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The Trichoptera of Panama V. Descriptions of new species,
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The Trichoptera of Panama V. Descriptions of new species, new country records, and a synonymy

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Abstract. The Río Chiriqui basin is one of 52 major watershed areas, or cuencas, in the Republic of Panama. It occurs in western Panama, discharges into the Pacific Ocean, and includes portions of Volcán Barú on its northern extent. The Río Caldera occupies the northernmost subbasin of this basin. Two of its tributaries, Quebrada Grande and Quebrada Jaramillo, occur in close proximity and on opposite sides, and have different recent geologic histories and current land use patterns. During the course of investigating the caddisfly fauna of these two drainages, three new species of the microcaddisfly genus *Neotrichia* Morton (Trichoptera: Hydroptilidae) were identified: *N. collierorum* and *N. anzuelo* from Quebrada Jaramillo and *N. tatianae* from Quebrada Grande. These are described and figured herein. We also add one new genus (*Rhyacopsyche* Mueller) and five new country records (*Hydroptila paschia* Mosely, *Metrichia ancora* Bueno-Soria and Holzenthal, *Ochrotrichia jolandae* Bueno-Soria and Holzenthal, *Rhyacopsyche obliqua* Flint, and *Chimarra (Curgia) maritza* Flint) for Panama. Finally, we designate *Ochrotrichia abrelata* Harris and Armitage, 2015 as a junior synonym of *Ochrotrichia jolandae* Bueno-Soria and Holzenthal, 2008. This synonymy and the newly recorded species and country records increase Panama's known trichopteran fauna to 350 species, distributed among 15 families and 52 genera.

Key words. Hydroptilidae, *Neotrichia*, cuenca, watersheds, drainages.

Introduction

The Río Chiriqui basin, one of 52 major basins (cuencas) in Panama, has a Pacific Ocean drainage and is located in western Panama. The Río Caldera, the northernmost subbasin in this cuenca, forms the eastern extent of historic volcanic eruption products (lahars, lava flows, debris-avalanche deposits) of Volcán Barú (Sherrod et al. 2008). Tributaries of the Río Caldera to the west of the main channel tend to have linear watersheds consistent with their origins from the steep slopes of the volcano, whereas tributaries to the east have a more typical dendritic pattern. The Río Caldera's drainage area is 14,325 ha (143.3 km²), representing 7.5% of the total Río Chiriqui basin. The subbasin has an altitude ranging from 675 up to 3302 m (Anonymous 1995).

As part of a larger effort to characterize the caddisfly fauna of Panama and to determine their distribution patterns, two drainages (Fig. 1–4) were studied over a two-year period, both of which are in close proximity to Boquete, north of David, Panama. One, Quebrada Grande (Big Creek), is located west of the mainstem of the Río Caldera. The second, Quebrada Jaramillo (Jaramillo Creek), is located east of the mainstem, and slightly south of the first. Previously, 12 new country records were identified (Armitage et al. 2016) from Quebrada Jaramillo and eight new species to science and eight new country records from the Quebrada Grande (Armitage et al. 2015b; Harris and Armitage 2015). The purpose of this paper is to describe three new species of microcaddisflies which were found in these two drainages, document a new genus and five new country records for Panama, and synonymize a species previously described from Quebrada Grande.

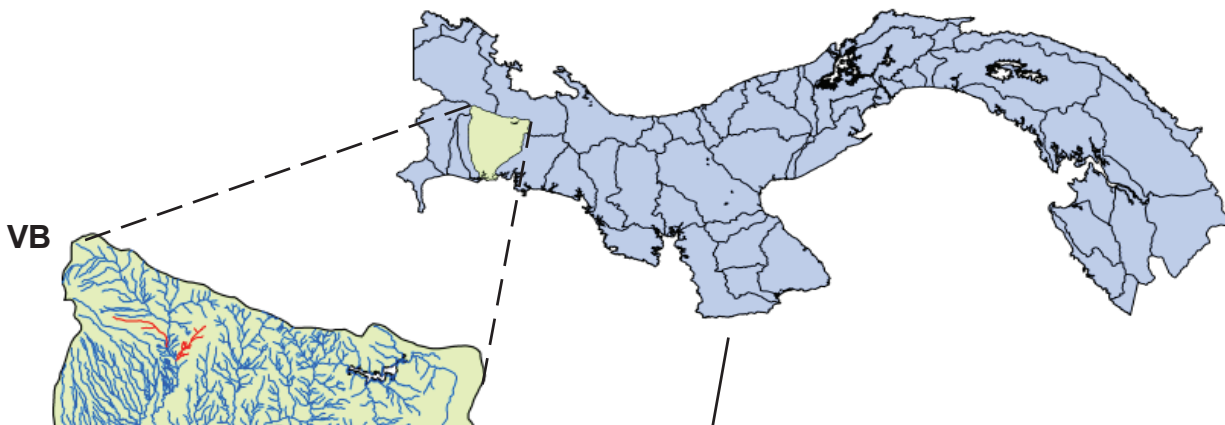


Figure 1. Map of Panama with major watersheds (cuencas) outlined. The Río Chiriqui watershed (Cuenca 108) is shaded in light green.

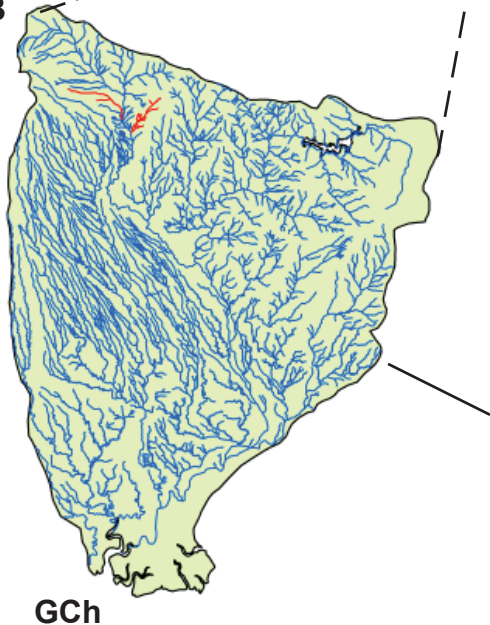


Figure 2. Map of the Río Chiriqui watershed (Cuenca 108) with associated hydrology overlay. The two study drainages are colored in red. Note the narrow watershed patterns descending from Volcán Barú (VB), contrasted with the dendritic patterns in other portions of the watershed. All water falling in this watershed eventually drains into the Gulf of Chiriqui (GCh), an embayment of the eastern Pacific Ocean.

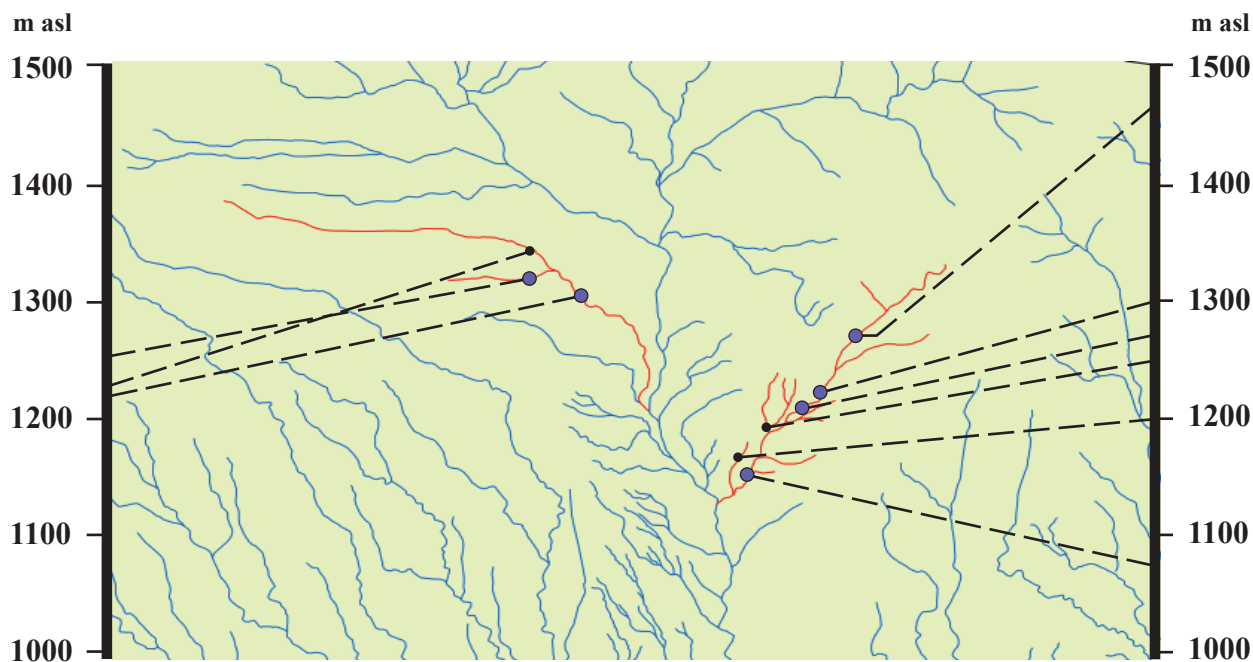


Figure 3. Enlarged map showing the two study drainages (Quebrada Grande-left and Quebrada Jaramillo-right), colored in red. Sample stations are indicated by black and blue dots, and their respective altitudes are indicated by the dashed lines and the lateral altitudinal axes (in m asl). Blue dots signify where new species or new country records were taken (see Type Material or Material Examined subsections that follow).



Figure 4. Habitat photographs of Quebrada Grande. **A)** Mainstream, adjacent to Hole No. 2. **B)** Tributary waterfall area) and Quebrada Jaramillo. **C)** Upstream view from Alto Jaramillo Road bridge. **D)** Downstream location above Centro Jaramillo Road bridge). Photos by Tatiana Arefina-Armitage.

Materials and Methods

Single-night collections were made using UV light and alcohol traps (Calor and Mariano 2012) in Quebradas Grande and Jaramillo. Adults, primarily males, were sorted to family and genus, and then identified to species under a Wild M-5 dissecting scope. For many individuals, the abdomens were cleared by soaking in a 4% KOH solution for a 12-hour period, so that reproductive structures could be better observed. Holotypes of new species will be deposited in the Colección Zoológica Dr. Eustorgio Méndez (COZEM) of the Instituto Conmemorativo Gorgas de Estudio de la Salud (Gorgas Institute). COZEM was recently approved by the Ministerio Ambiente as an official repository for biological specimens in Panama. Paratypes will either be deposited with COZEM or placed in the first author's reference collection (**BJA**) to assist with future identifications.

Results

During the course of this study, we identified three species that were new to science (*Neotrichia anzuelo* and *N. collierorum* from Quebrada Jaramillo; and, *N. tatianae* from Quebrada Grande). We also identified one new genus for Panama (*Rhyacopsyche*) and five new country records, including four from Quebrada Grande and one from Quebrada Jaramillo. These are described or recorded herein. We also uncovered a misidentification stemming from previous work in the Quebrada Grande drainage, to wit the recently described *Ochrotrichia abrealata* Harris and Armitage, 2015 was found to be identical with *Ochrotrichia jolandae* Bueno-Soria and Holzenthal, 2008. Therefore, we designate *O. abrealata* as a junior synonym of *O. jolandae*.

A. New species:

Neotrichia anzuelo Armitage and Harris, new species

Fig. 5

Description. Holotype male. Length 1.6–1.8 mm, 18 antennal segments, brown in alcohol. Abdominal segment VIII annular. Segment IX incomplete dorsolaterally and fused with segment X, bearing dorsal setal-bearing lobe, medially rounded posteriorly, anteriorly with ventromedial lobe; dorsally narrowing posteriorly, setal-bearing lobes laterally; in ventral view deeply incised on posterior margin, concave anterior margin. Tergite X narrow, with pair of short, symmetrical, horns distally, basally fused with segment IX with pair of setal-bearing lobes laterally; in lateral view apical horn short, tapering distally. Subgenital plate in lateral view narrow with 3-pronged apex, lowermost process elongate and projecting downward, upper process about half-length of lower, bearing elongate seta basally; in ventral view tapering distally with three short apical lobes, pair of subapical lateral wings bearing elongate setae. Bracteoles bifid, dorsal branch twice as long as ventral branch, each bearing short setae apically. Inferior appendages thin and tapering distally, extending beyond tergite X; in ventral view elongate and thin, sharply tapering subbasally, sinuate on lateral margins, mesally with narrow, tapering processes bearing stout apical seta. Phallus tubular in lateral view, constricted at mid-length and bearing thin paramere encircling shaft, apex narrowing to thin, upturned hook, ejaculatory duct ending subapically.

Female. Unknown.

Type material. Holotype, male—PANAMA, Chiriquí Province, Cuenca 108, Quebrada Jaramillo, Jaramillo Centro Road bridge, 8.75454°N, 82.41848°W, 1075 m, 14 December 2015, B. and T. Armitage (COZEM). **Paratypes**—ibid., Río Caldera, Boquete, Wilson Bridge, road to Lucero, 8.74228°N, 82.42160°W, 18 November 2015, B. and T. Armitage, 1 male (COZEM); Río Chirigagua, C108, SSE Guayabal, 8.64102°N, 82.55780°W, 737 m, Coll. COZEM, 19 June 2015, 27 males (COZEM); Río Brazo Prieto, C108, E. Guayabal, 797 m, 8.65683°N, 82.56153°W, Coll. COZEM, 19 June 2015, 2 males (BJA); Primer Brazo del Río David, C108-Ruta 103, Potrerillos Arriba, 8.64414°N, 82.49408°W, 696 m, Coll. COZEM, 21 May 2015, 1 male (BJA).

Etymology. Spanish (masculine gender only), “fish hook”, referring to the hook-like phallus apex.

Remarks. *Neotrichia anzuelo* is a member of the canixa Group of Keth et al. (2015) based on the apical horns of the tenth tergite and the bifid bracteoles, both characteristic of the group. The new species is most similar to *N. tauricornis* Malicky, which occurs on several Caribbean islands, Colombia, and Panama, in the short, symmetrical “horns” of the tenth tergite, and the 3-pronged apex of the subgenital plate. It differs from *N. tauricornis* in the structure of the bracteoles, with the dorsal branch longer than the ventral, the elongate inferior appendages, and the configuration of the phallus apex.

Neotrichia collierorum Armitage and Harris, new species

Fig. 6

Description: Holotype male. Length 2.1–2.3 mm, 18 antennal segments, brown in alcohol. Abdominal segment VIII annular. Segment IX incomplete dorsolaterally, widening posteromesally, rounded

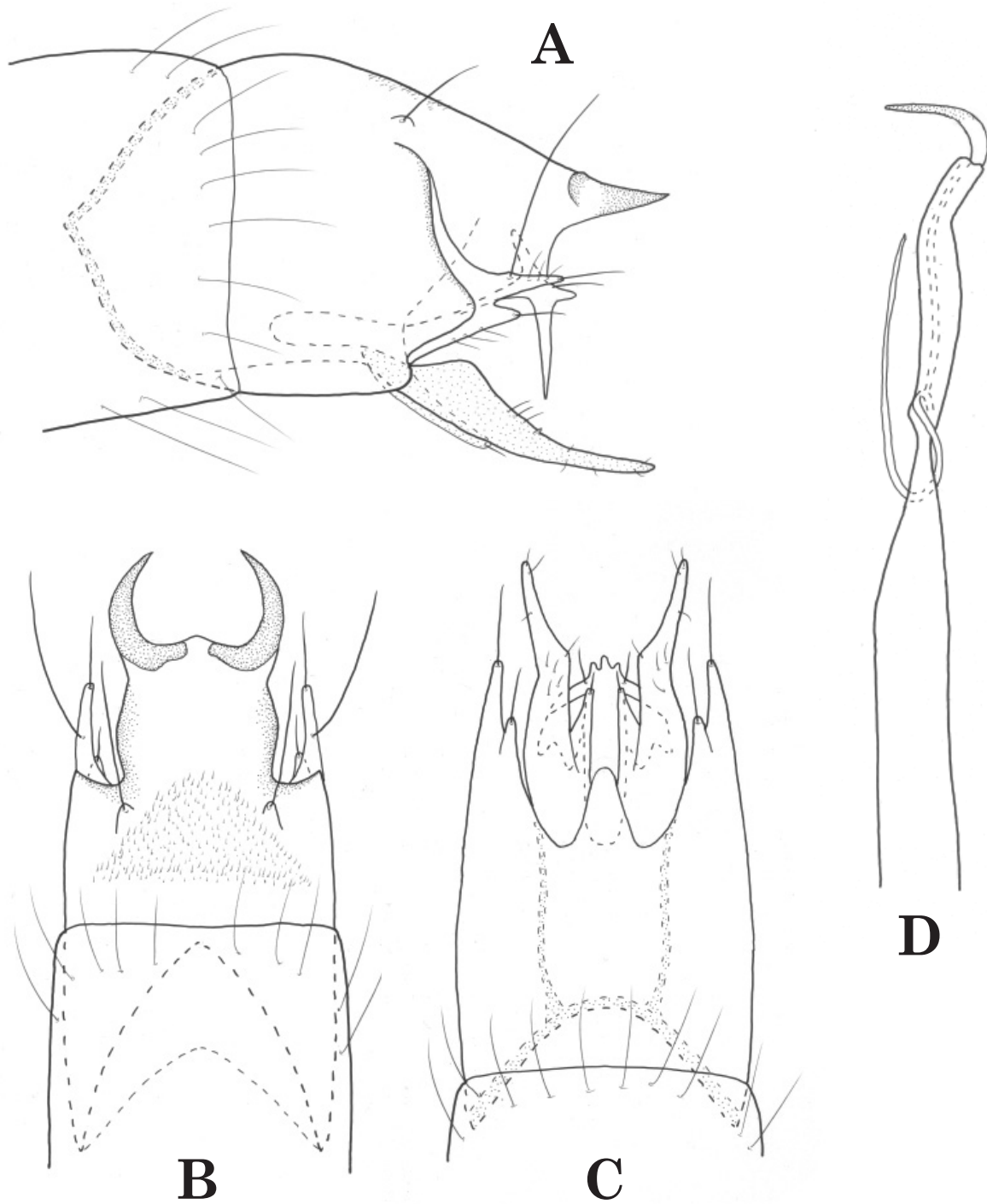


Figure 5. *Neotrichia anzuelo*, n. sp., male genitalia. **A)** Lateral view. **B)** Dorsal view. **C)** Ventral view. **D)** Phallus, lateral view.

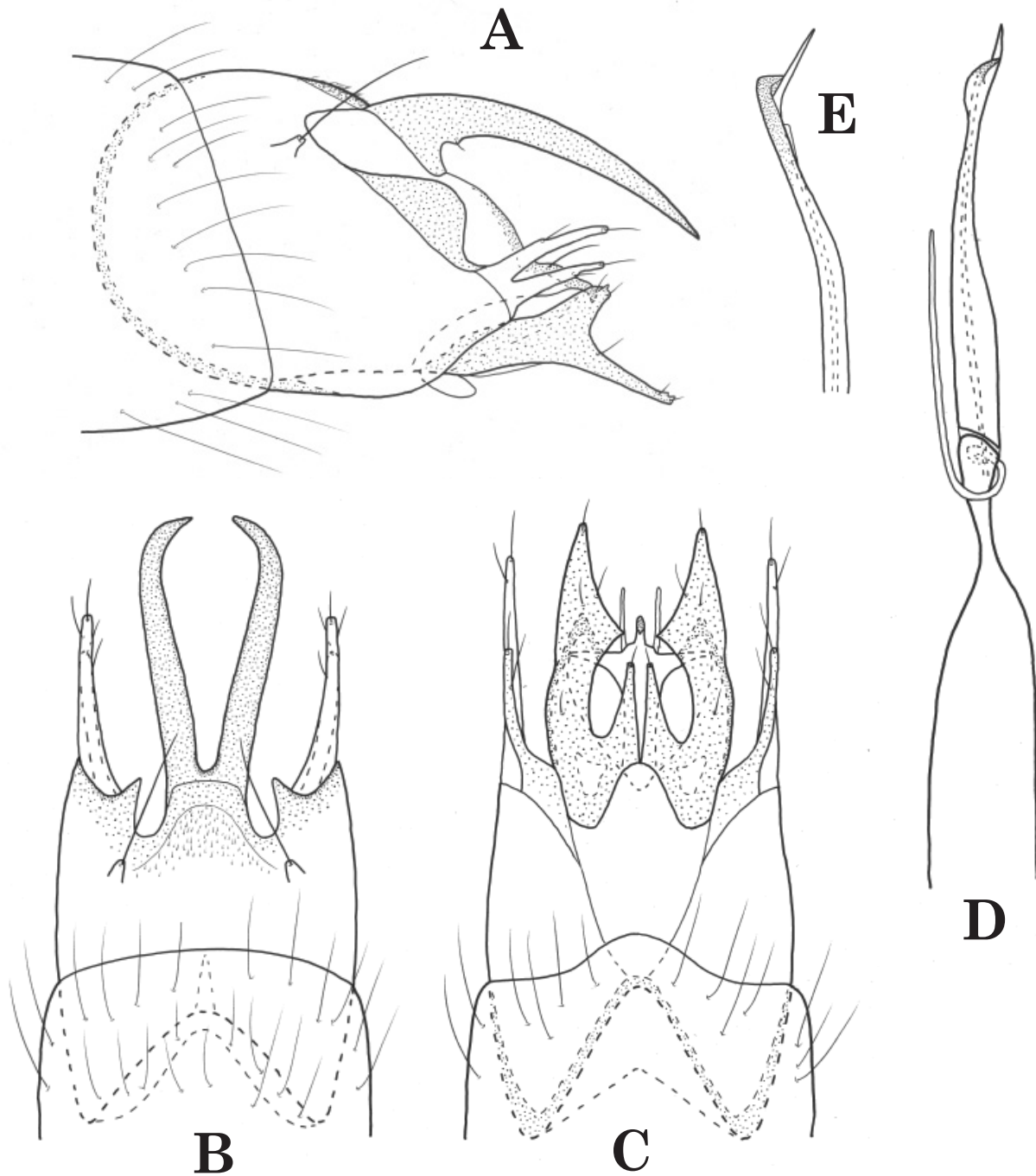


Figure 6. *Neotrichia collierorum*, n. sp., male genitalia. **A)** Lateral view. **B)** Dorsal view. **C)** Ventral view. **D)** Phallus, lateral view. **E)** Phallus apex, dorsal view.

anteriorly; dorsally fused with tergite X and deeply incised laterally, bearing subapical setal-bearing lobes, medially rounded posteriorly, concave anteriorly; in ventral view shallowly incised on posterior margin, thin suture lines laterally, converging medially, deeply incised anteriorly. Tergite X narrow, with pair of elongate, symmetrical, horns distally, basally fused with segment IX; in lateral view apical horn elongate, gradually tapering to acute apex, small ventral seta near base. Subgenital plate in lateral view wide basally, narrowing distally to downturned sclerotized apex bearing elongate subapical seta; in ventral view narrow basally, apex thin with small downturned point, pair of thick setae on either side, subapically with wing-like, tapering lateral processes. Bracteoles bifid, dorsal branch slightly longer than ventral branch, bearing short setae apically. Inferior appendages widening medially with short tooth, sharply narrowing apically with small teeth ventrally at apex; in ventral view elongate and thin, curving inward subapically to form point, apically narrowing and bearing stout seta, narrow sclerotized ridge on ventral surface, mesal processes short, wide basally, narrowing distally and bearing elongate apical seta. Phallus tubular in lateral view, constricted at mid-length and bearing thin paramere encircling shaft, posterior portion narrowing apically with small hook subapically; apex in dorsal view with elongate unsclerotized spike, ejaculatory duct protruding distally.

Female. Unknown.

Type material. Holotype, male—PANAMA, Chiriquí Province, Cuenca 108, Quebrada Jaramillo, Alto Jaramillo Road, 8.76671°N, 82.41341°W, 1253 m, 10 February 2015, B. and T. Armitage (COZEM). **Paratypes**—*ibid.*, upper bridge, 8.77427°N, 82.40699°W, 1470 m, 2 March 2015, B. and T. Armitage, 1 male (COZEM); tributary to Quebrada Jaramillo, Alto Jaramillo Road, 8.76671°N, 82.41519°W, 1300 m, 11 November 2015, B. and T. Armitage, 1 male (BJA).

Etymology. Named for Kelly and Laurie Collier of Finca Monterey, Jaramillo Mountain, Boquete, Chiriquí Province, Panama, for their enthusiasm for and assistance with our collections.

Remarks. *Neotrichia collierorum* is a member of the canixa Group of Keth et al. (2015) based on the apical horns of the tenth tergite and the bifid bracteoles, both characteristic of the group. The new species has some similarity to *N. maria* Bueno-Soria and Hamilton from Oaxaca, Mexico in the structure of the phallus and subgenital plate, but differs from this species and other *Neotrichia* in the elongate “horns” of the tenth tergite and the structure of the inferior appendages.

Neotrichia tatianae Armitage and Harris, new species

Fig. 7

Description: Holotype male. Length 1.7–1.9 mm, 18 antennal segments, brown in alcohol. Abdominal segment VIII tapering dorsally in lateral view, setose lobe from posterolateral margin. Segment IX retracted within segment VIII, rounded anteriorly, posterodorsally with elongate tapering process, turning ventrad subapically; left process much longer than right; in dorsal view, elongate lateral processes asymmetrical, left process longer and more sinuate than right, anterior margin shallowly incised. Segment X in lateral view shelf-like and tapering to acute distal apex; dorsally deeply incised laterally, posteriorly with mesal incision. Subgenital plate in lateral view wide basally, tapering to bifid apex, dorsal process bearing stout seta, ventral process with acute, downturned apex; in ventral view tapering distally to bifid apex bearing pair of stout setae, ventral process rounded with margins sclerotized. Bracteoles reduced to a short setal-bearing lobe. Inferior appendages wide basally and apically, distally with multiple incisions and setose; in ventral view curving slightly mesad, distally bifid, inner process acute apically, outer process with numerous apical setal-bearing knobs, thin setal-bearing process from mesal margin. Phallus in ventral view divided into apical and basally sections with thin paramere encircling shaft at midlength tubular, apical portion tapering distally, with apex bending laterally, ejaculatory duct protruding subapically.

Female. Unknown.

Type material. Holotype, male—PANAMA, Chiriquí Province, Cuenca 108, tributary of Quebrada Grande at the waterfall, Valle Escondido, Boquete, 8.78291°N, 82.44579°W, 1253 m, 26 September

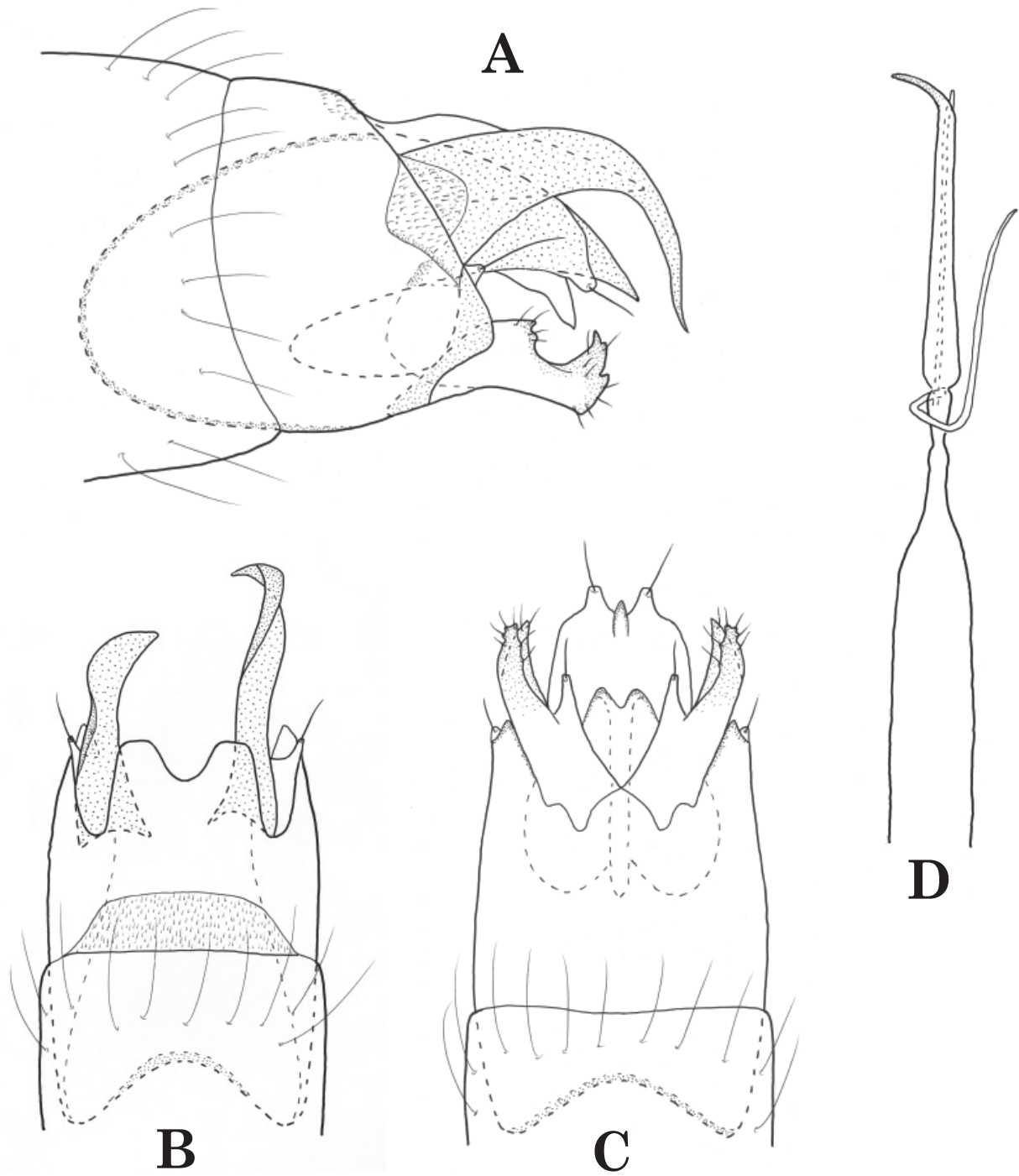


Figure 7. *Neotrichia tatiana*, n. sp., male genitalia. **A)** Lateral view. **B)** Dorsal view. **C)** Ventral view. **D)** Phallus, lateral view.

2015, B. and T. Armitage (**COZEM**). **Paratypes**—**PANAMA, Boca del Toro Province, Cuenca 93**, unnamed creek, Rambala Jungle Lodge, 3.7 km SSE Rambala, 8.91627°N, 82.15649°W, 9 August 2015, E. Carlson, 2 males (**BJA**).

Etymology. We take great pleasure in naming this species for Tatiana Arefina-Armitage who collected many of the specimens in Panama and who has contributed much to our knowledge of caddisflies around the world.

Remarks. *Neotrichia tatianae* belongs to a large cluster of neotropical species with a characteristic elongate process from segment IX, including *N. cayada* Harris and Davenport, *N. colmillosa* Harris, *N. hajla* Olah and Johanson, and *N. gilmari* Santos and Nessimian. The new species is readily identified by the structure of the inferior appendages, the asymmetrical nature of the processes from segment IX, and the very short lateral bracteoles.

B. New country records:

***Hydroptila paschia* Mosely, 1937**

Material Examined—**PANAMA, Chiriqui Province, Cuenca 108**, Quebrada Grande, Valle Escondido below Sabor Restaurant, 8.7797°N, 82.44016°W, 1122 m asl, 25 March 2015, B. and T. Armitage, 3 males.

Distribution: Costa Rica, Mexico, Nicaragua, Panama.

***Metrichia ancora* Bueno-Soria and Holzenthal, 2003**

Material Examined—**PANAMA, Chiriqui Province, Cuenca 108**, Quebrada Grande, Valle Escondido below Sabor Restaurant, 8.7797°N, 82.44016°W, 1122 m asl, 25 March 2015, B. and T. Armitage, 3 males.

Distribution: Costa Rica, Panama.

***Ochrotrichia jolandae* Bueno-Soria and Holzenthal, 2008**

Material Examined—**PANAMA, Chiriqui Province, Cuenca 108**, tributary of Quebrada Grande, Valle Escondido, at waterfall, 8.78291°N, 82.44579°W, 1253 m asl, 17 September 2015, B. and T. Armitage, 2 males.

Distribution: Costa Rica, Panama.

***Rhyacopsyche obliqua* Flint, 1971**

Material Examined—**PANAMA, Chiriqui Province, Cuenca 108**, Quebrada Grande, Valle Escondido below Sabor Restaurant, 8.7797°N, 82.44016°W, 1122 m asl, 17 September 2015, B. and T. Armitage, 2 males.

Distribution: Mexico, Panama.

***Chimarra (Curgia) maritza* Flint, 1998**

Material Examined—**PANAMA, Chiriqui Province, Cuenca 108**, Quebrada Jaramillo, Jaramillo Centro Road bridge, 8.754536°N, 82.418475°W, 1075 m asl, 14 December 2015, B. and T. Armitage, 1 male.

Distribution: Costa Rica, Panama.

C. New synonymy:

In Harris and Armitage (2015), we described the new species *Ochrotrichia abrelata* from Quebrada Grande. Subsequently, we discovered that this species is identical to *Ochrotrichia jolandae* Bueno-Soria and Holzenthal, 2008 described from Alajuela Province, Costa Rica. Therefore, we take this opportunity to correct this error by designating *O. abrelata* as a junior synonym of *O. jolandae*.

Discussion

The three new species, one new genus record for Panama, five new species records, and one synonymy, change our base of knowledge about Panamanian caddisflies established initially by Aguila (1992) and expanded, most recently, by Armitage et al. (2015a, 2016). There are now 350 species of caddisflies recorded from this country, distributed among 15 families and 52 genera. These totals for species and genera corrects an oversight in Armitage et al. (2015a, 2016) in not counting the genus *Plectropsyche* and the species *P. wallacei* as recorded from Panama (Bueno-Soria and Alvarez 2015), as well as including the genus *Rhyacopsyche*, new to Panama from this study.

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