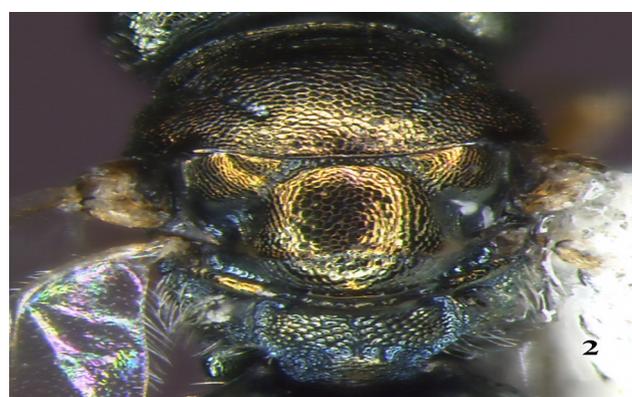
MATERIAL AND METHODS

The sericulturists from the states of Karnataka, Tamil Nadu and Andhra Pradesh regularly bring the cocoons of *Bombyx mori* to the markets for transaction, little portion of which also include uzi infested cocoons from which uzi maggots emerge out. Subsequently the maggots pupate in the corners/crevices/dark places and many of which will be further parasitized naturally by the hyperparasitoids. The present study is based on the specimens of the hyperparasitoid emerged from such a collection of pupae of *E. bombycis* which were collected from the cocoon market of Ramanagaram (District Ramanagaram, Karnataka). The emerged parasitoids were preserved in 70% ethyl alcohol and card mounted, and studied under a stereoscopic binocular microscope (Leica M 205C). Photographs were taken with a digital camera (MC170 HD) attached to the microscope. The terminology used generally follows Gibson (1997). The type specimens were deposited in the National Zoological Collections of the Zoological Survey of India, Calicut (ZSIK). The following abbreviations are used in the text: F1-F5 = Funicular segments 1 to 5; MV = Marginal vein; OOL = Ocellocular distance; PMV = Postmarginal vein; POL = Postocellar distance; SMV = Submarginal vein; STV = Stigmal vein; Gt1- Gt4 = Gastral tergites 1-4.

RESULTS

Species description

Trichomalopsis uziae Sureshan and Narendra Kumar, sp. nov.





Female holotype

Length, 2.5mm. Dark metallic greenish blue with strong bronzy reflection mainly on head and mesosoma. Eyes pale cupreous. Ocelli silvery. Antennae with scape, pedicel and anelli testaceous, remainder brown. Tegulae testaceous. Wings hyaline, veins pale brown. Fore and hind coxae concolorous with mesosoma, mid coxae brown, remainder of legs testaceous with tips of tarsi pale brown, darker on hind femora. Pubescence of body and wings white.

Head

In dorsal view, 1.9× as broad as long; POL 1.4× OOL; temple broad (Fig.1), 0.7× eye length; occipital carina moderately curved. Head, in front view, width 1.3× height, uniformly and moderately reticulate with small white pubescence; reticulation transverse on occiput, finer on malar space and gena; anterior margin of clypeus slightly emarginate, almost straight; clypeus medially polished, striated on lateral parts, striae extending halfway to paraclypeal area; area just above clypeus convex, so that lower face swollen (Fig. 6); toruli separated by a distance almost equal to individual diameter of it; malar grooves not indicated; gena not carinate. Right mandible with 3 and left mandible with 4 teeth. Antennae inserted slightly above lower ocular line; scape 0.9x as long as eye, not reaching median ocellus; pedicellus plus flagellum length 0.7× head width, pedicel 2× as long as broad; anelli two, second slightly longer than first, both transverse; flagellum gradually widening towards tip; all funicular segments transverse with one row of sensillae; clava a little shorter than three preceding segments combined.

Mesosoma

Mesosoma (Figs. 1, 2) In dorsal view, 1.5× as long as broad, uniformly and moderately reticulate. Pronotal collar 6.7× as broad as median length, not carinate anteriorly, raised in the middle, without shiny strip posteriorly. Mesoscutum 1.9× as wide as long, reticulation broader and finer on median lobe, notauli incomplete, distinctly marked with a different sculpture. Scutellum flattened, reticulation finer, almost as broad as long, frenum distinctly separated, reticulation on frenal area more finer. Dorsellum with transverse rugae. Propodeum 3.6× as broad as median length, median length 0.43× that of scutellum, median area raised reticulate, nucha transversely reticulate, median carina strong and complete, plicae strong and complete, callus closely reticulate with moderately dense pubescence,

spiracles broad and oval, separated from the hind margin of the metanotum by its own diameter. Mesopleuron distinctly reticulate except upper mesepimeron engraved reticulate. Metapleuron raised reticulate. Prepectus finely reticulate. Fore and mid coxae finely engraved reticulate, hind coxae moderately reticulate with four long setae ventro-laterally in the lower half, hind tibia with one spur. Fore wing (Fig. 3) 2.3× as long as broad, marginal fringe very small, discal pubescence less distinct, basal part almost bare. Relative lengths of SMV 41, MV 16.5, PMV 16.5 and STV13.

Metasoma

Metasoma (Fig. 5) Gaster broad and oval, 1.2× as long as broad and 0.74× as long as head plus mesosoma combined, petiole strongly transverse, less visible dorsally, all tergites uniformly engraved reticulate, hypopygium reaching hind margin of Gt4, Gt1 with a patch of 9-10 hairs on either side covering basal 2/3 portion, ovipositor slightly protruded out.

Male

Length, 1.4 mm. Resembles female but differs from it in having body size small, reduced wings with long marginal fringe and moderately thickened veins (Fig. 7), pubescence distinct and basal cell with few hairs and basal hairline indicated. Gaster short and compressed with Gt1 and Gt2 almost shiny dorsally. All legs except coxae yellow. Antennae (Fig.8) with second anellus quadrate.

Variation

Length of female varies between 1.7 to 2.6mm and male between 1.3 to 2.1mm. Ovipositor protruded out in various degrees or not. Hind femora in some male and female specimens are more brownish.

Material examined

Holotype, female (on card) - INDIA; Karnataka, Ramanagarm District, Ramanagaram. Narendra Kumar, ex. Pupae of *E.bombycis*, iii.2014. (ZSIK; Reg. No. ZSI/WGRC/IR.INV 3965).

Paratypes - 1 Male (on card) Reg. No.ZSI/WGRC/IR.INV 3966; 4 Females, 2 Males (on card) Reg.No.ZSI/WGRC/IR.INV3967; 17 Females, 10 Males (in alcohol) Reg. No. ZSI/WGRC/IR.INV 3968; other data same that of holotype.

Etymology - The species name is derived from the common name of the host, *Uzi* Fly.

Remarks - The new species is unique in having gaster uniformly sculptured, lower face blunt due to the convexity

of area just below toruli (Fig. 6), antenna short and more clubbed, and unique brachypterous males. Among the Oriental species it resembles *T. deplanata* (Kamijo and Gris-sell, 1982) in having a stout antenna in both sexes, similar colouration, nature of clypeus, flattened scutellum etc but distinctly differs from it in having propodeum with distinct median carina, gaster shorter than mesosoma, and males with shortened wings (in *deplanata*, propodeum with median carina not strong, gaster about as long as mesosoma, and males fully winged). The new species resembles the Palearctic species *T. subapterus* (Riley, 1885) in some general morphology but differs from it in having gaster oval and round with tergites less hairy and uniformly engraved reticulate, and propodeum shorter than scutellum (in *subapterus* gaster elongate lanceolate, basal tergites more hairy and not uniformly reticulate, and propodeum nearly as long as scutellum). It also resembles the American species *T. sarcophagae* (Gahan,1914) in having a unique blunt lower face due to the convexity below toruli, insertion of antenna slightly above lower level of eyes but differs from it in having different antenna, propodeum, gaster and brachypterous males. In the key to the brachypterous males of Palearctic region (Graham, 1969), the males of the new species run to *T. hemipterus* (Walker, 1835) = *T. hemiptera* (Walker) and resembles it in having wings with venation thickened, stigma relatively large, but differs from it in having antenna short with length of pedicellus plus flagellum 0.74× as long as breadth of head, clava 1.8× as long as broad (in *hemiptera*, male pedicellus plus flagellum equal or slightly greater than breadth of head, clava 3.2-3.5× as long as broad). The females of the new species resembles *T. hemiptera* in having similar colouration, general morphology but differ from it in having antenna inserted slightly above lower ocular line, mesoscutum with notauli distinctly marked with a different sculpture, propodeum with plicae strong, PMV as long as MV, MV 1.3× as long as STV and gaster shorter than mesosoma(in *hemiptera* antennae inserted distinctly above lower ocular line, notauli rather shallow, plicae sharp only posteriorly, PMV distinctly shorter than MV, MV 1.8-2.3× as long as STV, gaster acute apically and longer than mesosoma).

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REFERENCES

- Boucek Z. 1988. Australasian Chalcidoidea (Hymenoptera). A biosystematic revision of genera of fourteen families, with a reclassification of species. *CAB International*, Wallingford. p. 832.
- Dandin SB, Giridhar K. 2010. *Handbook of Sericulture Technologies*. Central Silk Board, Bangalore. p. 404–406.
- de V. Graham MWR. 1969. The Pteromalidae of north-western Europe (Hymenoptera: Chalcidoidea). *Bulletin of the British Museum (Natural History)*. **16**: 1–908.
- Gahan AB. 1914. Descriptions of new genera and species, with notes on parasitic Hymenoptera. *Proceedings of the United States National Museum*. **48**: 162–163.
- Gibson GAP. 1997. Morphology and Terminology. In: Gibson GAP, Huber JT, Woolley JB (Eds). *Annotated keys to the genera of Nearctic*. 16–44. Chalcidoidea (Hymenoptera). *NRC Research Press, Ottawa, Ontario, Canada*.
- Gibson GAP, Floate K. 2001. Species of *Trichomalopsis* (Hymenoptera: Pteromalidae) associated with filth flies (Diptera: Muscidae) in North America. *The Canadian Entomologist*. **133**(1): 49–85.
- Kamijo K, Grissell EE. 1982. Species of *Trichomalopsis* Crawford (Hymenoptera: Pteromalidae) from rice paddy, with descriptions of two new species. *Kontyu, Tokyo*. **50**(1): 76–87.
- Narayanaswamy KC, Devaiah MC. 1998. *Silkworm uzi fly*. Zen Publishers, Bangalore. p. 232.
- Noyes JS. 2003. Universal Chalcidoidea Database. World Wide Web electronic publication. <http://www.nhm.ac.uk/chalcidoids>.
- Riley CV. 1885. On the parasites of the hessian fly. *Proceedings of the United States National Museum*. **8**(26): 416.
- Singh RN, Maheshwari M. 2002. Biological control of pests of non-mulberry silkworms and its host plants in India. *Int J Indust Entomol*. **4**(2): 83–91.
- Singh RN, Thangavelu K. 1996. Biological characteristics of *Trichomalopsis apanteloctena* - A parasitoid of *Blepharipa zebina*. *Ind J Seric*. **35**(1): 62–63.
- Sureshan PM, Narendran TC. 2001. On the Indian species of *Trichomalopsis* Crawford (Hymenoptera: Chalcidoidea: Pteromalidae). *J Bombay Nat Hist Soc*. **98**(3): 396–405.
- Thangavelu K, Singh RN. 1993. Integrated Pest management of uzi fly in tasar eco- system. In: Channabasavanna GP, Veeranna G, Dandin SB (Eds). *Recent Advances in uzi fly Research*. KSSRDI, Bangalore, India. p. 239–246.
- Vinod Kumar V, Narendran Kumar JB, Sivaprasad V. 2014. Record of a new hyper-parasitoid, *Trichomalopsis* sp. (Hymenoptera: Pteromalidae) of the uzi fly, *Exorista bombycis* (Louis). *Indian Silk* (communicated).
- Walker F. 1835. Monographia Chalciditum. *Entomol Magazine*. **3**(2): 196.