The first species of *Trichopsomyia* Williston, 1888 (Diptera: Syrphidae) described from the Oriental region, with a discussion on the character states of the pilosity of the katepisternum

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Abstract. The first Oriental species of the genus *Trichopsomyia* Williston, 1888, *Trichopsomyia pilosa* sp. nov. (Java), has been discovered and is now described. This Oriental species of *Trichopsomyia* has several characters strongly differing from the other species within this genus. It is hypothesized that it forms a separate group within *Trichopsomyia*. One species, *Trichopsomyia formiciphila* Downes, Skevington & Thompson, 2017, from Australia, is similar to the Oriental species described here, and the group is named after this first described species, hence the *formiciphila* group. The characters for a future phylogenetic analysis are discussed. The character states of the pilosity of the katepisternum and the shape of the metasternum hitherto used in a phylogenetic analysis of Syrphidae Latreille, 1802 are discussed too.

Keywords. *Trichopsomyia formiciphila* group, new species, Oriental region, character states of the metasternum and katepisternum.


Introduction

Syrphidae Latreille, 1802 is a worldwide occurring dipterous family with several sub-families and species having very a different larval habitat and adult behaviour (Rotheray & Gilbert 2011). Many species are regarded as key pollinators of wild plants and crops, some are used for the natural control of aphids or as pulp decomposers while others are regarded as pests to bulbous plants (Bergh & Short 2008; Bugg et al. 2008; Ssymank & Kearns 2009; Morales & Wolff 2010). Within one genus, most species
show the same way of life, and this could help in finding larvae or adults and get to know more about their natural history (Rotheray & Gilbert 1999; Rojo et al. 2003).

The Oriental Syrphidae fauna is one of the least studied (e.g., Thompson & Skevington 2014), requiring more efforts as this part of the world is under great threat due to human influences and part of its syrphid fauna could already be lost (e.g., Hippa et al. 2015). The discovery of a new species of the genus Trichopsomyia Williston, 1888 for the Oriental region was the starting point of this research and this paper, with the hope to stimulate further research.

The genera, of which Trichopsomyia is one, grouped together with Pipiza Fallén, 1810, often classified as the tribe Pipizini Williston, 1885, are well-defined with some unique morphological characters (Thompson 1972; Kuznetsov 1988, 1992; Rotheray & Gilbert 1989; Hippa & Ståhls 2005; Vujić et al. 2013; Mengual et al. 2015). The adults of species of pipizine are small to medium-sized hoverflies (5–10 mm) with a mainly black-coloured body, a flat face which is not produced forwards and a round oral cavity (Vujić et al. 2013).

Larvae of pipizine are predatory and show a preference for woolly or root aphids with waxy secretions or gall-forming hemipterans, for example, Aphididae Latreille, 1802, Psyllidae Latreille, 1807, Phylloxeridae Herrich-Schaeffer, 1854 and Adelgidae Schouteden, 1909 (Rojo et al. 2003; Steenis et al. 2018). One Australian species is associated with weaver ants (Downes et al. 2017). The eggs of pipizines have a ribbed surface and the posterior respiratory process consisting of separate tubes on two strongly sclerotized processes in the first instar larva, both characters unique among Syrphidae (Kuznetsov 1988, 1992).

The classification of the pipizines has been a longstanding taxonomic problem as they have been grouped within Syrphinae Latreille, 1802, Eristalinae Newman, 1834 or even treated as a separate subfamily. The larval feeding mode is shared with the Syrphinae, but several adult characters are shared with the Eristalinae (e.g., Thompson 1972; Cheng et al. 2000) including a pilose postpronotum (bare in Syrphinae) and male abdomen with four unmodified pregenital segments (five in Syrphinae). As earlier proposed by Williston (1885) and Kuznetsov (1992), the recent combined morphological and molecular cladistic analyses showed that this group of genera deserves the rank of sub-family, the Pipizinae Williston, 1885 (Mengual et al. 2015).

Pipizinae has an almost worldwide distribution, but it is not known from the Afrotropical region, with most of its genera and species occurring in the Palaearctic region (Mutin 1998; Steenis & Lucas 2011; Huang & Cheng 2012; Vujić et al. 2013; Pape & Evenhuis 2018). Knutson et al. (1975) listed three species from two genera (Pipiza and Triglyphus Loew, 1840) for the Oriental region and Downes et al. (2017) added the occurrence of the genus Trichopsomyia for this region comprising two species, based on one male from Kuala Lumpur, Malaysia, erroneously stated as originating from Indonesia, and a female from Vietnam. Another species, T. pilosa sp. nov. from Java is here described, based on males only.

The pilose katepisternum, well developed metasternum and the long pilose metafemur sets the Oriental and Australian specimens of the genus Trichopsomyia aside from all other known species in this group. The aim of this study is to give the first records and description of the Oriental species of the genus Trichopsomyia and to discuss the value of the character states of the pilosity of the katepisternum and the development of the metasternum in phylogenetic analyses.

**Material and methods**

The specimens were studied using a Leica Wild M10 stereo microscope with a 2.5 times drawing tube. Genitalia were soaked in barbers fluid and removed from the otherwise dry specimens by means of an
entomological pin and afterwards briefly boiled in a 10% KOH solution. The genitalia were stored in a
genital vial containing glycerol after having been successively rinsed in 70% acetic acid, distilled water
and 90% ethanol. The genitalia were drawn in liquid by use of the aforementioned drawing tube. Other
figures were made by stacking several photos, using a Zerene Stacker 1.04, taken with a Canon EOS D6
camera equipped with a Canon MP-E 1–5 × macro lens and a Yongnuo YN14EX macro ring flash. The
-genitalia drawings and stacked images were further edited with the image editing program GIMP 2.8.14.

The terminology used is based on Thompson (1999), for the genitalia on Downes et al. (2017). All
specimens used for Figs 3–5 are deposited in the private collection of the first author (JSA).

Repositories
The specimens studied are deposited in:
NHM = Natural History Museum, London, United Kingdom
JSA = Private collection of the first author Jeroen van Steenis

Results

Class Insecta Linnaeus, 1758
Order Diptera Linnaeus, 1758
Family Syrphidae Latreille, 1802
Subfamily Pipizinae Williston, 1885

Genus *Trichopsomyia* Williston, 1888

The Oriental species of *Trichopsomyia*

*Trichopsomyia pilosa* sp. nov.
urn:lsid:zoobank.org:act:D4A23D4B-FCAC-4BEC-8B81-2583953DA34E
Figs 1–2, 3C

Diagnosis

Large, predominantly black and long black pilose pipizine; thorax black, extensively black pilose; wing
brown infuscated; cell c wide; legs black with long pilose tarsi and metaleg; terga II and III with large
rectangular brownish antero-lateral maculae; genitalia (Fig. 2) epandrium elongate; surstylus bilobed
with rather long baso-dorsal process and with very long, elongate and slightly sickle-shaped narrow,
elongate ventral process; hypoproct (see Downes et al. 2017) mushroom shaped, shaft on ventral surface
densely but short pilose; hypandrium narrow, elongate with elongate rectangular process; postgonite
(see Downes et al. 2017) dome-shaped in lateral view, with several small tooth in two rows on apico-
ventral surface.

Etymology

The specific epithet ‘pilosa’, the Latin word for ‘hairy’, refers to the extensively and long pilose
ekatepisternum, the long pili on the metasternum and especially the long pilose metatibia. The name is to
be treated as an adjective.

Type material

Holotype
INDONESIA – Java ♂; “Java: // Tjigaeha // i.1938 // coll. E. le Moult”; “QR-code // NHMUK
010864268”; NHM.
Paratypes
INDONESIA – Java • 1 ♂; same collection data as for holotype; “NHMUK 010864267”; JSA • 1 ♂; “Java: // Gunung Malang // Djampang Wetan // ii.1938 // coll. E. le Moult”; “QR-code // NHMUK 010864266”; NHM.

Description

Male
LENGTH. Body 9.7–11.4 mm, wing 8.2–9.3 mm.

HEAD. Facial shape simple, in lateral view, almost straight, without central knob and without antennal tubercle; oral cavity round, smooth without notch; clypeus horse-shoe shaped; face black, black pilose; frons black, black pilose with two small white pollinose maculae laterally along eye margin (Fig. 1C); vertical triangle black, black pilose; eye pilose; postocular orbit dorsally broad; eye-contiguity relatively short, about a quarter as long as length of vertical triangle; antenna (Fig. 1D) orange-brown, elongate, basoflagellomere four times longer than broad.

THORAX. Black, extensively pilose; postpronotum pilose; katepisternum almost entirely pilose, only narrowly bare antero-dorsally and medially along posterior margin (Fig. 3C); katepimeron pilose; metasternum rather well developed with some pile medio-laterally.

Fig. 1. Trichopsomyia pilosa sp. nov. A. Habitus, lateral view, holotype ♂ (NHMUK 010864268). B. Habitus, dorsal view, paratype ♂ (NHMUK 010864266). C. Head, dorsal view, paratype ♂ (NHMUK 010864266). D. Antenna, lateral view, holotype ♂ (NHMUK 010864268). E. Metaleg, frontal view, paratype ♂ (JSA). Scale bars: A–C, E = 1.0 mm; D = 0.5 mm.
WING. Membrane entirely brownish infuscated (Fig. 1A–B) covered with unusually long microtrichia, except bare on basal $\frac{1}{10}$ of cell bm; cell e exceptionally wide, clearly wider than cell bm; vein dm-cu ending almost perpendicularly to vein M; vein M$_1$ ending strongly oblique at vein R$_4+5$.

LEGS. Black, except apical half of basitarsi, and tarsomeres 2–4 white; pile long and predominantly black, but white parts of tarsi with long white pile; metaleg (Fig. 1E) with femur narrow and elongate, but slightly thickened and more densely long pilose apically; metatibia broad, laterally compressed and densely long-haired, hairs on dorsal surface longer than width of tibia.

ABDOMEN. Black and rather long black pilose; terga II and III each with one pair of large rectangular yellowish-brown maculae; pregenital terga black pilose.

GENITALIA (Fig. 2). See under diagnosis and remarks.

**Female**
Unknown.

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**Fig. 2.** *Trichopsomyia pilosa* sp. nov., male genitalia, holotype (NHMUK 010864268). A. Lateral view. B. Epandrium, dorsal view. C. Apical part of hypandrium, ventral view. Scale bars = 0.5 mm.
Remarks

According to the description and figures in Downes et al. (2017), our species is similar to the Australian Trichopsomyia formiciphila Downes, Skevington & Thompson, 2017 based on the overall appearance of the species and especially the extent of pilosity on the katepisternum, the shape of the metasternum, the colour of the legs and abdomen, the long basoflagellomere and the infuscated wing with wide cell c. Trichopsomyia pilosa sp. nov. differs from T. formiciphila by the long white pile on the tarsi, the very long black pile on the metatibia and several characters in the male genitalia like the surstyli with the apico-medial surface weakly and short pilose (more densely and long pilose in T. formiciphila); the shape of surstyli in ventral view weakly curved (more strongly curved in T. formiciphila); and the apico-dorsal gonocerus with weak teeth in two rows (stronger teeth present, not aligned in clear rows in T. formiciphila).

Discussion

Phylogenetic characters for the Trichopsomyia formiciphila group

All known genera of Pipizinae have clearly separated pile patches on the katepisternum (Mengual et al. 2015). In the character matrix of Hippa & Ståhls (2005), Pipizella viduata (Linnaeus, 1758) and Trichopsomyia flavitarsis (Meigen, 1822) are, however, stated to be wholly pilose, but based on our observations this must be a type setting error. The two known species of Trichopsomyia from the Oriental and Australian regions are clearly differentiated from all other Pipizinae by the almost entirely pilose katepisternum, indicating these species are closely related and possibly form a subgroup within Trichopsomyia. The relatively bare katepisternum is also found in Microdontinae Rondani, 1845 (Reemer & Ståhls 2013) and the following species: Brachyopa testacea (Fallén, 1817) (Fig. 5C) and B. obscura Thompson & Torp, 1982 (Bot & Van de Meutter 2019) while most other species of Brachyopa Meigen, 1822 have a ventral and a dorsal pile patch. In Myolepta Newman, 1838 and Euemerus Meigen, 1822, the extension of the pilosity differentiates between the M. dubia (Fabricius, 1805) and the E. tricolor (Fabricius, 1798) groups (medial pilosity, connecting dorsal and ventral pile patch), and the M. vara (Panzer, 1798) and the E. strigatus (Fallén, 1817) (sub)groups (only dorsal and ventral pile patch present) (Grković et al. 2019; Steenis 2020). On the other hand, an extensively pilose katepisternum is found in genera of different subfamilies like Scaeva Fabricius, 1805 (Fig. 3A) and Psilota Meigen, 1822 (Fig. 3B). The extent of pilosity differs widely within and between genera and even subfamilies, thus indicating this character is most likely highly homoplastic within Syrphidae and cannot solely be used to distinguish between genera.

The size and the shape of the metasternum is another widely used character in the phylogeny of Syrphidae (Thompson 1972; Hippa & Ståhls 2005). Within the subfamily Pipizinae, the metasternum is poorly developed and the medial part is either round (in Pipiza) or slightly elongate (e.g., Pipizella Rondani, 1856 and Trichopsomyia) and always bare of pilosity. In the T. formiciphila group, the metasternum is rather well developed, and in T. pilosa sp. nov., it bears one pili on each side. The development of the metasternum is the key character used in differentiating between Melanostoma Schiner, 1860 on the one hand, and Platycheirus Lepeletier & Serville, 1828 (Andersson 1970) and Afrostoma Skevington, Thompson & Vockeroth, 2014 (Thompson & Skevington 2014) on the other. The development of the metasternum as a key character in differentiating Afrostoma from Melanostoma was recently rejected by Mengual (2019) who synonymized these two genera. The extent and length of the pilosity were used to separate several genera of Xylotin Willistont, 1886 (Hippa 1978), but also to separate Eupeodes (Lapposyrphus) lapponicus (Zetterstedt, 1838) from all other species of Eupeodes Osten Sacken, 1877 (Dušek & Láška 1967). The use of the development of the metasternum and also its pilosity in separating species into different (sub)genera does not seem to be useful in all groups.

The male genitalia of the two species of the T. formiciphila group show some differences from other species of this genus, indicating a possible separate genus-group rank.
Based on the extent of pilosity on the katepisternum, the size and the shape of the metasternum, and the differences in genitalia, the *T. formiciphila* group may deserve a sub-group ranking. Molecular data (Jeffrey Skevington pers. comm.), however, refute this and suggest that the *T. formiciphila* group is nested within *Trichopsomyia*. More genes and a quantitative morphological phylogeny should be explored to test these competing hypotheses, but until that is done, a new genus should not be erected for the *T. formiciphila* group. This, however, lies out of the scope of this paper and is left for future research preferably on the entire world fauna of Pipizinae including fossil forms as outlined in Nidergas *et al.* (2018).

**Pilosity on the katepisternum**

The pilosity of the katepisternum is widely used in phylogenetics of Syrphidae as a character to distinguish between genera (e.g., Vockeroth 1969; Hippa & Ståhls 2005; Reemer & Ståhls 2013; Mengual *et al.* 2015). The character states used by Hippa & Ståhls (2005) for defining the extent of pilosity are: 0:

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**Fig. 3.** Pilosity of the katepisternum, ventro-lateral view. **A.** *Scaeva pyrastrri* (Linnaeus, 1758), ♂ (JSA), Switzerland, with extensive pilosity. **B.** *Psilota atra* (Fallén, 1817), ♂ (JSA), the Netherlands, with extensive pilosity. **C.** *Trichopsomyia pilosa* sp. nov., paratype ♂ (JSA), with extensive pilosity. **D.** *Trichopsomyia joratensis* Goeldlin, 1997, ♀ (JSA), Belgium, with separated dorsal and ventral pile patch. Scale bars = 0.5 mm. a = ventral pile patch; b = antero-dorsal area; c = postero-medial margin; d = dorsal pile patch.

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entirely pilose, e.g., *Callicera aenea* (Fabricius, 1777), *Ferdinandea cuprea* (Scopoli, 1763) (Fig. 5A) and *Temnostoma vespiformis* (Linnaeus, 1758) (Fig. 4D); 1 = dorsal and ventral pile patch present, e.g., *Chrysogaster solstitialis* (Fallén, 1817), *Rhingia campestris* Meigen, 1822, *Spilomyia diopthalma* (Linnaeus, 1758), *Syrophus vitripennis* (Meigen, 1822) and *Xylota segnis* (Linnaeus, 1758); 2 = only dorsal pile patch present, e.g., *Neoascia* Williston, 1887 (Fig. 5B) and *Sphegina* Meigen, 1822. Character states 1 and 2 are rather clear, although in some genera the dorsal and the ventral pile patch are connected by a narrow row of pile medially, e.g., in *Chrysogaster solstitialis* and *Syrophus vitripennis* categorized in the new state 44A: 0 (see below). Entirely pilose, in many genera, is in reality only pilose on posterior ½ to ¼ with medial part of posterior margin broadly non-pilose, e.g., *Sphaerophoria scripta* (Linnaeus, 1758), *Volucella inanis* (Linnaeus, 1758) and the under ‘entirely pilose’ listed species above. Besides *Trichopsomyia pilosa* sp. nov., we found only a few species with almost entirely pilose katepisternum, e.g., *Mallota fuciformis* (Fabricius, 1794), *Psilota atra* (Fallén, 1817) (Fig. 3B) and *Scaeva pyrastrii*.

**Fig. 4.** Pilosity of the katepisternum, ventro-lateral view. **A.** *Callicera macquarti* Rondani, 1843, ♂ (JSA), Cyprus, with medially connected dorsal pile patch with entire pilose ventral margin. **B.** *Eriozona syrphoides* (Fallén, 1817), ♂ (JSA), Belgium, with posteriorly connected dorsal pile patch with entire pilose ventral margin. **C.** *Pocota personata* (Harris, 1780), ♀ (JSA), Sweden, with three pile patches: dorsal, ventral and antero-medial. **D.** *Temnostoma vespiformis* (Linnaeus, 1758), ♂ (JSA), the Netherlands, with posteriorly connected dorsal and ventral pile patches. Scale bars = 0.5 mm. a = ventral pile patch; b = antero-dorsal area; c = postero-medial margin; d = dorsal pile patch; e = antero-medial pile patch.
(Linnaeus, 1758) (Fig. 3A). On the other hand, in *Pocota personata* (Harris, 1780) (Fig. 4C) there are three pile patches, a postero-dorsal, a postero-ventral and an antero-medial one. There are also species where only a ventral pile patch is present, e.g., *Brachyopa testacea* (Fig. 5C). The entirely non-pilose condition is not known in Syrphidae (Hippa & Ståhls 2005; Mengual *et al.* 2015). These examples make it clear that the old character states are much more complex and should be revised in the manner described below.

The three character states of the pilosity of the katepisternum are clearly not enough and should be extended to include all of the states as discussed above; however, for a phylogenetic analysis the number of codings is not unlimited. The proper use of the pilosity character has become more difficult and it is not easy to adjust this otherwise important character. The species in which the medial part of the katepisternum is pilose have always a ventral and dorsal pile patch, so the characters could be divided into two, numbered in accordance with Hippa & Ståhls (2005): **44A**: 0 = medial part of katepisternum pilose (Figs 3A–C, 4A–B, D, 5A); 1 = medial part of katepisternum bare (Figs 3D, 4C, 5B–D).

![Fig. 5. Pilosity of the katepisternum, ventro-lateral view. A. Ferdinandea cuprea (Scopoli, 1763), ♂ (JSA), the Netherlands, with medially connected dorsal and ventral pile patches. B. Neoascia annexa (Müller, 1776), ♀ (JSA), Germany, with ventral pile patch only. C. Brachyopa testacea (Fallén, 1817), ♂ (JSA), Belgium, with dorsal pile patch only. D. Hammerschmidtia ferruginea (Fallén, 1817), ♂ (JSA), Sweden, with dorsal and ventral pile patches, ventrally with additional long black setae. Scale bars = 0.5 mm. a = ventral pile patch; c = postero-medial margin; d = dorsal pile patch.](image-url)
first division differentiates between the former state ‘entirely pilose’ and is subdivided into four states: 

**44B0:** $0 = \text{katepisternum extensively pilose, postero-medial margin at most narrowly bare and anterior } \frac{1}{2} \text{ and entire antero-ventral part pilose (Fig. 3A–C); } 1 = \text{medial pile patch connecting dorsal and ventral pile patches, leaving at least the postero-medial area and the anterior half of the katepisternum bare (Figs 3C, 4, 5A); } 2 = \text{dorsal and ventral pile patches connected by narrow pilose area along posterior margin (Fig. 4B, D); } 3 = \text{three separated pile patches present (Fig. 4C). The second division (44A: 1) should then be subdivided into three character states: } 44B1: 0 = \text{dorsal and ventral pile patches present (Figs 3D, 5D); } 1 = \text{only a dorsal pile patch present (Fig. 5B); } 2 = \text{only a ventral pile patch present (Fig. 5C). In most species with character state } 44B0: 2, \text{ the ventral pile patch is extended to cover almost the entire ventral margin of the katepisternum, while in the other species there is only a postero-ventral pile patch present.}

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