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First detection of the Nearctic parasitoid species *Trichopoda pennipes* (Fabricius) (Diptera: Tachinidae) in Egypt

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Abstract

Specimens of the feather-legged fly, *Trichopoda pennipes* (Fabricius) (Diptera: Tachinidae), which parasitize adults of the southern green stink bug *Nezara viridula* (L.) (Hemiptera: Pentatomidae), have been detected in Giza, Egypt. This is the first record of this Nearctic species with its genus (*Trichopoda*) and its tribe (Gymnosomatini) in Egypt. *T. pennipes* is known as an endoparasitoid of many true bug hosts, the pests of various crops, and it could have a potentiality to control these pests in addition to *N. viridula*, which is known to be its principal host. Taxonomy and diagnosis of the detected parasitoid species in addition to a checklist of the subfamily Phasiinae in Egypt are provided. Colored photographs of the parasitoid larval and adult stages and parasitized host are provided as well.

Keywords: New record, *Trichopoda pennipes*, *Nezara viridula*, Egypt

Background

Flies of the family Tachinidae are an important group of endoparasitoids in their larval stage, and all their hosts are of the arthropods, almost exclusively other insects, including important insect pests in agriculture and forestry. There are four subfamilies traditionally recognized in the family Tachinidae, namely, Dexiinae, Exoristinae, Phasiinae, and Tachininae (El-Hawagry 2018). Of these, the subfamily Phasiinae is known to comprise species which attack true bugs (Heteroptera) (Arnaud 1978).

In Egypt, the subfamily Phasiinae is known as comprising only seven species in three tribes, namely, Cylindromyiini, Leucostomatini, and Phasiini (El-Hawagry 2018). The tribe Gymnosomatini comprising the species detected in the present study, *Trichopoda pennipes* (Fabricius 1781), has not previously been recorded from Egypt.

Species of the genus *Trichopoda* (Berthold 1827) are commonly known as the “feather-legged flies” because of the prominent fringe of feather-like setae on their hind legs. One of these species, *T. pennipes* (Fabricius 1781), is an endoparasitoid of late-instar nymph and adult of the southern green stink bug, *Nezara viridula* (L.) (Todd 1989). It is native to the Nearctic region; however, it was

introduced from its native fauna, precisely from the USA into some Australasian countries to combat true bugs, especially the southern green stink bug, *N. viridula* (Waterhouse 1998). Although it has been successfully established in Hawaii reporting a 100% rate of parasitism of *N. viridula* (Davis 1964; Michael 1981), *T. pennipes* has failed to become established in Australia as it was introduced there in the 1940s and 1950s, then more recently in 1990s (Waterhouse 1998). Moreover, attempts to establish *T. pennipes* in Antigua (Cock 1985), Fiji (O'Connor 1950), New Zealand (Clausen 1978), Papua New Guinea (Waterhouse and Norris 1987), Solomon Islands (O'Connor 1950), and South Africa (Bennett 1990) have also failed. Failure to establish *Trichopoda* spp. may have been due in part to difficulties with rearing sufficient numbers of parasitoids for release (Michael 1981).

In the Old World, *T. pennipes* has been accidentally introduced to Italy, where it was first recorded near Rome in 1988, and it is now well established as an important natural enemy of *N. viridula* in this country (Colazza et al. 1996). In following years, it was recorded from several other Mediterranean and European countries: Spain (Peris 1998; Tschorsnig et al. 2000), France (Tschorsnig et al. 2000; Galerie-insecte 2015), Slovenia (De Groot et al. 2007), the Netherlands (Zeegers 2010),

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Israel (Freidberg et al. 2011), Albania (Tschorasnig et al. 2012), Croatia (Bystrowski 2012), Hungary (Sándor 2014), Switzerland (Obrecht 2014; Pétremand et al. 2015), and Portugal (Pétremand et al. 2015).

Egypt, as a part of the Great Desert Belt, is characterized by a warm and almost rainless climate and has a greater affiliation to the Palearctic region except for the Gebel Elba, its southeastern triangle, which has a greater affiliation to the Afrotropical region (El-Hawagry and Gilbert 2014; El-Hawagry 2017). However, and according to the present study, *T. pennipes* seems to be established in Egypt.

In addition to Pentatomidae (genera *Nezara*, *Acrosternum*, *Euschistus*, *Halyomorpha*, *Murgantia*, *Plautia*, and *Thyanta*), *T. pennipes* was recorded to have a broad host range including Coreidae (genera *Acanthocephala*, *Anasa*, *Archimerus*, *Chelinidea*, *Euthochtha*, and *Leptoglossus*), Largidae (genus *Lergus*), and Scutelleridae (genus *Coleotichus*) (Arnaud 1978; Rice et al. 2014).

In optimal climatic conditions, *T. pennipes* shows 2–3 generations per year. The female lays one or more whitish plano-convex, non-incubated eggs upon the body wall of the adult, or occasionally on late nymphal instar of the bug, and attach these eggs firmly to the body wall. The majority of the eggs are found on the sides of the

thorax (Worthley 1924; Salerno et al. 2002). Each female produces several hundred eggs during its lifespan (Pétremand et al. 2015). After hatching, newborn larva bores the host bug tegument entering its body and feeds on its body fluids for about 2 weeks. The host bug usually dies after the infection, and mature larvae emerge through its anal extremity and enter the upper soil layer to form a dark-brownish puparium (Worthley 1924). Pupation usually requires about 2–4 weeks (Cargnus et al. 2011).

Adults of *T. pennipes* mostly are nectar feeders. Larvae overwinter within the host bug and emerge in the following late spring or early summer (Worthley 1924).

Materials and methods

This study is based on 6 adult individuals (4 males and 2 females) of *T. pennipes*. Two of these individuals were found in November 2019 within a cage in which the southern green stink bug *N. viridula* was reared at the Faculty of Agriculture, Cairo University, Giza, Egypt. The reared bugs were originally collected from a field cultivated with bean at the farm of "Faculty of Agriculture, Cairo University, Giza" in October 2018. Two parasitized adults (Fig. 1a, b) and one nymph of the bug were detected in the cage as well. The parasitized bug

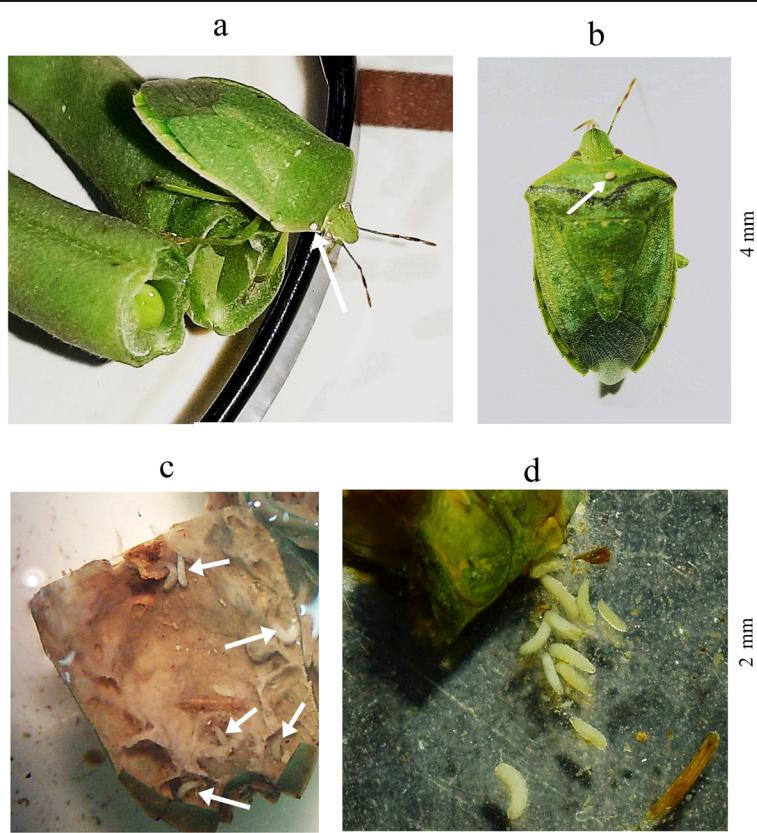


Fig. 1 **a, b** Adult specimens of *Nezara viridula* (L.) bearing eggs of *Trichopoda pennipes* on the pronotum. **c** Larvae of *T. pennipes* inside a dissected *N. viridula* specimen. **d** Larvae of *T. pennipes* released from a dissected *N. viridula* specimen

individuals were transferred to a separate cage at the same laboratory conditions to verify that they are parasitized by the same parasitoid. After about 3 weeks, another 4 individuals of the same parasitoid emerged in the cage. One of the parasitized bugs was dissected to check the larvae of the parasitoid within it (Fig. 1c, d). The parasitoid larvae, adults, and the parasitized hosts were photographed. Four adult individuals (two males and two females) of *T. pennipes* were deposited in the collection of the Entomology Department, Faculty of Science, Cairo University (Efflatoun Bey's collection (EFC)), while the other 2 individuals (1 male and 1 female) were deposited in the Ministry of Agriculture Collection, Plant Protection Research Institute, Dokki, Giza (PPDD).

Results and discussion

Diagnosis of *T. pennipes*

Adult about 10 mm in length, strikingly characterized by a peculiar row of flattened feather-like setae standing nearly erect on the outer side of the hind tibiae, and the longest of which are at least one-third the length of the tibia itself (Fig. 2); head velvety black; antennae, in resting position, are situated in the forehead in a cephalic depression, the antennal fossa; pedicel subcylindrical in shape; flagellum approximately triangular in cross section, densely covered with non-innervated microtrichia, with arista consisting of 2 short basal and a long distal segment, situated proximally on its dorsal side; prescutum including the humeral calli yellowish with four longitudinal velvety-black stripes; scutum blackish, merged with yellowish coloration that extended from the prescutum especially in males; scutellum of both sexes, black with yellowish tinge; wings in male mostly black with a hyaline posterior margin, having a pale ferruginous costal area (Fig. 2a), whereas in female, they are usually uniformly dusky or black, with the costal ferruginous marks sometimes occur (Fig. 2b); calypters large, yellowish in color; halteres large, yellowish; legs almost blackish with coxae, trochanters, and proximal portions of femora yellowish; pulvilli enlarged in males and small in females, buff colored; abdomen in males brightly reddish-orange, sometimes with a black tip, whereas in female it varies from completely black to orange with a black tip (Fig. 2).

Taxonomy of the newly recorded taxa

Subfamily Phasiinae

Tribe Gymnosomatini (new record from Egypt)

Genus *Trichopoda* Berthold 1827 (new record from Egypt)

Trichopoda Berthold 1827: 508 (as "Trichopode" (vernacular) by Latreille 1825: 498. Type species: *Thereva plumipes* Fabricius 1805, by subsequent designation of Coquillett (1910): 616)

Trichiopoda. Incorrect subsequent spelling of *Trichopoda* Berthold 1827 (Latreille 1829: 512)

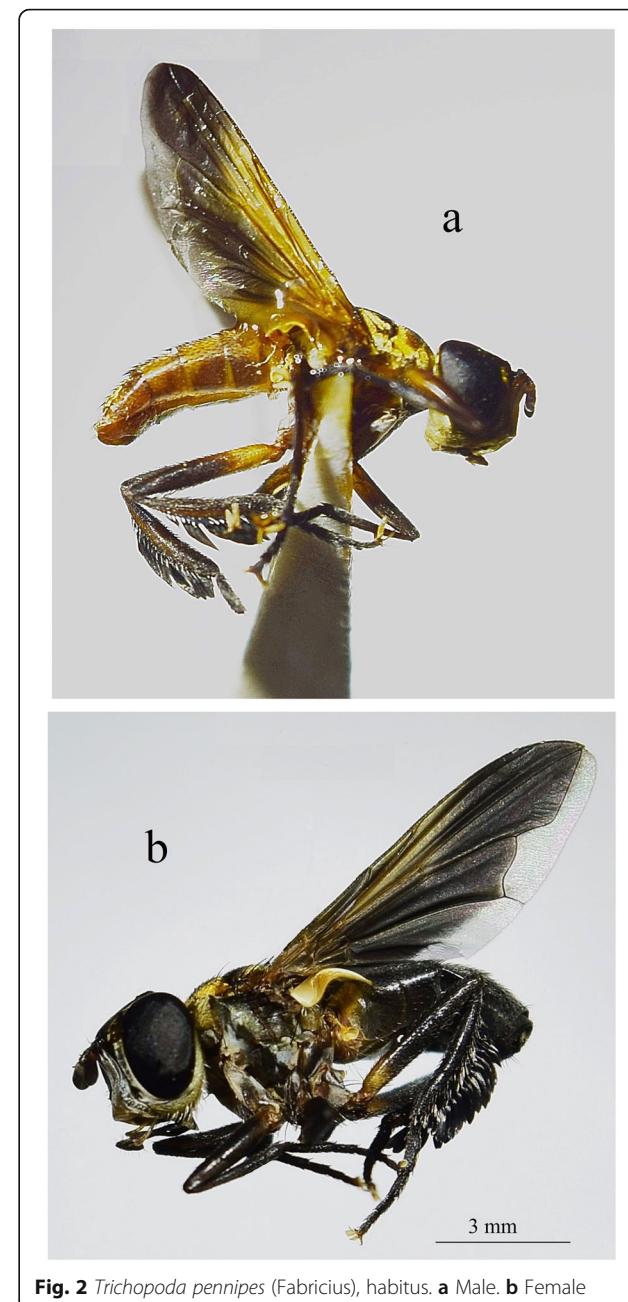


Fig. 2 *Trichopoda pennipes* (Fabricius), habitus. **a** Male. **b** Female

Trichopoda pennipes (Fabricius 1781) (new record from Egypt)

Musca pennipes Fabricius 1781: 450. Type locality: North America

Thereva hirtipes Fabricius 1805: 219. Type locality: USA (Carolina)

Thereva pennipes Fabricius 1805: 219 (junior secondary homonym of *Musca pennipes* Fabricius 1781). Type locality: USA (Carolina)

Phasia jugatoria Say 1829: 172. Type locality: USA (IN)

Trichopoda ciliipes Wiedemann 1830: 276 (a new replacement name for *pennipes* Fabricius 1805)

Trichopoda flavigornis Robineau-Desvoidy 1830: 284.
Type locality: USA (Carolina)

World distribution: AU (introduced): Hawaiian Is. NE and NEO: native to both North and South America. PA (introduced): Egypt (new record), Israel, southern Europe (France, Italy, Spain, Slovenia, the Netherlands, Israel, Albania, Croatia, Hungary, Switzerland, Portugal)

Egyptian localities: lower Nile Valley and Delta: Giza (parasitoid of *Nezara viridula*)

Dates of collection: October to December

A list of other previously recorded Egyptian taxa of the subfamily Phasiinae (based on El-Hawagry 2018):

Tribe Cylindromyiini

Genus *Besseria* Robineau-Desvoidy 1830

Besseria anthophila (Loew 1871)

Egyptian localities: coastal strip: Dekhila, Mariout

Dates of collection: June to August

Genus *Cylindromyia* Meigen 1803

Cylindromyia intermedia (Meigen 1824)

Egyptian localities: coastal strip: Alexandria, Mariout, Max, Ramleh. Upper Nile Valley: Beni Suef

Dates of collection: April to September

Cylindromyia rufipes (Meigen 1824)

Egyptian localities: coastal strip: Alexandria. Lower Nile Valley and Delta: Gebel Asfar, Kubba

Dates of collection: October to February

Tribe Leucostomatini

Genus *Dionomelia* Kugler

Dionomelia hennigi Kugler, 1978

Egyptian localities: Sinai

Dates of collection: April to September

Genus *Leucostoma* Meigen

Leucostoma engeddense Kugler, 1966

Egyptian localities: lower Nile Valley and Delta: Minia El-Qamh, Tanta

Dates of collection: February to May

Leucostoma obsidianum (Wiedemann 1830)

Egyptian localities: upper Egypt: Asswan

Dates of collection: unknown

Tribe Phasiini

Genus *Phasia* Latreille

Phasia pusilla Meigen 1824

Egyptian localities and dates of collection are not precisely known.

Conclusion

In Egypt, the feather-legged fly, *T. pennipes*, is newly detected to parasitize adults of the southern green stink bug, *N. viridula*. It seems to be established in Egypt. An effort should be done to assess the role of this parasitoid species in the biological pest control in Egypt.

Abbreviations

AF: Afrotropical; AU: Australasian; Is: Islands; NE: Nearctic; NEO: Neotropical; OR: Oriental; PA: Palearctic

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