



## ***Tanytarsus* van der Wulp (Chironomidae, Diptera): new species from the western Amazon region in Peru and Brazil, new records from the Neotropics, and remarks on the taxonomy of the genus**

GALILEU P.S. DANTAS<sup>1,3</sup>, NEUSA HAMADA<sup>1,4</sup> & WOJCIECH GIŁKA<sup>2\*</sup>

<sup>1</sup>Instituto Nacional de Pesquisas da Amazônia, Coordenação de Biodiversidade (CoBio), Divisão de Curso em Entomologia (DiEnt); Av. André Araújo, 2936, 69067-375, Manaus, Amazonas, Brazil.

<sup>2</sup>University of Gdańsk, Faculty of Biology, Department of Invertebrate Zoology and Parasitology, Laboratory of Systematic Zoology; Wita Stwosza 59, 80-308 Gdańsk, Poland. ✉ [wojciech.gilka@ug.edu.pl](mailto:wojciech.gilka@ug.edu.pl); <https://orcid.org/0000-0002-8403-5432>

<sup>3</sup>✉ [galileu.psd@gmail.com](mailto:galileu.psd@gmail.com); <https://orcid.org/0000-0002-9155-533X>

<sup>4</sup>✉ [nhamada@inpa.gov.br](mailto:nhamada@inpa.gov.br); <https://orcid.org/0000-0002-3526-5426>

\*Corresponding author. ✉ [wojciech.gilka@ug.edu.pl](mailto:wojciech.gilka@ug.edu.pl)

### Abstract

This research is focused on the diversity and systematics of Neotropical non-biting midges of the genus *Tanytarsus* van der Wulp, 1874, based on specimens collected from pristine areas of the western Amazon region in Peru and Brazil. Six new species are described: *Tanytarsus aries* sp. nov. (Peru), *T. chicomendesi* sp. nov. (Brazil, Acre), *T. kaxinawa* sp. nov. (Brazil, Acre; Peru), *T. pinedoi* sp. nov. (Peru), *T. serra* sp. nov. (Peru), and *T. frameatus* sp. nov. (Peru), the latter placed in the *Tanytarsus hastatus* species group, here defined. Data on several recently described Neotropical *Tanytarsus*, obtained by analyzing specimens recorded from different regions of Brazil (Amazonas, Bahia, Federal District, Pará, São Paulo, Tocantins) are appended, and remarks on the taxonomy and variations of their diagnostic structures are provided. *Tanytarsus pollicis* Reis, Lin et Ferreira-Keppler, 2022 is treated as a **new synonym** of *Tanytarsus insolens* Dantas et Gilka, 2017. Further two species, *Tanytarsus marianae* Reis, Lin et Ferreira-Keppler, 2022 and *Tanytarsus rafaelli* Reis, Lin et Ferreira-Keppler, 2022 are placed in the *Tanytarsus kiche* group. The *Tanytarsus curvicristatus* group is also supplemented with *Tanytarsus giovannii* Sanseverino et Trivinho-Strixino, 2010.

**Key words:** aquatic insects, non-biting midges, systematics, *Tanytarsini*

### Introduction

The western Amazon is regarded as one of the most unsurveyed regions of the world in terms of biological diversity (Bush & Lovejoy 2007, Hopkins 2007), therefore with large Wallacean and Linnean shortfalls (Hortal *et al.* 2015). Brack & Mendiola (2004) points out that insects are abundant in the aquatic environments of the high Peruvian Amazon (region located approximately between 400 and 1000 m a.s.l. to the east of the Andes Mountain), playing an important role in the aquatic food webs. Although knowledge about the organisms that form the basis of the trophic chains in this region is incipient, it is very likely that a large part of this aquatic insect fauna is composed of non-biting midges, chironomids. Chironomidae is the most species-rich and abundant insect family found in freshwater environments worldwide, and one of the most diverse and widely distributed genus is *Tanytarsus* van der Wulp, 1874.

*Tanytarsus* is composed of nearly 400 species distributed worldwide (Lin *et al.* 2018, Roskov *et al.* 2019, Dantas *et al.* 2022). Recently, Dantas *et al.* (2022) compiled a list consisting of 89 species (valid names) for the Neotropical region. Subsequently, Reis *et al.* (2022) described a couple of new species from Brazil. Thus, the total number of Neotropical species exceeds 90, of which more than 70% are known to occur in Brazil. In contrast, only two species have so far been recorded in Peru, *T. curvicristatus* Contreras-Lichtenberg, 1988 and *T. hastatus* Sublette *et Sasa*, 1994, the occurrence of *T. rinihuensis* Reiss, 1972 requires confirmation (Roback & Coffman 1983, Sanseverino 2006), but no species of *Tanytarsus* has a *locus typicus* in Peru, nor have any of the original descriptions to date been based on specimens from this country.

In our research, six new species of *Tanytarsus* are described on the basis of adult males collected in the western Amazonian forest—four from Peru, and two from Peru and/or Brazil (Acre). The new species and their descriptions are presented as a systematic study, with discussions on their position within the genus, the diversity and variability of diagnostic structures. The review is summarized with remarks on difficulties that may arise in defining these minute dipterans.

## Material and methods

The specimens have been collected with Malaise traps (Fig. 1), fixed with 80% alcohol and subsequently slide-mounted in Euparal® following the procedures outlined by Sæther (1969). The terminology follows Sæther (1980). Measurements were made using the Cell D software, and a digital camera attached to an Olympus BX 51 microscope. The photographs were taken with a Leica DFC295 camera attached to a Leica DM5500B compound light microscope and adjusted using the Helicon Focus® ver. 8.2.0 image stacking software. Ink drawings were made by hand using a drawing tube, and the drawings were digitized using the *Procreate*® app. The type material will be deposited at the Museo de Historia Natural de la Universidad Nacional Mayor de San Marcos (MUSM, Lima, Peru) and in the Invertebrates collections of the Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Amazonas, Brazil; some specimens examined are deposited in the Laboratory of Systematic Zoology, Department of Invertebrate Zoology and Parasitology (LSZ DIZP), University of Gdańsk, Poland.

## Systematics

**Family: Chironomidae Newman, 1834**

**Subfamily: Chironominae Newman, 1834**

**Tribe: Tanytarsini Zavřel, 1917**

**Subtribe: Tanytarsina Zavřel, 1917**

**Genus: *Tanytarsus* van der Wulp, 1874**

### New species

***Tanytarsus aries* sp. nov.**

<https://zoobank.org/urn:lsid:zoobank.org:act:19965FA3-4F73-4F16-BAAC-9EC8C72608EA>

(Fig. 2 A–I)

**Type material.** Holotype ♂, PERU, Cusco, Quincemil, Araza river tributary, 13°20'10"S, 70°50'57"W, 874 m a.s.l., 23–31.viii.2012, Malaise trap, J.A. Rafael, R.R. Cavichioli, D.M. Takiya (MUSM). Paratypes: 5 ♂♂ (2 MUSM, 3 INPA), same data as holotype.

***Derivatio nominis.*** From Latin, in reference to the hypopygial anal point, in the lateral aspect resembling a horned head of a male sheep/ram (Fig. 2D). Noun in apposition.

**Diagnosis.** AR ≤ 0.30. Tergite IX with microtrichia-free area near base of anal point, tergite bands Y-shaped. Anal point stout, triangular, crests broad, flanking large horn-like bars curved and turned up in proximal sections. Superior volsella subrectangular, with posteromedian corner slightly projected, bearing small ventral lip; digitus finger-like, not reaching margin of superior volsella. Median volsella with several setiform and single small foliate lamella. Inferior volsella with posteromedially directed head bearing dorsal flap.



**FIGURE 1.** Sites of sampling the type material in Peru (A, B) and Brazil (C, D).

**Description.** Adult male (n = 6)

*Body size and proportions.* Total length 2.05–2.21 mm. Wing length 1.04–1.07 mm. Total length/wing length 1.97–2.06. Wing length/length of profemur 2.12–2.30.

*Colouration.* Head capsule and palps yellow to light brown, eyes mostly pale brown, basal portion black, antenna brown. Scutal vittae and postnotum light brown, ground colour of thorax, scutellum, sternum, and haltere yellow to faint brown. Legs yellow to light brown. Wing veins yellow, membrane pale. Abdomen yellowish.

*Head.* Eyes bare, with well-developed dorsomedian extensions. Antenna with 13 flagellomeres; ultimate flagellomere 122–125 µm long; AR 0.28–0.30. Frontal tubercles 7–8 µm long. Tentorium 93–100 µm long, with elongate digitiform apex. Temporal setae 7–9 on each side. Clypeus with 10–13 setae. Lengths of palpomeres 1–5 (in µm): 20–25, 23–26, 78–85, 92–94, 143; third palpomere with 2 sensilla clavata subapically, 12 µm long.

*Thorax.* Ac 14–18, restricted to anterior region of scutum; Dc 5–6 on each side, uniserial; Pa 1 on each side; Scts 4. Scutum projected and rounded anteriorly, overreaching antepronotum.

*Wing.* Obovate, with anal lobe strongly reduced. Almost all veins (except subcosta) and entire membrane posterior to radial veins area (except 1/5 basal of m and cu cells) covered with macrotrichia. Brachiolum with 1 seta. VRCu 1.40–1.46.

*Legs.* Foreleg tibia with short lanceolate spur 16–19 µm long. Tibial combs of mid and hind legs separated; spurs of mid leg unequal: one apically curved, 20–22 µm long, second straight, 12–16 µm long; spurs of hind leg unequal: one apically curved, 25–26 µm long, second straight, 16–17 µm long. Basitarsus of mid leg without sensilla chaetica. Lengths and proportions of legs as in Table 1.

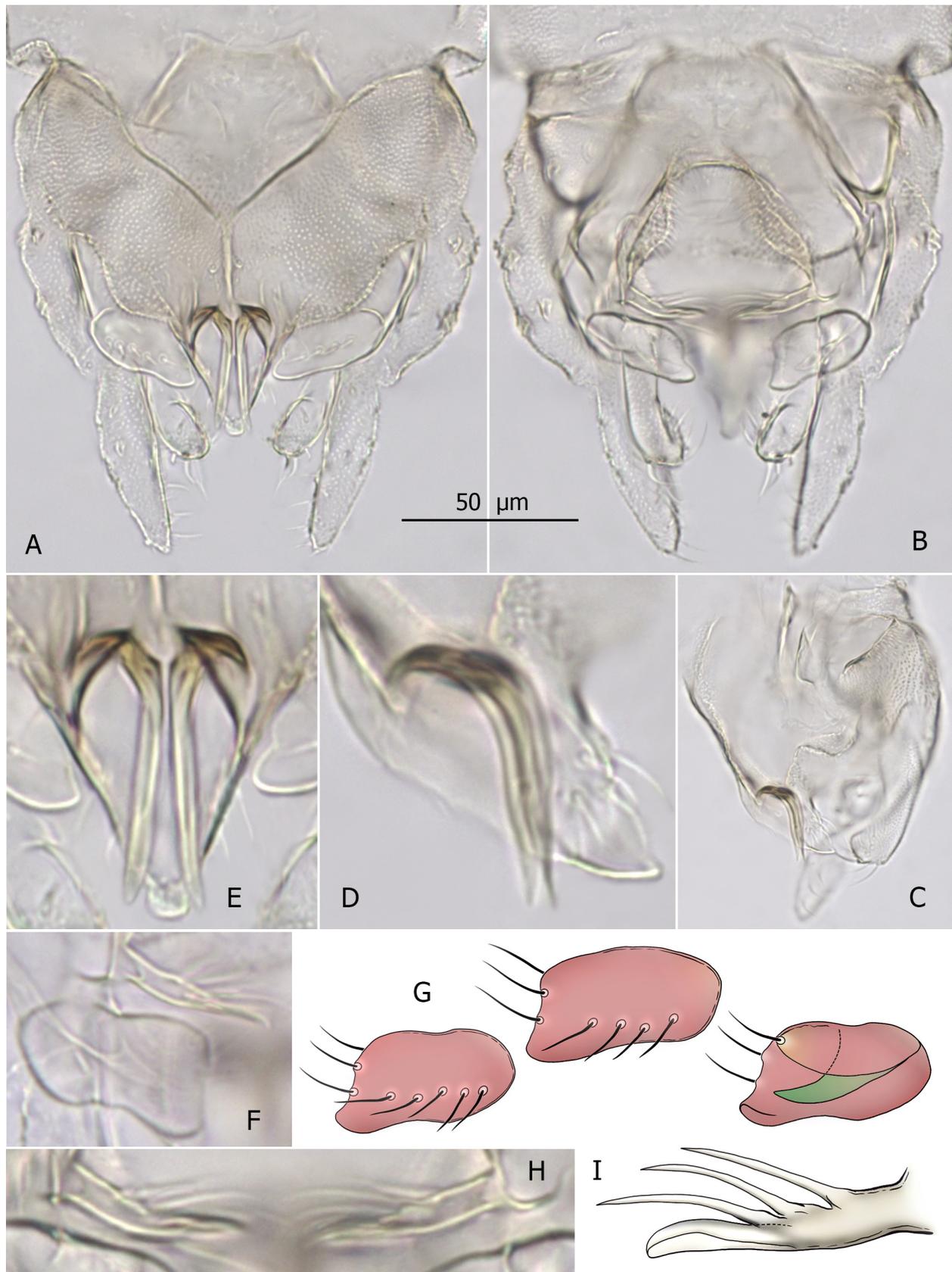
**TABLE 1.** Lengths (in µm) and proportions of leg segments of *Tanytarsus aries* sp. nov., male (n = 6).

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV
p <sub>1</sub>	468–489	240–247	648–672	300–341	250–273	190–203	100–104	2.62–2.80	1.50–1.64	1.05–1.14
p <sub>2</sub>	515–541	386–395	225–230	100–102	65–68	37–40	36–38	0.58–0.60	4.70–4.72	4.00–4.07
p <sub>3</sub>	553–560	460–465	300–305	185–190	174–178	102–111	58–63	0.65–0.67	2.46–2.52	3.39–3.42

*Hypopygium.* Tergite IX covered with dense short microtrichia except for bare area near base of anal point, with two simple median setae; lateral teeth small, bilobed; tergite bands Y-shaped, fused part ~20–25 µm long, reaching anal point base (Fig. 2A). Anal point stout, triangular, lateral margins with 3–4 setae, crests broad and round, flanking large (27–33 µm long) horn-like bars—strongly curved and turned up in proximal sections (Fig. 2A, C–E). Superior volsella 26–29 µm long, subrectangular, posteromedian corner slightly projected, with small ventral lip; 4–5 setae dorsally, 2 setae on median margin and 1 seta on anteroventral tubercle, microtrichia on dorsal surface absent; digitus finger-like, 12–14 µm long, not reaching median margin of superior volsella (Fig. 2A, B, F, G). Stem of median volsella simple, 12–13 µm long, with three setiform and one small foliate lamella (Fig. 2B, F, H, I). Inferior volsella 45–52 µm long, slightly curved, with posteromedially directed head bearing dorsal flap (Fig. 2A, B). Phallapodeme 50–56 µm long; transverse sternapodeme 35–38 µm long, with small oral projections. Gonocoxite 75–82 µm long. Gonostylus 52–55 µm long, slightly swollen at mid length, tapering to slender tip. HR 1.38–1.58, HV 3.90–4.25.

Female and immature stages. Unknown.

**Taxonomy.** Sæwedal (1981) proposed *Caladomyia* for 18 species known at that time, which have been divided into two groups, *spixi* and *orellanai*. The division has been, however, considered unwarranted (Reiff 2000) and ceased to be used (Trivinho-Strixino 2012). Moreover, difficulties in diagnosing and delimiting or remarks on close relations between *Caladomyia* and *Tanytarsus* have been raised (e.g., Reiff 2000, Sanseverino 2006, Trivinho-Strixino 2012), also based on the fossil record (Zakrzewska & Gilka 2013). Recently, after synonymizing *Caladomyia* and *Tanytarsus*, all former *Caladomyia* have been proposed to be placed in the *ortoni* group, recognized as monophyletic, although DNA sequences of only three described and named species (among 30) + those of two specimens of unknown *Caladomyia* have been used in the molecular analysis (Lin *et al.* 2018). Phylogenetic relationships within these species still need support using integrative methods, those of molecular, based on at least the majority of described species, and their morphology. The significant heteromorphism in former *Caladomyia* seems to reflect the full range of structural diversity found in *Tanytarsus*, from relatively simple to the most sophisticated, thus the concept of one group for all these species can be perceived as tentative. Hence, we do not include *T. aries* to the *ortoni* group and refrain from proposing a possible division in the cluster(s) of these taxa (not an aim of this study), but we present the new species that extends the knowledge on the structural diversity. Regarding the shape



**FIGURE 2.** *Tanytarsus aries* sp. nov., male. A–C: hypopygium in dorsal (A), ventral (B) and lateral aspect (C); D, E: anal point in lateral (D) and dorsal aspect (E); F, G: superior volsella and digitus photographed (F) and drawn (G); H, I: median volsellae photographed (H) and drawn (I); D–I magnified  $\times 1.5$ –3 relative to A and B; superior volsella in the drawings (red) with anteroventral tubercle (yellow), and digitus (green).

of the gonostylus, anal tergite and volsellae, *T. aries* slightly resembles *T. humboldti* (Säwedal, 1981). However, it differs from all former *Caladomyia* and other *Tanytarsus* in the shape of the anal point, bearing broad crests and large, strongly curved horn-like bars (Fig. 2). The low antennal ratio (AR 0.3 or less) is a supplementation of the diagnosis for *T. aries*.

**Geographical distribution and bionomics.** *Tanytarsus aries* is known only from the type locality in the highlands of Amazonian Forest in Peru (Fig. 1A, B). All specimens were collected using a Malaise trap set over a small rocky-bottomed stream surrounded by dense vegetation. This region is known for its numerous long and narrow valleys, mountain streams and warm, humid, and rainy weather (Pulgar-Vidal 1996, Brack & Mendiola 2004). As noted by Brack & Mendiola (2004), this ecoregion is a significant centre of endemism; however, it has been rapidly degraded by human activities, particularly those related to occupation along roads.

***Tanytarsus chicomendesi* sp. nov.**

<https://zoobank.org/urn:lsid:zoobank.org:act:B37F4D29-033E-4133-B27E-6BB607964385>

(Fig. 3A–F)

**Type material.** Holotype ♂, BRAZIL, Acre, Mâncio Lima, PARNA Serra do Divisor, Morro da Poranga stream, 7°25'47"S, 73°39'43"W, 260 m a.s.l., 19–27.vii.2022, Malaise trap, G.R. Desidério, A.M.O. Pes, J.O. Silva, R.B. Pinedo, H.L.M.S. Ferreira (INPA). Paratypes: 2 ♂♂ (INPA), same data as holotype.

**Derivatio nominis.** The specific epithet is a tribute to Francisco Alves Mendes Filho, better known as “Chico Mendes”, a Brazilian rubber tapper, trade union leader and environmentalist. He fought to preserve the Amazon rainforest and advocated for the human rights of Brazilian peasants and Indigenous peoples. Chico Mendes was born and lived in Acre, the same Brazilian state where the new species was found, and he was cowardly assassinated on 22 December 1988. Noun in apposition.

**Diagnosis.** Minute species, body length < 1.7 mm, wing length < 0.9 mm. Frontal tubercles absent. Tergite IX covered with microtrichia on the entire surface, median setae present, lateral teeth absent, tergite bands V-type, widely separated, curved. Anal point elongate, slender, with 3–4 spinulae and one minute spiniform seta between anterior part of crests. Superior volsella roundish or ellipse-shaped, with anteromedian tubercle extending beyond its margin; digitus finger-like, reaching or extending slightly beyond posteromedian margin of superior volsella. Stem of median volsella slightly swollen apically, with setiform and foliate lamellae. Inferior volsella with dorsoapical swelling.

**Description.** Adult male (n = 3)

**Body size and proportions.** Total length 1.45–1.62 mm. Wing length 0.82–0.85 mm. Total length/wing length 1.74–1.91. Wing length/length of profemur 2.22–2.24.

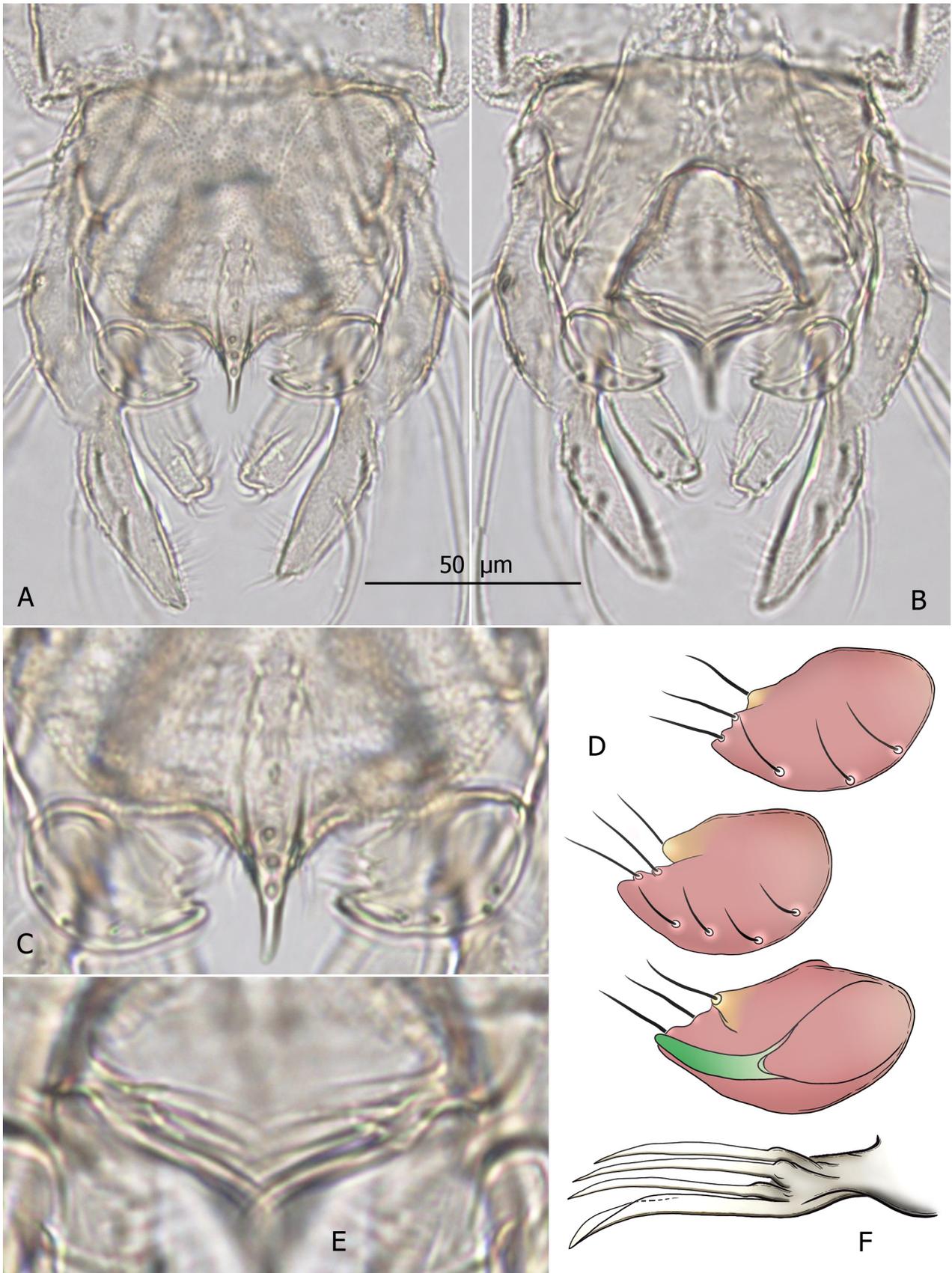
**Colouration.** Head capsule and palps light brown, eyes black, antenna brown. Scutal vittae and postnotum brown, ground colour of thorax, scutellum, and haltere yellow to light brown. Legs light brown. Wing veins light brown, membrane with light brownish undertone. Abdomen yellow to light brown.

**Head.** Eyes bare, without dorsomedian extensions. Antenna with 13 flagellomeres; ultimate flagellomere 170–178 µm long; AR 0.45–0.50. Frontal tubercles absent. Tentorium 70–75 µm long. Temporal setae 5–7 on each side. Clypeus with 8–11 setae. Lengths of palpomeres 1–5 (in µm): 15–18, 20–22, 62–65, 70–75, 120; third palpomere with 2 sensilla clavata subapically, 8–9 µm long.

**Thorax.** Ac about 20, restricted to anterior region of scutum; Dc 5 on each side, uniserial; Pa 1 on each side; Scts 2. Scutum projected and rounded anteriorly, overreaching antepronotum.

**Wing.** Obovate, with anal lobe strongly reduced. Almost all veins (except subcosta) and entire membrane posterior to radial veins area (except 1/2 basal of m, cubital and base of anal cell) covered with macrotrichia. Brachiolum with 1 seta. VRCu 1.32–1.36.

**Legs.** Foreleg tibia with short lanceolate spur 10–12 µm long. Tibial combs of mid and hind legs separated; spurs of mid leg unequal: one apically curved, 15–16 µm long, second straight, 8–10 µm long; spurs of hind leg unequal: one apically curved, 16–18 µm long, second straight, 10–12 µm long. Basitarsus of mid leg without sensilla chaetica. Lengths and proportions of legs as in Table 2.



**FIGURE 3.** *Tanytarsus chicomendesi* sp. nov., male. **A, B:** hypopygium in dorsal (**A**) and ventral aspect (**B**); **C:** anal point and superior volsellae in dorsal aspect; **D:** superior volsella and digitus; **E, F:** median volsellae photographed (**E**) and drawn (**F**); C–F magnified  $\times 1,5$ –3 relative to A and B; superior volsella in the drawings (red) with anteroventral tubercle (yellow), and digitus (green).

**TABLE 2.** Lengths (in  $\mu\text{m}$ ) and proportions of leg segments of *Tanytarsus chicomendesi* sp. nov., male (n = 3).

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV
p <sub>1</sub>	377–380	165–180	496–510	250–254	225–228	175–186	82–85	2.83–3.01	1.41–1.42	1.09–1.10
p <sub>2</sub>	406–410	315–320	175–185	82–85	56–58	32–35	29–32	0.55–0.59	4.42–4.47	3.91–4.15
p <sub>3</sub>	410–415	388–392	235–246	138–146	140–146	80–85	45–50	0.60–0.65	2.49–2.55	3.27–3.42

**Hypopygium.** Tergite IX covered with dense short microtrichia on entire surface, with 4 median setae, and 5–6 setae on each side of anal point; lateral teeth absent; tergite bands V-type, widely separated, curved, running parallel at middle of tergite (Fig. 3A, C). Anal point elongate, slender, crests well-developed, microtrichia between crests usually present; 3–4 spinulae in regular row or placed irregularly, and one minute spiniform seta between anterior part of crests (Fig. 3A, C). Superior volsella 22–24  $\mu\text{m}$  long, roundish or ellipse-shaped, posteriomedian part slightly projected, anteromedian tubercle distinctly extending beyond margin of superior volsella; 4 setae dorsally, 2 setae on median margin and 1 seta on anteroventral tubercle, microtrichia on dorsal surface absent; digitus finger-like, 14–16  $\mu\text{m}$  long, reaching or extending slightly beyond posteromedian margin of superior volsella (Fig. 3A–D). Stem of median volsella slightly swollen apically, 10  $\mu\text{m}$  long, with setiform and foliate lamellae (Fig. 3E, F). Inferior volsella 40–45  $\mu\text{m}$  long, slightly sinuous, posteromedially directed, with distinct dorsoapical swelling (Fig. 3A, B). Phallapodeme 45–52  $\mu\text{m}$  long; transverse sternapodeme 32–35  $\mu\text{m}$  long, with well-developed oral projections. Gonocoxite 60–65  $\mu\text{m}$  long. Gonostylus 45–50  $\mu\text{m}$  long, slightly swollen at mid length, tapering to slender tip. HR 1.30–1.33, HV 3.24–3.27.

Female and immature stages. Unknown.

**Taxonomy.** The adult male of *Tanytarsus chicomendesi* is the smallest within those of studied here, and one of the smallest within Neotropical *Tanytarsus*. The body and the wing lengths (1.45–1.62 mm | 0.82–0.85 mm) are comparable with those of *T. longitubuli* Trivinho-Strixino, Wiedenbrug *et da* Silva, 2015 (1.65–1.73 | 0.90–1.05) and several species formerly ascribed to *Caladomyia*, with probably the smallest *T. erikae* (Reiff, 2000) having the wing 0.74–0.78 mm long (cf. Säwedel 1981, Reiff 2000, Trivinho-Strixino 2012, Trivinho-Strixino *et al.* 2015). The lack of frontal tubercles, the anal point shape and its armature consisting of spinulae and the minute spiniform seta, the ellipse-shaped superior volsella, with the well-developed anteromedian tubercle, and the long finger-like digitus form a set of characters best separating *T. chicomendesi* from other *Tanytarsus*.

**Geographical distribution and bionomics.** *Tanytarsus chicomendesi* is known only from the type locality in the western Brazilian Amazon (Fig. 1C, D). The type locality is in the Serra do Divisor National Park (SDNP), which encompasses a mountain range located on the border between Brazil and Peru, in the Amazon region. This is a region of great ecological importance, as some of the main rivers of the Amazon basin, such as Juruá and Tarauacá, originate there. Although the SDNP is considered one of the most preserved and biodiverse areas in the world, hosting several endemic species (Whitney *et al.* 2004, Silveira *et al.* 2008, Dolibaina *et al.* 2015, Bernarde *et al.* 2016), this region has been suffering serious threats due to disastrous environmental and economic policies (Koga *et al.* 2022, Ruaro & Laurance 2022). This situation highlights the urgent need to study the biodiversity of the region, as this knowledge is crucial for developing effective conservation strategies.

### *Tanytarsus kaxinawa* sp. nov.

<https://zoobank.org/urn:lsid:zoobank.org:act:86ACEDC7-AC6C-4E35-A911-4D1C228D7282>

(Fig. 4A–G)

**Type material.** Holotype ♂, BRAZIL, Acre, Mâncio Lima, PARNA Serra do Divisor, Morro da Poranga stream, 7°25'47"S, 73°39'43"W, 260 m a.s.l., 19–27.vii.2022, Malaise trap, G.R. Desidério, A.M.O. Pes, J.O. Silva, R.B. Pinedo, H.L.M.S. Ferreira (INPA). Paratypes: 3 ♂♂, PERU, Cusco, Quincemil, Araza river tributary, 13°20'10"S, 70°50'57"W, 874 m a.s.l., 23–31.viii.2012, Malaise trap, J.A. Rafael, R.R. Cavichioli, D.M. Takiya (MUSM).

**Derivatio nominis.** The specific epithet is a tribute to the Kaxinawá indigenous people (also known as Huni Kuin), who live in the western Amazon (in Brazil and Peru), which is exactly the known distribution of the new species. Noun in apposition.

**Diagnosis.** Tergite IX covered with microtrichia on entire surface, median setae and lateral teeth absent, tergite bands short, broadly separated. Anal point slender, tapering to narrowly rounded apex, without crests, bars or

spinulae. Superior volsella rhombus-shaped, posteriomedian part slightly projected, with small ventral lip; digitus well-developed, pointed, reaching or extending slightly beyond posteromedian margin of superior volsella. Median volsella with setiform and foliate lamellae.

**Description.** Adult male (n = 4)

*Body size and proportions.* Total length 1.81–2.24 mm. Wing length 1.02–1.22 mm. Total length/wing length 1.77–1.90. Wing length/length of profemur 1.86–2.03.

*Colouration.* Head capsule and palps yellow to faint brown, eyes black, antenna brown. Scutal vittae and postnotum brown, median anepisternum II (MA II) and ventral portion of preepisternum light brown, ground colour of thorax, scutellum, and haltere yellow to faint brown. Foreleg: femur and tibia brown, tarsus yellowish. Mid and hind legs: yellowish to light brown. Wing veins yellowish to light brown, membrane with faint brownish undertone. Abdomen yellow to light brown.

*Head.* Eyes bare, with well-developed dorsomedian extensions. Antenna with 13 flagellomeres; ultimate flagellomere 160–194 µm long; AR 0.36–0.42. Frontal tubercles in shape of minute swellings (~2 µm). Tentorium 80–105 µm long. Temporal setae 7–10 on each side. Clypeus with 12–14 setae. Lengths of palpomeres 1–5 (in µm): 18–30, 20–31, 96–105, 95–106, 177; third palpomere with 2 sensilla clavata subapically, 12 µm long.

*Thorax.* Ac 20–24, restricted to anterior region of scutum; Dc 6–8 on each side, uniserial; Pa 1 on each side; Scts 3–4. Scutum projected and rounded anteriorly, overreaching anteprotonotum.

*Wing.* Typical of the genus. Almost all veins (except subcosta) and entire membrane posterior to radial veins area (except 1/5 basal of m and 2/3 of cu cell) covered with macrotrichia. Brachiolum with 2 setae. VRCu 1.31–1.32.

*Legs.* Foreleg tibia with short lanceolate spur 18–23 µm long. Tibial combs of mid and hind legs separated; spurs of mid leg unequal: one apically curved, 20–22 µm long, second straight, 10–12 µm long; spurs of hind leg unequal: one apically curved, 24–27 µm long, second straight, 15–18 µm long. Basitarsus of mid leg without sensilla chaetica. Lengths and proportions of legs as in Table 3.

**TABLE 3.** Lengths (in µm) and proportions of leg segments of *Tanytarsus kaxinawa* sp. nov., male (n = 4).

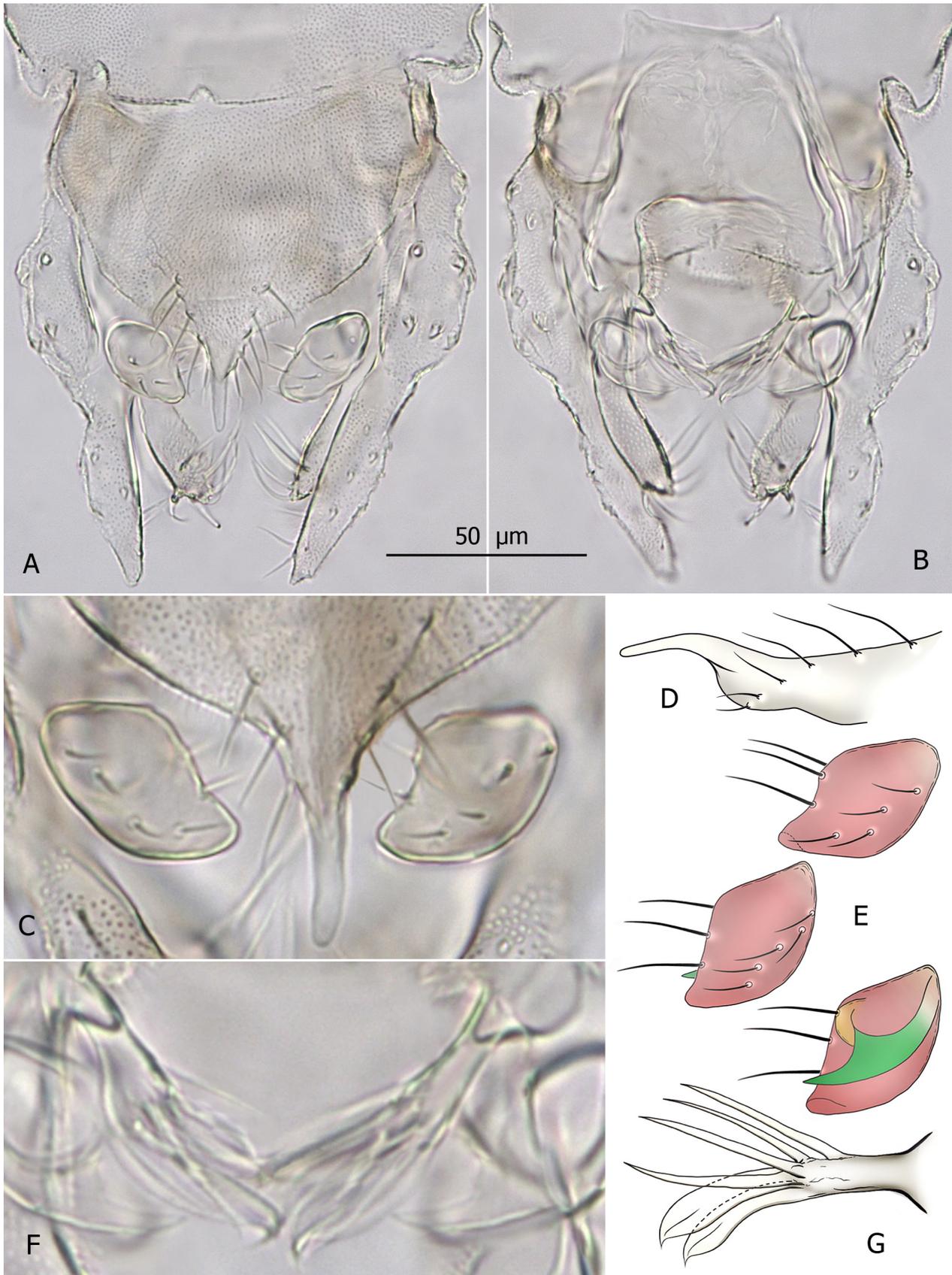
	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV
p <sub>1</sub>	550–600	265–300	738	335	287	225	127	2.64	1.64	1.16
p <sub>2</sub>	520–580	400–465	225–252	105–138	70–88	45–55	40–45	0.54–0.57	3.98–4.25	4.09–4.14
p <sub>3</sub>	540–620	505–565	350–388	210–242	185–218	112–120	70–78	0.64–0.69	2.39–2.44	3.06–3.31

*Hypopygium.* Tergite IX covered with dense short microtrichia on entire surface, median setae absent, 4–6 setae on each side of anal point (2–3 laterodorsal, 2–3 ventral); lateral teeth absent; tergite bands short, broadly separated (Fig. 4A). Anal point hyaline, slender, tapering toward narrowly rounded apex, without crests, bars or spinulae (Fig. 4A, C, D). Superior volsella 28–33 µm long, somewhat rhombus-shaped, posteriomedian part slightly projected, with small ventral lip; 3–5 setae dorsally 2 setae on median margin and 1 seta on anteroventral tubercle, microtrichia on dorsal surface absent; digitus well-developed, pointed, 16–20 µm long, reaching or extending slightly beyond posteromedian margin of superior volsella (Fig. 4A, B, C, E). Stem of median volsella simple, 15–18 µm long, with setiform and foliate lamellae (Fig. 4B, F, G). Inferior volsella 50–60 µm long, with slightly swollen and posteromedially directed distal part (Fig. 4A, B). Phallapodeme sinuous, 70–74 µm long; transverse sternapodeme 45–55 µm long, with well-developed oral projections. Gonocoxite 63–72 µm long. Gonostylus 52–60 µm long, slightly swollen at mid length, tapering to slender tip. HR 1.14–1.20, HV 3.20–3.70.

Female and immature stages. Unknown.

**Taxonomy.** The combination of characters given in the diagnosis of *Tanytarsus kaxinawa* is unknown among *Tanytarsus* males. Noteworthy is the structure of the anal point, slender, lacking spinulae or crests (the structures known from the majority of *Tanytarsus*), as well as the shape of the superior volsella, more or less rhomboid, and the well-developed digitus (Fig. 4). For comparison of Neotropical *Tanytarsus* with the slender and bare anal points see also *T. pinedoi* described below.

**Geographical distribution and bionomics.** *Tanytarsus kaxinawa* is known from the western Amazon in Brazil and Peru (Fig. 1). The adult male specimens examined were obtained along with those of other five species described in the present paper. For further information on the ecology and bionomics refer to the notes on *T. aries* and *T. chicomendesi* (above).



**FIGURE 4.** *Tanytarsus kaxinawa* sp. nov., male. **A, B:** hypopygium in dorsal (**A**) and ventral aspect (**B**); **C:** anal point and superior volsellae in dorsal aspect; **D:** anal point in lateral aspect; **E:** superior volsella and digitus; **F, G:** median volsellae photographed (**F**) and drawn (**G**); **C–G** magnified  $\times 1.5$ – $3$  relative to **A** and **B**; superior volsella in the drawings (red) with anteroventral tubercle (yellow), and digitus (green).

***Tanytarsus pinedoi* sp. nov.**

<https://zoobank.org/urn:lsid:zoobank.org:act:F8231DFE-C627-4F3B-A9C6-290402B524EB>

(Fig. 5A–F)

**Type material.** Holotype ♂, PERU, Cusco, Quincemil, Araza river tributary, 13°20'10"S, 70°50'57"W, 874 m a.s.l., 23–31.viii.2012, Malaise trap, J.A. Rafael, R.R. Cavichioli, D.M. Takiya (MUSM). Paratype: 1 ♂ (INPA), same data as holotype.

**Derivatio nominis.** The species is named in honour of the young Peruvian researcher Raul Bismarck Pinedo Garcia, for his friendship and constant support both in the laboratory and field works.

**Diagnosis.** Tergite IX covered with dense short microtrichia on the entire surface, median setae absent, tergite bands short, broadly separated. Anal point slender, pointed, without crests, bars or spinulae. Superior volsella basally rounded, tapering to truncate and posteriorly or posterolaterally curved apex bearing ventral lip; digitus triangular, basally broad but strongly shortened. Median volsella with two setiform and one foliate lamella.

**Description.** Adult male (n = 2)

**Body size and proportions.** Total length 2.03–2.15 mm. Wing length 1.05 mm. Total length/wing length 2.04. Wing length/length of profemur 2.22.

**Colouration.** Head capsule and palps light brown, eyes black, antenna brown. Scutal vittae, postnotum and preepisternum brown, ground colour of thorax, haltere, scutellum, yellow to light brown. Legs light brown. Wing veins yellow to light brown, membrane with light brownish undertone. Abdomen yellowish.

**Head.** Eyes bare, with well-developed dorsomedian extensions. Antenna with 13 flagellomeres; ultimate flagellomere 140–163 µm long; AR 0.33–0.37. Frontal tubercles 6–7 µm long. Tentorium 70–78 µm long. Temporal setae 7–8 on each side. Clypeus with 8–10 setae. Lengths of palpomeres 1–5 (in µm): 22–25, 23–26, 76–78, 78–80, 130–135; third palpomere with 2 sensilla clavata subapically, 12 µm long.

**Thorax.** Ac about 20, restricted to anterior region of scutum; Dc 7–8 on each side, uniserial; Pa 1 on each side; Scts 5. Scutum projected and rounded anteriorly, overreaching anteprepronotum.

**Wing.** Obovate, with anal lobe reduced. Almost all veins (except subcosta) and entire membrane posterior to radial veins area (except 1/2 basal of m and cu cells) covered with macrotrichia. Brachiolum with 1 seta. VRCu 1.36.

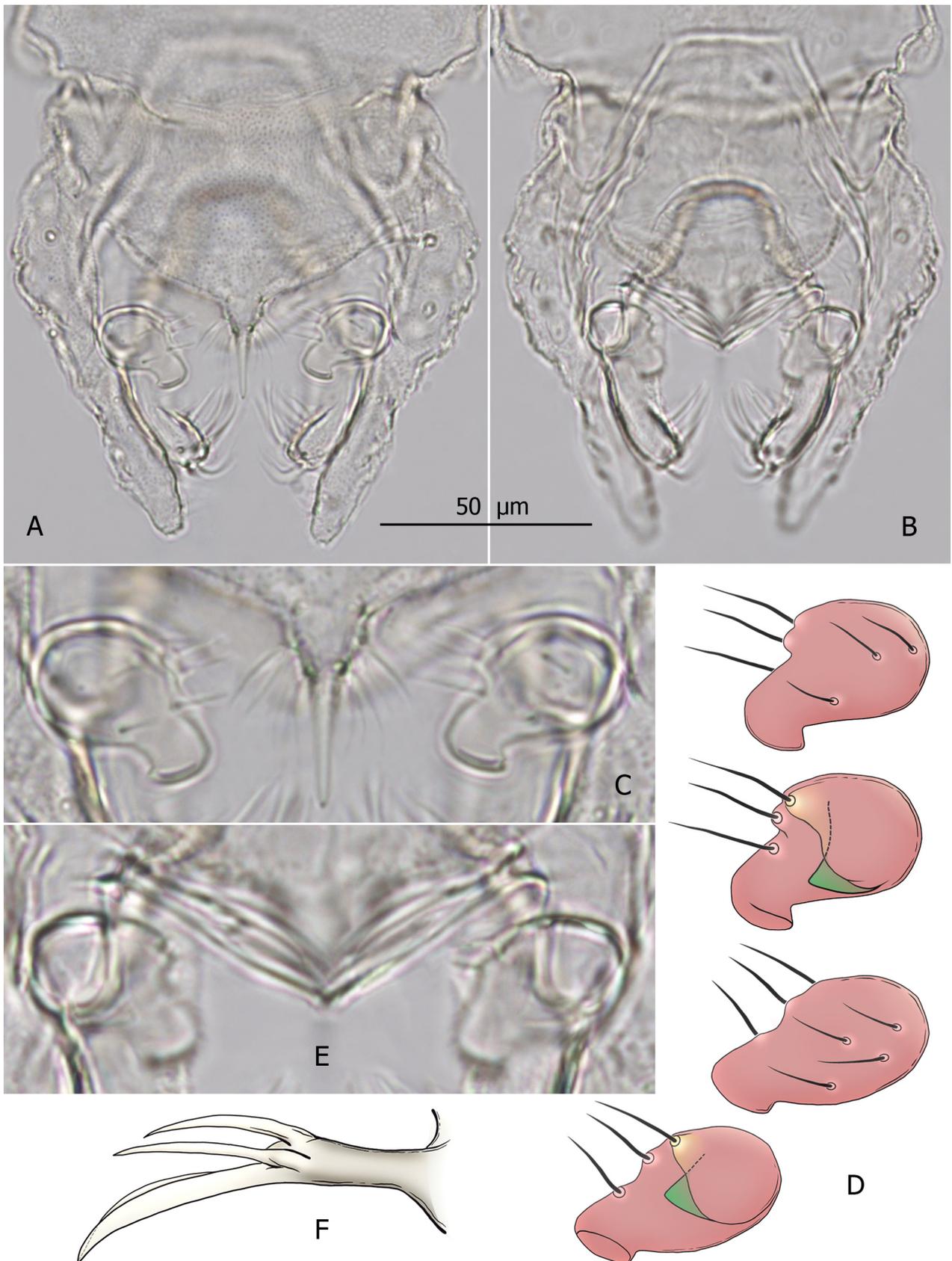
**Legs.** Foreleg tibia with lanceolate spur 18–20 µm long. Tibial combs of mid and hind legs separated; spurs of mid leg unequal: one apically curved, 17–18 µm long, second straight, 10–12 µm long; spurs of hind leg unequal: one apically curved, 18–20 µm long, second straight, 10–12 µm long. Basitarsus of mid leg without sensilla chaetica. Lengths and proportions of legs as in Table 4.

**TABLE 4.** Lengths (in µm) and proportions of leg segments of *Tanytarsus pinedoi* sp. nov., male (n = 2).

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV
p <sub>1</sub>	435–474	215–230	536–576	280–290	226–238	182–204	100–102	2.49–2.50	1.50–1.53	1.21–1.22
p <sub>2</sub>	438–480	322–365	196–220	102–112	72–80	43–45	38–40	0.60–0.61	3.75–3.84	3.84–3.88
p <sub>3</sub>	470–523	395–444	310	180	160	102	64	0.70	2.52	3.12

**Hypopygium.** Tergite IX covered with dense short microtrichia on the entire surface, median setae absent, 4–5 setae on each side of anal point; lateral teeth vestigial; tergite bands short, broadly separated (not reaching middle of tergite) (Fig. 5A). Anal point hyaline, slender, pointed, without crests, bars or spinulae (Fig. 5A, C). Superior volsella 24–25 µm long, basally rounded, tapering to truncate and posteriorly or posterolaterally curved apex bearing distinct ventral lip; 3–4 setae dorsally, 2 setae on median margin and 1 seta on anteroventral tubercle, microtrichia on dorsal surface absent; digitus triangular, basally broad but strongly shortened (4–5 µm), not reaching margin of superior volsella (Fig. 5A–E). Stem of median volsella simple, 14–18 µm long, with two setiform and one foliate lamella (Fig. 5E, F). Inferior volsella 45–50 µm long, with slightly swollen and posteromedially directed distal part (Fig. 5A, B). Phallapodeme sinuous, 55–65 µm long; transverse sternapodeme 36–45 µm long, with small oral projections. Gonocoxite 60–70 µm long. Gonostylus 46–50 µm long, slightly swollen at mid length, evenly tapering toward blunt apex. HR 1.30–1.40, HV 4.06–4.67.

Female and immature stages. Unknown.



**FIGURE 5.** *Tanytarsus pinedoi* sp. nov., male. **A, B:** hypopygium in dorsal (**A**) and ventral aspect (**B**); **C:** anal point and superior volsellae in dorsal aspect; **D:** superior volsella and digitus (variations); **E:** median and superior volsellae in ventral aspect; **F:** median volsella; **C–F** magnified  $\times 2\text{--}3$  relative to **A** and **B**; superior volsella in the drawings (red) with anteroventral tubercle (yellow), and digitus (green).

**Taxonomy.** The male of *Tanytarsus pinedoi* is characterized by a unique hypopygium structure, the comparison of which with those of other known *Tanytarsus* is limited to species with a slender anal point without crests and/or spinulae, or other structures typical of the genus (Fig. 5). Among the Neotropical *Tanytarsus*, a similar anal point is known in *T. fastigatus* Reiss, 1972 (but broader in distal half), *T. hirsutus* Trivinho-Strixino, Wiedenbrug *et da Silva*, 2015 (parallel-sided), *T. jatai* Trivinho-Strixino, Wiedenbrug *et da Silva*, 2015 (with minute subapical triangular protrusions), *T. obiriciae* Trivinho-Strixino *et* Sonoda, 2006 (broadened in distal half), *T. reissi* Paggi, 1992 (triangular at tip), *T. sanseverinoi* Dantas, Amat, Hamada *et* Gilka, 2022 (nearly identical with *T. pinedoi*), *T. tuberculatus* Reiss, 1972 (with vestigial crests or flap-like enlargements), and in species of the *impar* group (but shorter, broader or with narrow crest) (Reiss 1972, Paggi 1992, Trivinho-Strixino & Strixino 2004, Trivinho-Strixino & Sonoda 2006, Trivinho-Strixino *et al.* 2015, Dantas & Gilka 2017, Dantas *et al.* 2022). The simple (bare) and slender anal point, but with round apex, we also describe in other new species here (see *T. kaxinawa*). None of the species compared here has characters in a combination given in the diagnosis of *T. pinedoi* (see above). Apart from the unique anal point structure, the species is distinct in having the superior volsella with its posteriomedian part truncate, curved posteriorly or posterolaterally, and the digitus, basally broad but short.

**Geographical distribution and bionomics.** *Tanytarsus pinedoi* is known only from the type locality in the highlands of the Amazonian Forest in Peru (Fig. 1A, B). The adult male specimens examined were obtained along with those of four other species described in the present paper. For further information on the ecology and bionomics refer to the notes on *Tanytarsus aries* (above).

### *Tanytarsus serra* sp. nov.

<https://zoobank.org/urn:lsid:zoobank.org:act:764D4850-3F6A-4265-BF09-9B55CD4595A8>

(Fig. 6A–H)

**Type material.** Holotype ♂, PERU, Cusco, Quincemil, Araza river tributary, 13°20'10"S, 70°50'57"W, 874 m a.s.l., 23–31.viii.2012, Malaise trap, J.A. Rafael, R.R. Cavichioli, D.M. Takiya (MUSM). Paratypes: 4 ♂♂ (2 MUSM, 2 INPA), same data as holotype.

**Derivatio nominis.** From Latin, in reference to the serrated or saw-like hypopygial anal point (Fig. 6C–E). Noun in apposition.

**Diagnosis.** Tergite IX covered with microtrichia on the entire surface, median setae and lateral teeth absent, tergite bands weak, fading at anteromedian part of tergite. Anal point slightly broadened subapically, apex round with slender process, without crests, bars or spinulae, lateral margins distinctly serrated. Superior volsella roundish, distal part slightly projected with a ventral lip; digitus finger-like, tapering to slender tip, not extending beyond margin of superior volsella. Median volsella with 3–4 setiform and 1–2 subulate lamellae.

**Description.** Adult male (n = 5)

**Body size and proportions.** Total length 1.95–2.51 mm. Wing length 1.06–1.55 mm. Total length/wing length 1.68–1.83. Wing length/length of profemur 1.91–2.06.

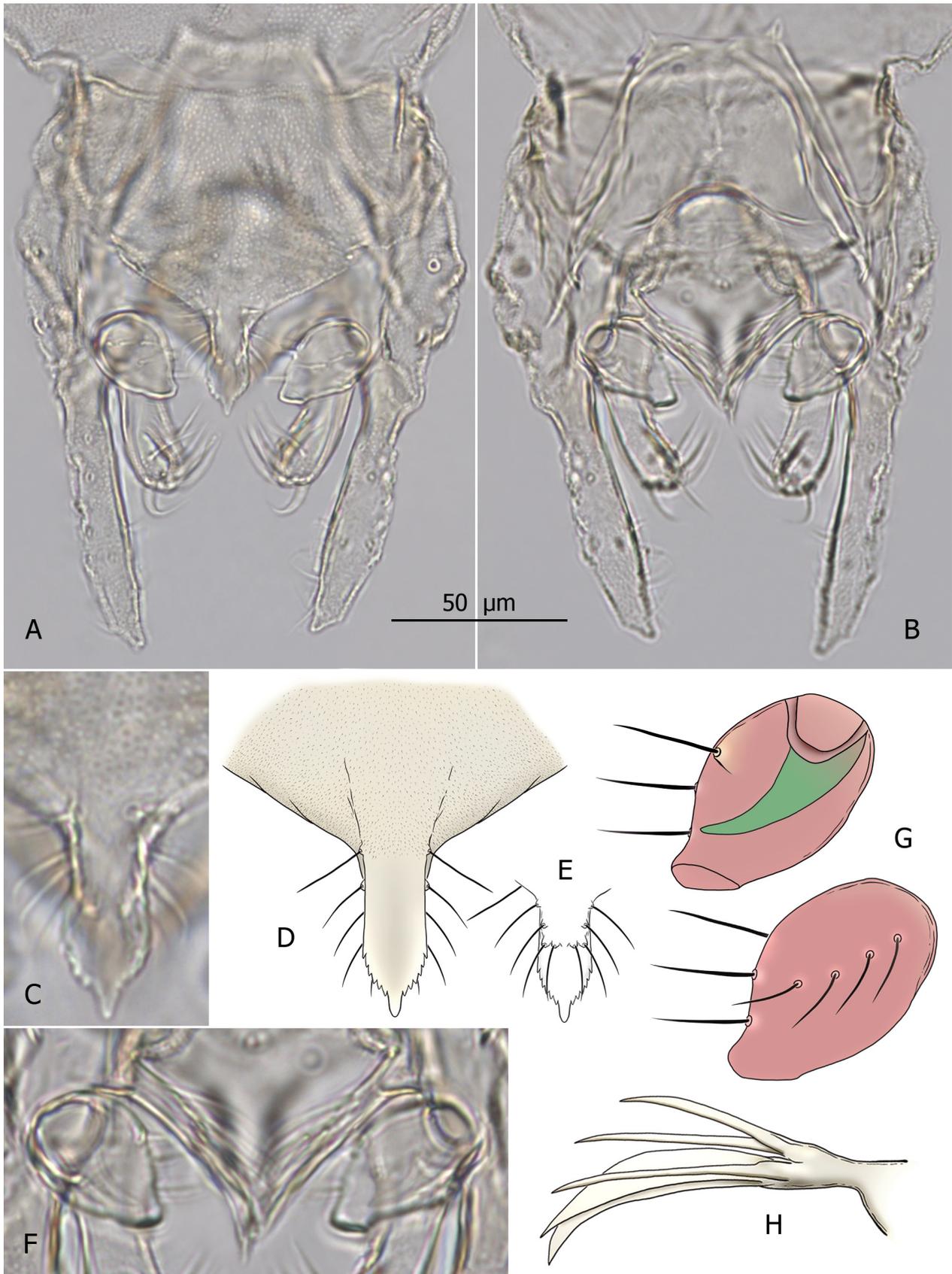
**Colouration.** Head capsule and palps yellow to faint brown, eyes black, antenna brown. Scutal vittae and postnotum brown, ventral portion of preepisternum light brown, ground colour of thorax, scutellum, and haltere yellow to faint brown. Legs yellowish to light brown. Wing veins yellowish to light brown, membrane with light brownish undertone. Abdomen yellow to light brown.

**Head.** Eyes bare, dorsomedian extensions developed. Antenna with 13 flagellomeres; ultimate flagellomere 170 µm long; AR 0.39. Frontal tubercles 6–7 µm long. Tentorium 98–105 µm long. Temporal setae 8–10 on each side. Clypeus with 10–13 setae. Lengths of palpomeres 1–5 (in µm): 25–28, 25–30, 88–95, 96–98, 165; third palpomere with 2 sensilla clavata subapically, 13–14 µm long.

**Thorax.** Ac 22–24, restricted to anterior region of scutum; Dc 7–8 on each side, uniserial; Pa 1 on each side; Scts 4. Scutum projected and rounded anteriorly, overreaching antepronotum.

**Wing.** Obovate, with anal lobe reduced. Almost all veins (except subcosta) and entire membrane posterior to radial veins area (except 2/3 basal of cubital cell) covered with macrotrichia. Brachiolum with 1 seta. VRCu 1.26–1.30.

**Legs.** Foreleg tibia with lanceolate spur 16–17 µm long. Tibial combs of mid and hind legs separated; spurs of mid leg unequal: one apically curved, 18–20 µm long, second straight, 12–14 µm long; spurs of hind leg unequal: one apically curved, 21–22 µm long, second straight, 17–19 µm long. Basitarsus of mid leg with two sensilla chaetica. Lengths and proportions of legs as in Table 5.



**FIGURE 6.** *Tanytarsus serra* sp. nov., male. **A, B:** hypopygium in dorsal (**A**) and ventral aspect (**B**); **C–E:** anal point photographed (**C**) and drawn in dorsal (**D**) and ventral aspect (**E**); **F:** median and superior volsellae in ventral aspect; **G:** superior volsella and digitus; **H:** median volsella; **C–H** magnified  $\times 1.5$ – $3$  relative to **A** and **B**; superior volsella in the drawings (red) with anteroventral tubercle (yellow), and digitus (green).

**TABLE 5.** Lengths (in  $\mu\text{m}$ ) and proportions of leg segments of *Tanytarsus serra* sp. nov., male (n = 5).

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV
p <sub>1</sub>	553–572	260–273	690–750	313–320	255–280	197–220	97–117	2.65–2.75	1.70–1.74	1.12–1.18
p <sub>2</sub>	525–552	389–435	243–258	110–125	75–82	46–55	42–50	0.59–0.62	3.99–4.24	3.76–3.82
p <sub>3</sub>	522–590	485–515	330–362	200–215	187–200	108–120	68–70	0.68–0.70	2.37–2.42	3.05–3.07

**Hypopygium.** Tergite IX covered with dense short microtrichia on the entire surface, median setae absent, 5–6 setae on each side of anal point; lateral teeth not observed; tergite bands weak, running transversally relative to main body axis, fading at anteromedian part of tergite (Fig. 6A, C). Anal point parallel-sided in basal part, slightly broadened subapically, tapering to round apex bearing slender process, without crests, bars or spinulae, dorsal surface concave, lateral margins distinctly serrated (Fig. 6A, C–E). Superior volsella 26–30  $\mu\text{m}$  long, roundish, distal part slightly projected, with a ventral lip; 4–5 setae dorsally, 2 setae on median margin and 1 seta on anteroventral tubercle, microtrichia on dorsal surface absent; digitus finger-like, tapering to slender tip, 13–16  $\mu\text{m}$  long, not extending beyond margin of superior volsella (Fig. 6A, B, F, G). Stem of median volsella simple, 15–16  $\mu\text{m}$  long, with 3–4 setiform and 1–2 subulate lamellae (Fig. 6B, F, H). Inferior volsella 50–52  $\mu\text{m}$  long, with slightly swollen and posteromedially directed distal part (Fig. 6A, B). Phallapodeme sinuous, 80  $\mu\text{m}$  long; transverse sternapodeme 40  $\mu\text{m}$  long, with distinct oral projections. Gonocoxite 75–88  $\mu\text{m}$  long. Gonostylus 68–72  $\mu\text{m}$  long, more or less parallel-sided, apically tapering to narrow apex. HR 1.10–1.24, HV 2.80–3.60.

Female and immature stages. Unknown.

**Taxonomy.** The distinctly serrated margins of the hypopygial anal point in the new species is another character within the extraordinary range of structural diversity of *Tanytarsus*. The general shape of the anal point of *Tanytarsus serra* (slightly broadened subapically and tapering to round apex bearing slender process) is similar to those of *T. kraussi* (Säwedal, 1981) and *T. poppigi* (Säwedal, 1981) originally described as *Caladomyia*. However, in *T. serra* it lacks any other structures typical of the compared species—crests, spinulae or bars [cf. Fig. 6 and Säwedal (1981) figs 15 & 18]. Such the peculiarly structured anal point in combination with other characters (see diagnosis) allows easy identification of the adult male.

**Geographical distribution and bionomics.** *Tanytarsus serra* is known only from the type locality in the highlands of the Amazonian Forest in Peru (Fig. 1A, B). The adult male specimens examined were obtained along with those of four other species described in the present paper. For further information on the ecology and bionomics refer to the notes on *Tanytarsus aries* (above).

### *Tanytarsus hastatus* species group

Members: *Tanytarsus hastatus* Sublette et Sasa, 1994, *Tanytarsus frameatus* sp. nov.

**Diagnosis.** Hypopygial anal point lanceolate, subapically broadened, with triangular distal section tapering to pointed apex, bearing numerous spinulae distributed irregularly between well-developed crests. Superior volsella round or heart-shaped, with median margin concave, and ventral lip posteromedially. Digitus long, extending well beyond median margin of superior volsella, finger- or knife-shaped. Stem of median and digitus of similar length.

#### *Tanytarsus frameatus* sp. nov.

<https://zoobank.org/urn:lsid:zoobank.org:act:2A344199-7C3E-4C71-B406-77B785B022FE>

(Fig. 7A–H)

**Type material.** Holotype ♂, PERU, Cusco, Quincemil, Araza river tributary, 13°20'10"S, 70°50'57"W, 874 m a.s.l., 23–31.viii.2012, Malaise trap, leg. J.A. Rafael, R.R. Cavichioli, D.M. Takiya (MUSM). Paratype: 1 ♂ (INPA), same data as holotype.

**Derivatio nominis.** From Latin *framea* (spear, or *hasta*), in reference to the shape of the hypopygial anal point (Fig. 7C), the key character of the proposed *Tanytarsus hastatus* species group.

**Diagnosis.** Frontal tubercles relatively small, up to 10  $\mu\text{m}$  long. Tergite IX covered with microtrichia on the

entire surface, 2–6 median setae placed irregularly at base of anal point, lateral teeth vestigial, tergite bands V-shaped, widely separated. Anal point with 12–14 spinulae between well-developed crests. Superior volsella heart-shaped, with evenly concave median margin; digitus long, finger-like. Stem of median volsella simple, bearing several setiform and pectinate lamellae with wavy apices.

**Description.** Adult male (n = 2)

*Body size and proportions.* Total length 2.53–2.90 mm. Wing length 1.47–1.57 mm. Total length/wing length 1.72–1.85. Wing length/length of profemur 1.92–1.93.

*Colouration.* Head capsule and palps yellow to light brown, eyes black, antenna brown. Scutal vittae and postnotum light brown, ground colour of thorax, scutellum, and haltere yellow to pale brown. Legs and abdomen yellow to light brown. Wing veins yellowish to light brown, membrane with yellow undertone.

*Head.* Eyes bare, with well-developed dorsomedian extensions. Antenna with 13 flagellomeres; ultimate flagellomere 155–178  $\mu\text{m}$  long; AR 0.28–0.31. Frontal tubercles 8–10  $\mu\text{m}$  long. Tentorium 125–130  $\mu\text{m}$  long. Temporal setae 7–9 on each side. Clypeus with 14–16 setae. Lengths of palpomeres 1–3 (in  $\mu\text{m}$ ): 32, 38, 112; third palpomere with 4 sensilla clavata subapically, 18  $\mu\text{m}$  long.

*Thorax.* Ac about 20–22, restricted to anterior region of scutum; Dc 8–10 on each side, uniserial; Pa 2 on each side; Scts 4–6. Scutum projected anteriorly, overreaching antepronotum.

*Wing.* Obovate, with anal lobe strongly reduced. Almost all veins (except subcosta) and entire membrane posterior to radial veins area (except 1/5 basal of m and 1/2 of cubital cell) covered with macrotrichia. Brachiolum with 1 seta. VRCu 1.27–1.31.

*Legs.* Foreleg tibia with lanceolate spur 20–25  $\mu\text{m}$  long. Tibial combs of mid and hind legs separated; spurs of mid leg unequal: one apically curved, 32–33  $\mu\text{m}$  long, second straight, 18–19  $\mu\text{m}$  long; spurs of hind leg unequal: one apically curved, 36–38  $\mu\text{m}$  long, second straight, 28–32  $\mu\text{m}$  long. Basitarsus of mid leg with two sensilla chaetica. Lengths and proportions of legs as in Table 6.

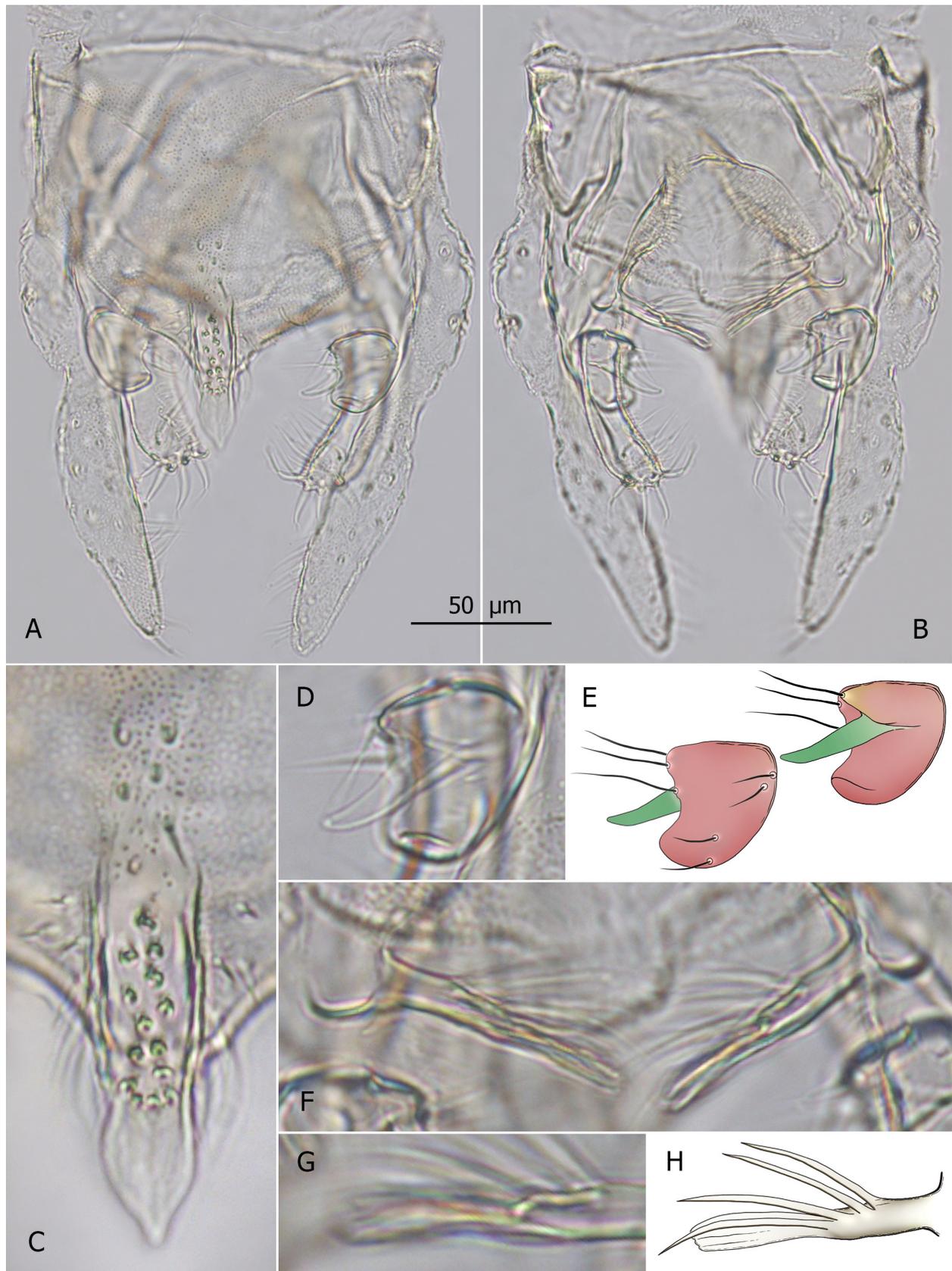
**TABLE 6.** Lengths (in  $\mu\text{m}$ ) and proportions of leg segments of *Tanytarsus frameatus* sp. nov., male (n = 2).

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV
p <sub>1</sub>	766–815	440–477	1124	507	400	373	190	2.51	1.62	1.12
p <sub>2</sub>	775–834	590–642	348–362	165–190	115–128	67	50	0.56–0.59	4.31	3.92–4.08
p <sub>3</sub>	840–875	705–758	530	332	280	185	100	0.70	2.41	3.08

*Hypopygium.* Tergite IX covered with dense short microtrichia on entire surface, 2–6 median setae placed irregularly at base of anal point, 5–7 setae on each side of anal point (+6 setae ventrally); lateral teeth vestigial; tergite bands V-shaped, widely separated, curved, fading at middle of tergite (Fig. 7A). Anal point lanceolate, with a pair of well-developed crests, microtrichia between crests absent, 12–14 spinulae placed irregularly (Fig. 7A, C). Superior volsella 32–33  $\mu\text{m}$  long, heart-shaped, with evenly concave median margin, posteromedian corner slightly projected, with ventral lip; 4 setae dorsally, 2 setae on median margin and 1 seta on anteroventral tubercle, microtrichia on dorsal surface absent; digitus 23–24  $\mu\text{m}$  long, extending far beyond posteromedian margin of superior volsella (Fig. 7A, B, D, E). Stem of median volsella simple, 18–19  $\mu\text{m}$  long, with setiform and pectinate lamellae (apices wavy) (Fig. 7B, F–H). Inferior volsella 70–80  $\mu\text{m}$  long, with slightly swollen and posteromedially directed distal part (Fig. 7A, B). Phallapodeme 90–96  $\mu\text{m}$  long; transverse sternapodeme 52–53  $\mu\text{m}$  long, with small oral projections. Gonocoxite 98–110  $\mu\text{m}$  long. Gonostylus 92–105  $\mu\text{m}$  long, slightly swollen at mid length, tapering to round tip. HR 1.05–1.07, HV 2.75–2.78.

Female and immature stages. Unknown.

**Taxonomy.** Recent studies and a redescription of *Tanytarsus hastatus* have supported its exclusion from the *riopreto* group (Dantas *et al.* 2022), as formerly proposed. However, indications of known species sufficiently close to be considered as relatives at the group level have so far remained problematic. *Tanytarsus frameatus*, described above, fits into this gap in knowledge and together with *T. hastatus* forms a species couple that is proposed as a separate group here. Both species share several features defined as key for the group (see the group diagnosis), and some characters clearly show they are distinct species. These are: relatively small frontal tubercles in *T. frameatus* (vs. large in *T. hastatus*), vestigial lateral teeth of the anal tergite (vs. large), just over a dozen of spinulae (vs. 2 or 3 dozens of spinulae), heart-shaped superior volsella with an evenly concave median margin (vs. round, deeply concave), stem of median volsella simple (vs. swollen apically) (cf. Fig. 7 and Sublette & Sasa 1994, Sanseverino 2006, Dantas *et al.* 2022).



**FIGURE 7.** *Tanytarsus frameatus* sp. nov., male. **A, B:** hypopygium in dorsal (**A**) and ventral aspect (**B**); **C:** anal point; **D, E:** superior volsella and digitus photographed (**D**) and drawn (**E**); **F–H:** median volsellae photographed (**F, G**) and drawn (**H**); **C–H** magnified  $\times 1,5$ – $2$  relative to **A** and **B**; superior volsella in the drawings (red) with anteroventral tubercle (yellow), and digitus (green).

**Geographical distribution and bionomics.** *Tanytarsus frameatus* is known only from the type locality in the highlands of the Amazonian Forest in Peru (Fig. 1A, B). The adult male specimens examined were obtained along with those of four other species described in the present paper. For further information on the ecology and bionomics refer to the notes on *Tanytarsus aries* (above).

### Remarks to other Neotropical *Tanytarsus* described recently

Adult males of the subfamily Chironominae and the tribe Tanytarsini in particular, are known to have the most complex genital apparatus among the non-biting midges. The hypopygium is armed with three or four pairs of appendages, the digitus and/or volsellae of greatly diverse shapes, often divided into lobes, bearing setae, microtrichia, lamellae, tubercles or processes of different sizes (Gílka 2011). Understanding their spatial configuration and defining homologies between such complex and minute structures (usually smaller or much smaller than 30 micrometres), can thus be difficult, and diagnoses based on incorrectly understood characters can mislead. Defining the species can be further hindered by intraspecific variations, often significant and crucial in their delimitation. The small *Tanytarsus* males with their sophisticatedly shaped volsellae are hence a particular challenge.

### *Tanytarsus kiche* species group

Members: *Tanytarsus kiche* Vinogradova, Riss *et* Spies, 2009, *Tanytarsus insolens* Dantas *et* Gílka, 2017, *Tanytarsus marianae* Reis, Lin *et* Ferreira-Keppler, 2022, *Tanytarsus rafaeli* Reis, Lin *et* Ferreira-Keppler, 2022.

### *Tanytarsus insolens* Dantas *et* Gílka, 2017

*Tanytarsus insolens* Dantas *et* Gílka, 2017: 287 (adult male; Brazil, Amazonas, Manaus).

*Tanytarsus pollicis* Reis, Lin *et* Ferreira-Keppler, 2022: 427 (adult male; Brazil, Amazonas, Manaus), **syn. nov.**

**Material examined.** Holotype, adult ♂: **BRAZIL. Amazonas:** Puraquequara near Manaus, 02°43'02"S, 59°54'04"W, 07.vii.2015, Malaise trap, leg. G.P.S. Dantas (INPA); paratypes: 4 ♂♂ (1 INPA, 3 LSZ DIZP), same data as for holotype except for date: 19.vi.2015. **New material examined. BRAZIL. Pará:** Belterra, igarapé na saída da FLONA, BR 163, Km 85, 16-23.x.2019, 03°03'02"S, 54°55'30"W, Malaise trap, legs. J.O. Silva, G.J. Melo, R.B. Pinhedo, S.E. Santos, L.A. Oliveira, 1 ♂ (INPA). **Distrito Federal:** Brasília, Reserva ecológica do IBGE, Roncador stream, 03.v.2018, 15°56'15"S, 47°53'08"W, 1064m a.s.l., Malaise trap, legs. G.R. Desidério, C.A. Campos, 1 ♂ (INPA). **Bahia:** Barreiras, Rio de Janeiro river, 02.vi.2013, 11°53'53", 45°36'39", 735m. a.s.l., Leg. N. Hamada, 1 ♂, INPA.

**Remarks.** Complex structures can mislead. An example of a misunderstood structure of the hypopygium is the recently described *Tanytarsus pollicis* Reis, Lin *et* Ferreira-Keppler, 2022, diagnosed on the basis of the superior volsella and the digitus (Reis *et al.* 2022). The name (derived from Latin *pollex* =thumb) was referred to a “posterior projection of superior volsella”, unfortunately confused with the digitus, while a digitus *sensu* Reis *et al.* (2022) was misidentified with the anteroventral projection of the superior volsella, particularly well-developed in the *kiche* group (cf. Dantas & Gílka 2017, fig. 3). A “digitus with setae at apex”, that in fact is the anteroventral projection (homologous with anteroventral setal tubercle/tubercles present in the majority of *Tanytarsus*), was incorrectly defined by Reis *et al.* (2022) as a unique feature in *Tanytarsus*. As a consequence, a new nomenclatural act was published (see the discussion therein). The material examined here, coming from several sites in Brazil, indicates that all the characters given in the original description of *T. pollicis* are identical or fall within the variability of *Tanytarsus insolens* Dantas *et* Gílka, 2017 (*loci typici* for the two names situated less than 25 km from each other). Consequently, both names are treated as synonyms.

*Tanytarsus insolens* was originally described on the basis of materials collected in the central Amazon (Dantas & Gílka 2017). Here, we supplement the knowledge on the geographic range of this species to other areas of the Amazon, and also to the Cerrado biome.

## *Tanytarsus marianae* Reis, Lin et Ferreira-Keppler, 2022

(Fig. 8A–F)

*Tanytarsus marianae* Reis, Lin et Ferreira-Keppler, 2022: 429 (adult male; Brazil, Amazonas, Manaus).

**Material examined: BRAZIL. Amazonas:** Manaus, Experimental Station ZF-2, Km 14, 02°35'21"S, 60°06'55"W, Malaise trap, 15-28.ii.2017, legs. J.A. Rafael & F.F. Xavier, 2 ♂♂ (INPA). **Tocantins:** Palmas, Ig. Brejo da Jéssica, 01-14.vi.2016, 48°14'58.00"W, 10°03'53.60"S, 448m a.s.l., Malaise trap, legs. S.R.M. Couceiro, G. Amora, 2 ♂♂ (INPA).

**Remarks.** Knowledge on intraspecific variations can prevent misidentification. Variability is an inherent feature of all species, and its scale may be a derivative of different geographical locations, development conditions, a generation in a season, etc. Variable colouration, body size and other metric characters, as well as shapes of the main diagnostic structures can mislead, especially when derived from incomplete, deformed during preparation, or weakly described specimens. Failure to distinguish the characters or, on the contrary, overinterpretation or abuse slight differences of the usual variability can lead to the same result—multiplication of names (see remarks to *T. pollicis*). Hundreds of synonyms, doubtful or invalid names are evidenced in Tanytarsini (Ashe & Cranston 1990, Ashe 1992, Spies & Szther 2004; see also Giūka & Gadawski 2022). Following this problem (see remarks to *T. pollicis*), we here present variations of the main diagnostic structures in the two recently described species: *Tanytarsus marianae* and *T. rafaeli*. Descriptions of these species were based on materials collected in the central Amazonia (Reis *et al.* 2022); now we supplement the knowledge on their geographic range eastward to the Brazilian Cerrado biome.

In the material examined, sampled at sites far apart from each other (~1500 km), we found adult males showing an interesting variety of shapes of the most important diagnostic structures, the superior volsella and the digitus, on the basis of which *T. marianae* was diagnosed. The superior volsella takes the shape from oval or ellipsoidal to almost rectangular, with a rounded posterolateral margin, while the digitus is always well-developed and extended far beyond the superior volsella, with more or less prominent distal part in the shape of an elongated dumpling/flap or lanceolate, with a blunt tip (Fig. 8C–F). These characters occur in various combinations and fit other diagnostic characters of *T. marianae* (cf. Reis *et al.* 2022), thus are defined as intraspecific variations. Slight differences we observed also in the shape of the anal point (Fig. 8A) with distal spinulae slightly separated from the others or fused into a bar-shaped process. This character, as well as the particularly well-developed, bottle-shaped anteromedian projection of superior volsella are typical of the *kiche* group to which we here include *T. marianae*.

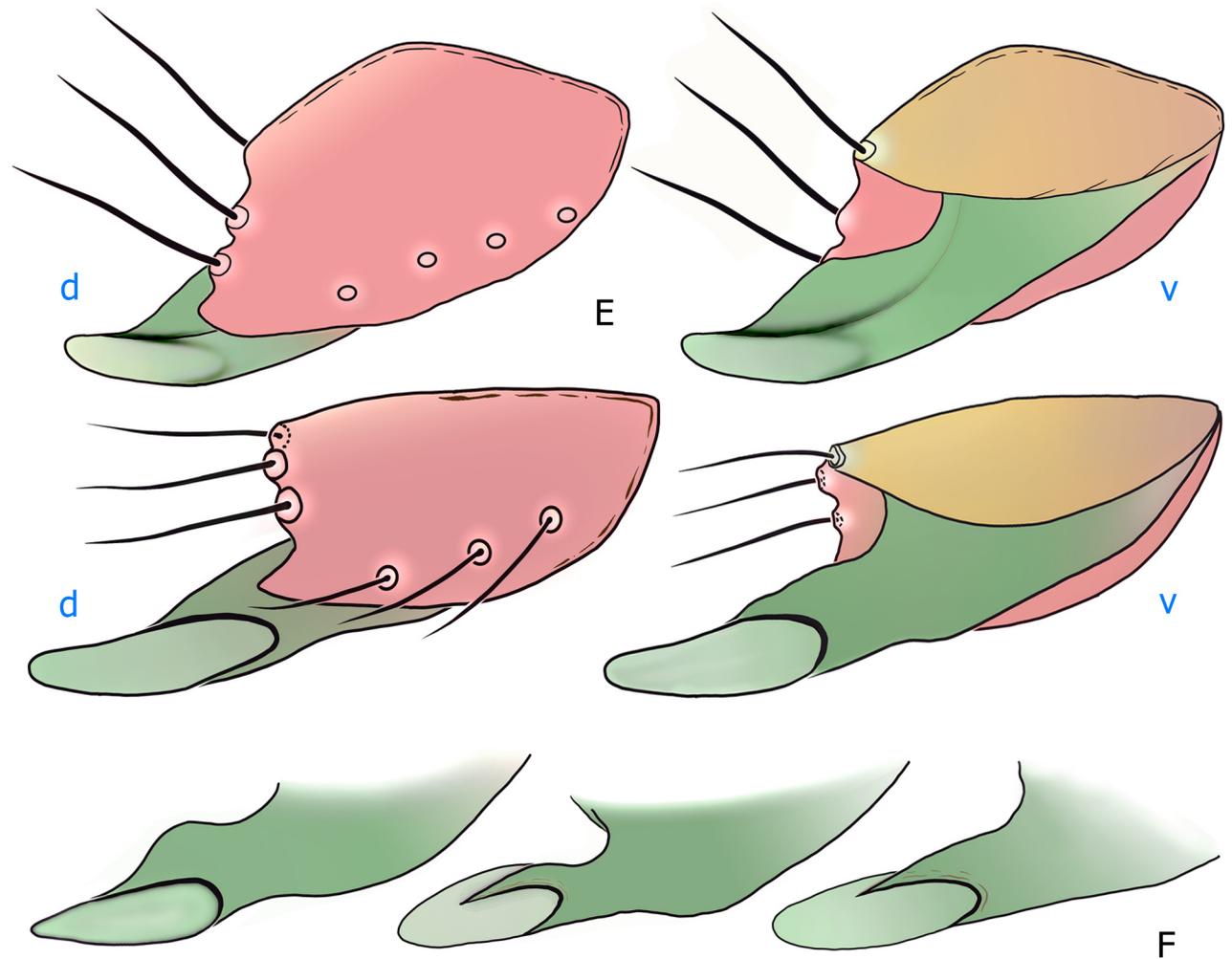
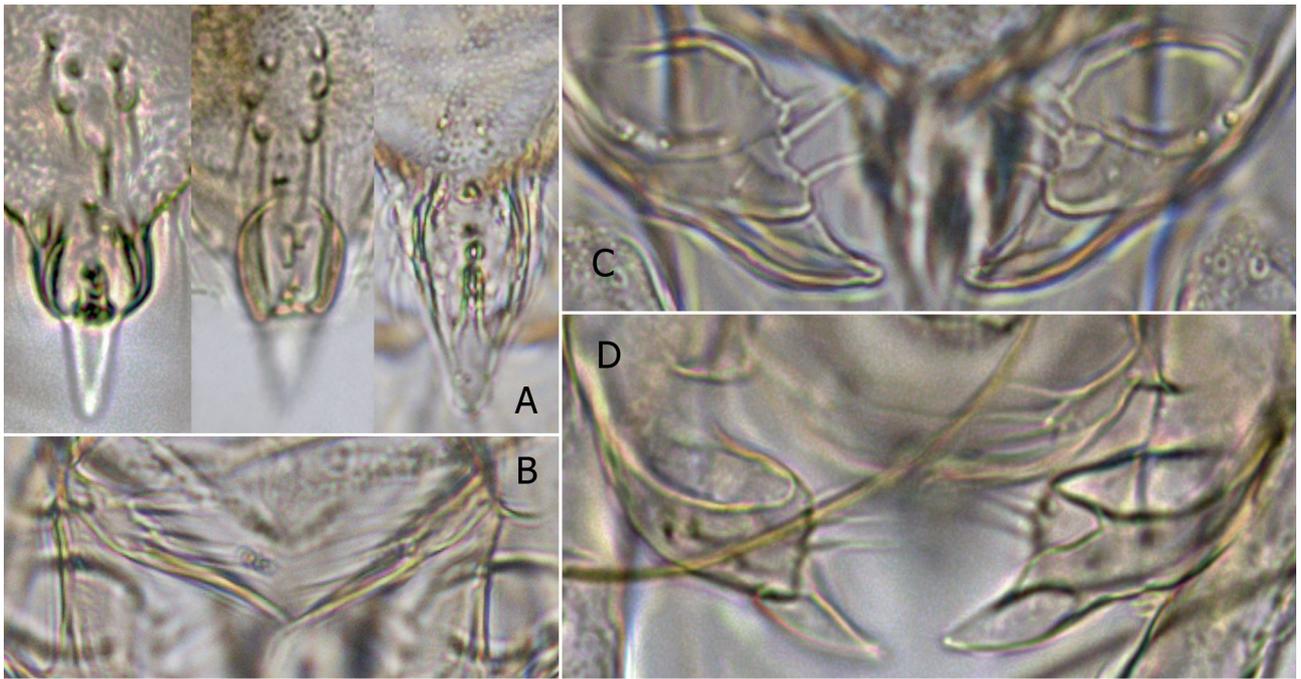
## *Tanytarsus rafaeli* Reis, Lin et Ferreira-Keppler, 2022

(Fig. 9A–C)

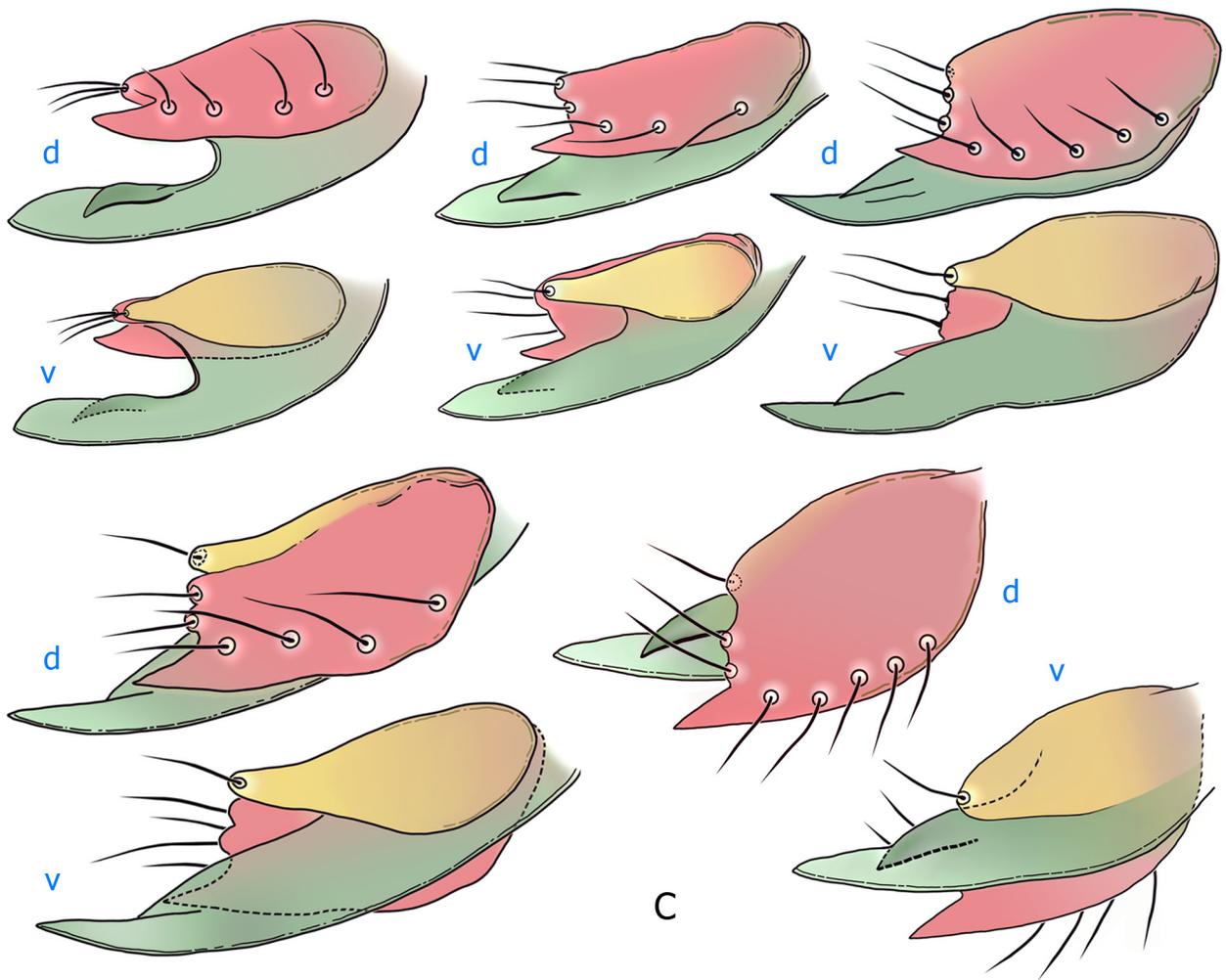
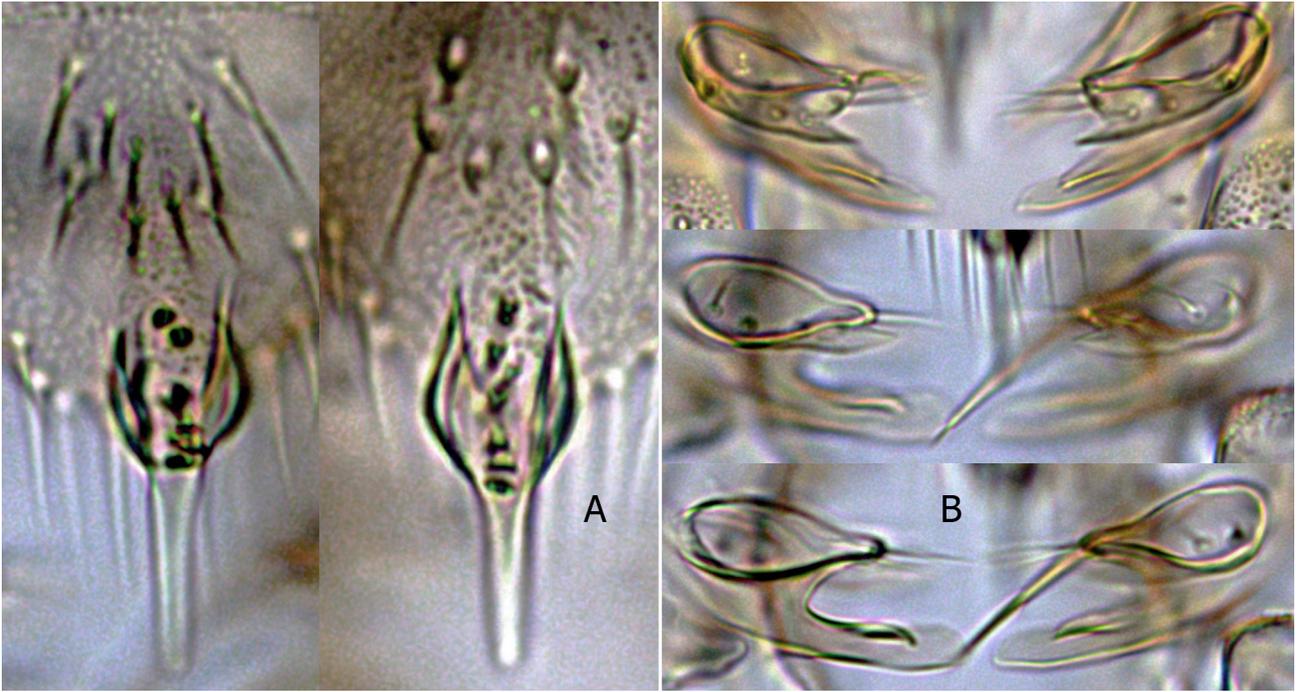
*Tanytarsus rafaeli* Reis, Lin et Ferreira-Keppler, 2022: 431 (adult male; Brazil, Amazonas, Manaus).

**Material examined: BRAZIL. Amazonas:** Manaus, Experimental Station ZF-2, Km 14, 02°35'21"S, 60°06'55"W, Malaise trap, 15-28.ii.2017, legs. J.A. Rafael & F.F. Xavier, 2 ♂♂ (INPA). **Tocantins:** Palmas, Igarapé da Onça, 02-14.vi.2016, 48°15'31.10"W, 10°06'44.50"S, 596m a.s.l., Malaise trap, legs. S.R.M Couceiro, G. Amora, 2 ♂♂ (INPA); Igarapé do Gilson, 02-14.vi.2016, 48°12'45.40"W, 10°10'24.80"S, 586m a.s.l., Malaise trap, legs. S.R.M Couceiro, G. Amora, 1 ♂ (INPA).

**Remarks.** In the illustrations (Fig. 9), we present several variations of the anal point, as well as the superior volsella and the digitus of *Tanytarsus rafaeli*, in the dorsal and ventral aspects, with individual parts marked with colours to avoid overinterpretation of these diagnostic characters in the future. For justification of including *T. rafaeli* to the *kiche* group see remarks to *T. marianae* (above), both species considered here as morphologically close.



**FIGURE 8.** *Tanytarsus marianae* Reis, Lin *et* Ferreira-Kepler, 2022, male, variations of diagnostic structures. **A:** anal point; **B:** median volsella; **C–E:** superior volsella and digitus photographed (**C**, **D**) and drawn (**E**); superior volsella in the drawings (red) with anteroventral projection (yellow) and digitus (green), in dorsal (**d**) and ventral aspect (**v**).



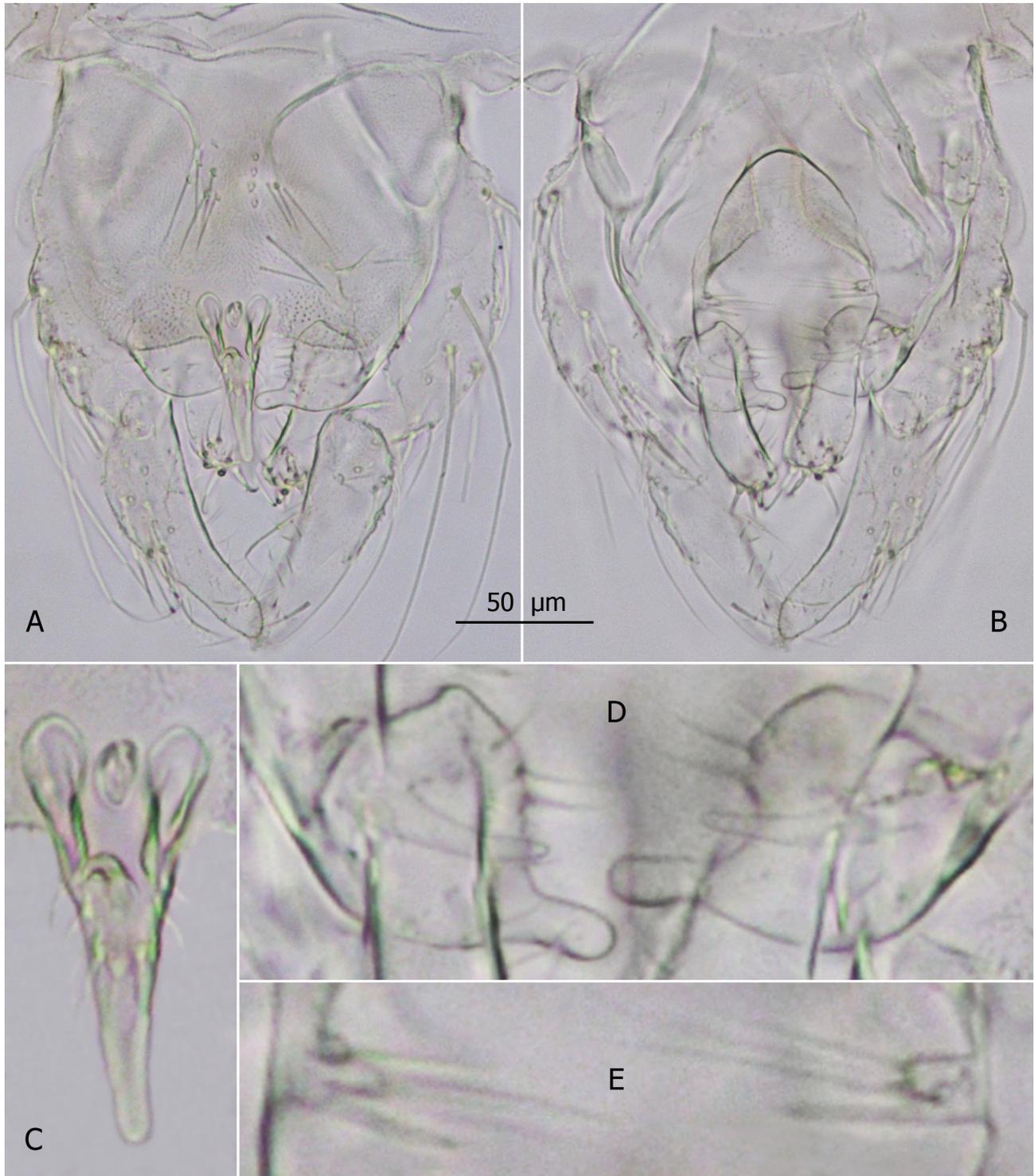
**FIGURE 9.** *Tanytarsus rafaели* Reis, Lin *et* Ferreira-Keppler, 2022, male, variations of diagnostic structures. **A:** anal point; **B,** **C:** superior volsella and digitus photographed (**B**) and drawn (**C**); superior volsella in the drawings (red) with anteroventral projection (yellow) and digitus (green), in dorsal (d) and ventral aspect (v).

*Tanytarsus curvicristatus* species group (supplementation)

*Tanytarsus giovannii* Sanseverino et Trivinho-Strixino, 2010

(Fig. 10A–E)

*Tanytarsus giovannii* Sanseverino et Trivinho-Strixino, 2010: 71 (adult male, pupa, larva; Brazil, São Paulo State, São Carlos); Trivinho-Strixino et al. (2015): 100 (Brazil, Mato Grosso do Sul, Corumbá); Lin et al. (2018): 6, 9, 10, 13, 16 (molecular systematics).



**FIGURE 10.** *Tanytarsus giovannii* Sanseverino et Trivinho-Strixino, 2010, male. **A, B:** hypopygium in dorsal (**A**) and ventral aspect (**B**); **C:** anal point; **D:** superior volsella and digitus; **E:** median volsella; C–E magnified  $\times 2$ – $3$  relative to A and B.

**Material examined: BRAZIL. São Paulo:** São Carlos, Ecological Park of São Carlos, 21°59'10"S, 47°52'51"W, manual collection in freshwater sponge, 01.iii.2006, leg. L.M. Fusari, 1 ♂ with pupal and larval exuviae (INPA).

**Remarks.** To the recently established *curvicristatus* group we here include one more species, *Tanytarsus giovannii*, the adult male of which fits well into the group diagnosis (Dantas *et al.* 2022). The hypopygial anal point crests are short and broad, rounded, flake-shaped, the anterior (smaller) bar is present, the posterior (larger) bar is branched and anteriorly directed and turned up, spinulae are absent, and the superior volsella has the well-developed posteromedian corner (cf. Fig. 10 and Sanseverino & Trivinho-Strixino 2010, fig. 11–14). The group diagnosis should be amended with one character—the length of the digitus that in *T. giovannii* is relatively long and extends beyond the concave median margin of the superior volsella (Fig. 10D). In the *curvicristatus* group, the anterior bar of the anal point can take a variety of interesting shapes, from a pine cone or grub to a form of a spine bunch.

Interestingly, *Tanytarsus giovannii*, along with two morphologically undefined *Tanytarsus*, has been postulated as a separate *giovannii* group based on molecular data, though *T. giovannii* has been reported as morphologically similar to *T. curvicristatus* and *T. pseudocurvicristatus*, and a cluster of *T. giovannii* + the two unnamed species has been presented as sister to *T. curvicristatus* (Lin *et al.* 2018). In light of the recent definition of the *curvicristatus* group (Dantas *et al.* 2022) and the supplementation presented here, we see no reason to sustain the *giovannii* group based on two morphologically undefined and unnamed species. In the aftermath, the *curvicristatus* group is consisted of five Neotropical species: *Tanytarsus curvicristatus* Contreras-Lichtenberg, 1988, *T. germani* Dantas, Amat, Hamada *et* Gilka, 2022, *T. giovannii* Sanseverino *et* Trivinho-Strixino, 2010, *T. gnomon* Dantas, Amat, Hamada *et* Gilka, 2022, and *T. pseudocurvicristatus* Trivinho-Strixino, Wiedenbrug *et* da Silva, 2015.

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