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The Trichoptera of Panama. XVIII. Twelve first country records of macrocaddisflies (Insecta, Trichoptera) from the Republic of Panama

BRIAN J. ARMITAGE[1,2*], YUSSEFF AGUIRRE[1,3], TOMÁS A. RÍOS GONZÁLEZ[1,4] & ROGER J. BLAHNIK[5,6]
[1]*Museo de Peces de Agua Dulce e Invertebrados, Universidad Autónoma de Chiriquí, David, (Chiriqui Province), Republic of Panamá*
[2] *brian.armitage@unachi.ac.pa; https://orcid.org/0000-0003-3182-1533*
[3] *yusseff1422@gmail.com; https://orcid.org/0000-0001-5222-7563*
[4] *tomas.rios@unachi.ac.pa; https://orcid.org/0000-0003-0590-6488*
[5]*Department of Entomology, University of Minnesota, St. Paul, Minnesota, U.S.A.*
[6] *blahn003@umn.edu; https://orcid.org/0000-0002-0648-454X*
[*]*Corresponding author.* *brian.armitage@unachi.ac.pa*

Abstract

Herein we add twelve first country records to Panama's macrocaddisfly fauna (Insecta: Trichoptera): Calamoceratidae—*Banyallarga acutiterga* (Denning & Hogue 1983); Glossosomatidae—*Protoptila bicornuta* Flint 1963 and *Protoptila jolandae* Holzenthal & Blahnik 2006; Helicopsychidae—*Helicopsyche rentzi* Denning & Blickle 1979; Hydropsychidae—*Calosopsyche sandrae* (Flint 1967) and *Smicridea acuminata* Flint 1974; Leptoceridae—*Oecetis hastapulla* Quinteiro & Holzenthal 2017; Philopotamidae—*Chimarra angustipennis* Banks 1903; Polycentropodidae—*Polyplectropus exilis* Chamorro-Lacayo & Holzenthal 2004; and Xiphocentronidae—*Caenocentron immaculatum* Flint 1991, *Caenocentron lausus* Schmid 1982, and *Xiphocentron alcmeon* Schmid 1982.

Key words: caddisflies, first country records, geographic distribution

Introduction

Beginning in 2014, field sampling for adult caddisflies commenced to increase our knowledge about the presence and distribution of Panama's species. Since then, we have added two families, 11 genera, and 215 species to Panama's fauna, nearly doubling what had been known before (Thomson & Armitage 2021; Armitage *et al*. 2022). Whereas many of the species added were new to science, the majority were first country records. In this paper, we record twelve additional species as first records to Panama, derived from a number of projects undertaken throughout the country. Nine species were collected as part of a project accomplished by the Museo de Peces de Agua Dulce e Invertebrados (MUPADI) of the Universidad Autónoma de Chiriquí (UNACHI). The remaining three species were collected in Bosque Protector Palo Seco (= Palo Seco Protected Forest) or Santa Fe National Park as part of a multi-year survey of Panama's National Parks under the management of the Ministerio de Ambiente. Designated "Proyecto Sistema de Producción Sostenible Conservación de la Biodiversidad (PSPSCB; http://produccionsostenibleybiodiversidad.org/proyecto/)," this survey was funded by the World Bank. The Ministerio de Ambiente contracted with the Instituto Conmemorativo Gorgas de Estudios de la Salud (Gorgas Institute), and their Colección Zoológica Dr. Eustorgio Méndez (COZEM) to execute the work.

Methods

Single, overnight collections were made, in general, using UV light traps (Calor & Mariano 2012). Multiple-night collections were made employing Malaise traps over four or more days. Specimens were prepared and examined following standard methods outlined by Blahnik & Holzenthal (2004). Caddisfly specimens or their abdomens were soaked in 5% KOH overnight, and washed in weakly acidified alcohol prior to examination under a dissecting scope. All specimens are stored in 75–80% ethanol.

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Collection locations and associated taxa are indicated in Figure 1. Specimens listed in this publication are deposited in MUPADI or COZEM. Codes in the Materials Examined paragraphs following these depository acronyms represent identification designations by coauthors. For example, "MUPADI-YA-2020-056": "MUPADI" is the depository, and "YA-2020-056" is the identifier's designation code for a species from a specific location and date. The order of families, genera, and species given below is alphabetic.

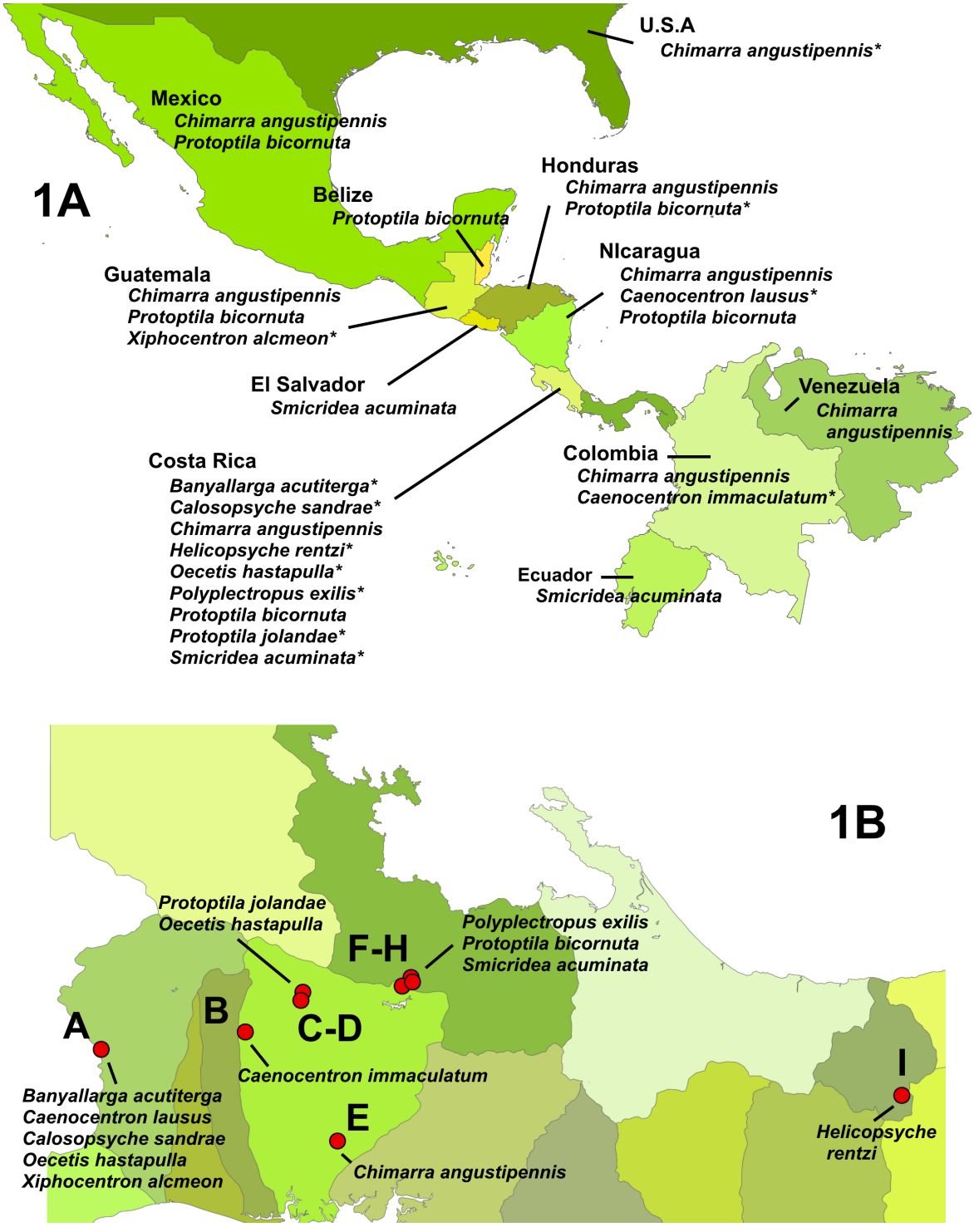

FIGURE 1. Maps. **1A**, regional map showing distribution of newly recorded Panamanian taxa in other countries [* = type country]. **1B**, map of western Panama's major cuencas (watersheds) showing site locations and associated new country record taxa. Both maps were created using ARCGIS 10.1 (ESRI corporation) software. [Location codes: A, Quebrada sin nombre–Landis Reserve. B, Río Majagua. C, Quebrada Jaramillo Abajo. D, Quebrada Jaramillo. E, Río Papayal. F, Quebrada Arenal. G, Quebrada Cabello de Angel. H, Quebrada Martinez. I, Río Piedra de Moler.]

Results

Map locations for first country records are presented in Fig. 1. The following text provides information about each family and genus from a Neotropical perspective, followed by collection, distribution, and identification information for each species first recorded for Panama.

Taxonomy

Family Calamoceratidae Ulmer 1905a

This family is represented in the Neotropics by two genera, *Banyallarga* and *Phylloicus,* and 75 total species (Holzenthal & Calor 2017).

Genus *Banyallarga* Navás 1916

Endemic to the Neotropics, this genus is represented by 17 species distributed from Nicaragua south to Argentina (Prather 2004; Holzenthal & Calor 2017). Previously, a single species, *Banyallarga fortuna* (Resh 1983) (in Denning *et al*. 1983), was described from Panama. We here add a second species.

Banyallarga acutiterga (Denning & Hogue 1983) (in Denning *et al*. 1983)

New Record (1 locality). PANAMA—Chiriqui Province: Cuenca 102; Renacimiento District; Landis Private Reserve; Quebrada sin nombre; 8.643769°N and 82.829749°W; 755 m a.s.l.; 15–31 March 2020; M. Landis, leg.; Malaise trap; 1 male, MUPADI-YA-2020-048. Ibid., 14–20 May 2020; 1 male; MUPADI-YA-2020-056. Ibid., 12–17 August 2020; 1 male; MUPADI-YA-2020-063.

Distribution. Costa Rica (type country), Panama.

Identification. This species was identified from descriptions and illustrations found in the revision by Prather (2004). It is similar to *B. quincemil* and *B. sylvana*, but differs in having a long, acute apicoventral projection of tergum X.

Family Glossosomatidae Wallengren 1891

This family is represented in the Neotropics by 11 genera and over 270 species (Holzenthal & Calor 2017; Blahnik & Armitage 2019). In Panama, three genera are known (*Culoptila*; *Mortoniella*, and *Protoptila*), and 31 total species.

Genus *Protoptila* Banks 1904

Known from Mexico, Central and South America, and the Lesser Antilles, 90 species have been identified in the Neotropics (Holzenthal & Calor 2017; Blahnik & Armitage 2019). Additional taxa are found in North America. Panama is home to 13 species (Armitage *et al*. 2015; Blahnik & Armitage 2019). Herein we add two more species from western Panama.

Protoptila bicornuta Flint 1963

New Records (1 locality). PANAMA—Comarca Ngäbe Buglé: Cuenca 093; Bosque Protector Palo Seco; Quebrada Martinez; 8.79424°N and 82.19047°W; 490 m a.s.l.; 29 October 2019; T. Ríos, Y. Aguirre, leg.; Malaise trap; 1 male, MUPADI-TRG-2019-154.

Distribution. Belize, Costa Rica, Guatemala, Honduras (type country), Mexico, Nicaragua, Panama.

Identification. This species was identified from descriptions and illustrations found in the revision by Holzenthal & Blahnik (2006). The horn-like processes projecting from the phallicata are similar to those of *P. cristula* Holzenthal & Blahnik 2006 and *P. rota* Mosely 1937. It differs from these two species by the shorter, ventral processes of the phallicata and by the ventral margin of sternum VIII, which is shorter and less deeply bifurcate apically.

Protoptila jolandae Holzenthal & Blahnik 2006

New Record (1 locality). PANAMA—Chiriqui Province: Cuenca 108; Dolega District; Quebrada Jaramillo Abajo; 8.746003°N and 82.418038°W; 1060 m a.s.l.; 6 March 2019; K. Castillo, leg.; UV light trap; 1 male, MUPADI-YA-2019-457.

Distribution. Costa Rica (type country), Panama.

Identification. This species was identified from descriptions and illustrations found in the revision by Holzenthal & Blahnik (2006). The phallicata of this species is distinctively shaped, appearing wide preapically in lateral view and narrow basally in dorsoventral view. Additional characters, such as the elongate, apically bifurcate processes of tergum X, the shape of the paramere spine, and the elongate, narrowed ventral apex of sternum VIII assist in the diagnosis of this species (Holzenthal & Blahnik 2006).

Family Helicopsychidae

Worldwide in distribution, this family has over 250 species, primarily in tropical regions. In the Neotropics there are over 120 species, all in the genus *Helicopsyche*. The other genus in this family, *Rakiura* McFarlane 1973, is endemic to New Zealand**.**

Genus *Helicopsyche* von Siebold 1856

This genus has been divided into two subgenera (*Ferropsyche* and *Cochliopsyche*) in the Neotropics (Johanson 1998; Holzenthal & Calor 2017). The current 14 species of *Helicopsyche* in Panama all belong to the *Ferropsyche* subgenus (Armitage *et al*. 2015, 2020). Herein we add one more species from central Panama.

Helicopsyche (*Ferropsyche*) *rentzi* Denning & Blickle 1979

New Records (1 locality). PANAMA: Veraguas Province • Cuenca 097; Santa Fe District; Santa Fe National Park; Río Piedra de Moler; PSPSCB-PNSF-C097-2017-011; 8.55343°N and 81.17675°W; 395 m a.s.l.; 20 April 2017; A. Cornejo, T. Ríos, E. Álvarez, C. Nieto, leg.; UV light trap; in alcohol; 1 male; COZEM-RJB-2019-358.

Distribution. Costa Rica (type country), Panama.

Identification. This species was identified from keys, descriptions, and illustrations found in the publications by Denning & Blickle (1979), Johanson (2002, 2003), Johanson & Malm (2006), and Johanson & Holzenthal (2010). This species, based on the boomerang-shaped inferior appendages, bears a slight resemblance to *H. vergelana* Ross 1956. It differs from this and other species by the ventrad-directed tergum X and the overall shape of the inferior appendages in lateral and dorsal views, each with the distal portion <1.5X as broad as its distal portion in lateral view.

Family Hydropsychidae

This is a large trichopteran family which is divided into five subfamilies. The greatest diversity of Neotropical species and genera occur in the Macronematinae and Smicrideinae subfamilies (Holzenthal & Calor 2017). Fifteen genera and approximately 480 species are known from the Neotropics.

Genus *Calosopsyche* Ross & Unzicker 1977

The genus *Calosopsyche* is found in Costa Rica and Panama (five species; *C. continentalis* Group) and the Greater Antilles (nine species; *C. calosa* Group). In Panama there are four species previously known (Holzenthal & Calor 2017). Here we add one more species.

***Calosopsyche sandrae* (Flint 1967)**

New Record (1 locality). PANAMA—Chiriqui Province: Cuenca 102; Renacimiento District; Landis Private Reserve; Quebrada sin nombre; 8.643769°N and 82.829749°W; 755 m a.s.l.; 15–31 March 2020; M. Landis, leg.; Malaise trap; 1 male, MUPADI-TRG-2021-119. Ibid., 13–21 April 2020, 1 male; MUPADI-TRG-2021-239.

Distribution. Costa Rica (type country), Panama.

Identification. This species was identified by keys, descriptions, and figures by Flint (1967) and Flint & Bueno-Soria (1987). A member of the *C. continentalis* Group (Oláh & Johanson 2008), it is most closely related to *C. continentalis* Flint & Bueno-Soria 1987 and *C. bicuspis* Flint & Bueno-Soria 1987, differing from both by the widely forked apex of each inferior appendage.

Genus *Smicridea* McLachlan 1871

The genus *Smicridea* is found throughout the Neotropical realm, with a few species extending into the Nearctic portions of Mexico and the southwestern United States. The genus is divided into two subgenera: *Smicridea s.s*. and *Rhyacophylax*. In Panama there are 26 species known (Razuri-Gonzalez & Armitage, 2019). Here we add one more species in the *Rhyacophylax* subgenus.

***Smicridea* (*Rhyacophylax*) *acuminata* Flint 1974**

New Record (1 locality). PANAMA—Comarca Ngäbe Buglé: Cuenca 093; Bosque Protector Palo Seco; Quebrada Martinez; 8.79424°N and 82.19047°W; 490 m a.s.l.; 8 October 2019; T. Ríos, Y. Aguirre, leg.; Malaise trap; 1 male, MUPADI-YA-2020-273.

Distribution. Costa Rica (type country), Ecuador, Panama.

Identification. This species was identified by keys, descriptions, and figures by Flint (1974). A member of the *S. peruana* Group within the *Rhyacophylax* subgenus, in Panama it is most closely related to *S.* (*R.*) *talamanca* Flint 1974. The pointed triangular process on sternum IX and major differences in the aedeagus distinguish this species from *S. talamanca*.

Family Leptoceridae

This is another large trichopteran family with over 1,800 species worldwide. Divided into four subfamilies, it is represented in the Neotropics by three of them (Triplectidinae, Grumichellinae, and Leptocerinae). There are approximately 235 extant species known from the Neotropics, distributed among 16 genera (Holzenthal & Calor 2017).

Genus *Oecetis* McLachlan 1877

This is a very large genus with worldwide distribution, *Oecetis* is represented in the Neotropics by 51 species (Holzenthal & Calor 2017). In Panama, nine species are known. Herein we add one more species.

Oecetis hastapulla Quinteiro & Holzenthal 2017

New Record (3 localities). PANAMA—Chiriqui Province: Cuenca 108; Boquete District; Finca Monterey; Quebrada Jaramillo; 8.76320°N and 82.41383°W; 1250 m a.s.l.; 20–25 April 2018; K. Collier, leg.; Malaise trap; 1 male, MUPADI-RJB-2019-54. Ibid.; Dolega District; Quebrada Jaramillo Abajo; 8.746003°N and 82.418038°W; 1060 m a.s.l.; 9 March 2019; K. Castillo, leg.; UV light trap; 1 male, MUPADI-YA-2020-229. Ibid., 3 April 2020; 1 male; MUPADI-YA-2021-34. Ibid., Cuenca 102; Renacimiento District; Landis Private Reserve; Quebrada sin nombre; 8.643769°N and 82.829749°W; 755 m a.s.l.; 13–21 April 2020; M. Landis, leg.; Malaise trap; 1 male, MUPADI-YA-2021-82. Ibid., 14–20 May 2020; 1 male; MUPADI-YA-2021-138.

Distribution. Costa Rica (type country), Panama.

Identification. This species is in the *O. falicia* Group, which is characterized by the dorsolateral processes on segment IX and the membranous tergum IX. This species was identified from the description and figures in the revision by Quinteiro & Holzenthal (2017). It can be distinguished from other members of this group by the very elongate dorsal lobe of tergum X, with its slightly clavate apex, the divided apex of each inferior appendage, and by the elongate, asymmetrical, dorsolateral processes on segment IX. It is most closely related to *O. prolongata* Flint 1981 (Quinteiro & Holzenthal 2017).

Family Philopotamidae

This is a very large trichopteran family in the Neotropics, with five genera and over 277 species (Holzenthal & Calor 2017). In Panama, three genera are recorded: *Chimarra*, *Chimarrhodella*, and *Wormaldia*.

Genus *Chimarra* Stephens 1829

This genus is divided into four subgenera (*Chimarra*, *Chimarrita*, *Curgia*, and *Otarrha*), the latter three of which, with the exception of a few species of *Curgia*, are endemic to the Neotropics. Over 256 Neotropical species are distributed among the subgenera.

Chimarra (*Chimarra*) *angustipennis* Banks 1903

New Record (1 locality). PANAMA—Chiriqui Province: Cuenca 108; David District; Rio Papayal, Zambrano, Cochea; 8.457346°N and 82.340912°W; 59 m a.s.l.; 26 June 2018; J. Bernal, K. Castillo, T. Rios, leg.; UV light trap; 1 male; MUPADI-RJB-2021-149.

Distribution. Colombia, Costa Rica, Guatemala, El Salvador, Honduras, Mexico, Nicaragua, Panama, U.S.A., Venezuela.

Identification. This species was identified using the keys, descriptions, and illustrations by Blahnik (1998). It resembles *C. pylaea* Denning 1941 most closely, with both having fold-like lateral lobes of tergum X. It differs from this species in having a less elongate ventral apex of each inferior appendage.

Family Polycentropodidae

This family is represented in the Neotropics by five genera and about 315 species (Holzenthal & Calor 2017; Camargos

2020). In Panama, 24 species are known, distributed among four genera: *Cernotina*, *Cyrnellus*, *Polycentropus*, and *Polyplectropus*.

Genus *Polyplectropus* Ulmer 1905b

This genus is represented in Panama by 12 species. Here we add one more new country record.

Polyplectropus exilis Chamorro-Lacayo & Holzenthal 2004

New Record (2 localities). PANAMA—Comarca Ngabe Bugle: Cuenca 108; Bosque Protector Palo Seco; Quebrada Arenal, PSPSCB-BPPS-C108-2019-031; 8.77650°N and 82.20897°W; 1044 m a.s.l.; 8 October 2019; T. Ríos, E. Pérez y Y. Aguirre, leg.; UV light trap; 1 male, COZEM-YA-2020-243. Cuenca 093; Quebrada Caballero de Angel, PSPSCB-BPPS-C108-2019-034; 8.784833°N and 82.187378°W; 609 m a.s.l.; 8 October 2019; Y. Aguirre, T. Ríos, leg.; UV light trap; 1 male, MUPADI-YA-2020-244.

Distribution. Costa Rica (type country), Panama.

Identification. *Polyplectropus exilis* was identified by keys, descriptions, and illustrations in the revision by Charmorro & Holzenthal (2010). It is a member of the *P. charlesi* Group and is most closely related to *P. charlesi* (Ross 1941) and *P. kylistos* Chamorro-Lacayo & Holzenthal 2004. It is distinguished from both of these species by the absence of peg-like setae on either the dorsal or ventral branches of the inferior appendages, by the absence of endothecal phallic spines, by the acute apex of the mesoventral process of each preanal appendage, and by the presence of a narrow, lightly sclerotized process between the dorsal and ventral branches (Chamorro-Lacayo & Holzenthal 2004).

Family Xiphocentronidae

This family is represented in the Neotropics by three genera and over 62 species (Vilarino & Bispo 2020). In Panama, all three Neotropical genera are known: (*Caenocentron* Schmid 1982, *Machairocentron* Schmid 1982, and *Xiphocentron* Brauer 1870), within which are distributed eight species.

Genus *Caenocentron* (Schmid 1982)

Previously, the genus *Cnodocentron* was divided into two subgenera: *Cnodocentron* (Oriental in distribution) and *Caenocentron* (Neotropical and Nearctic in distribution). However, Vilarino *et al*. (2021) demonstrated separate evolutionary histories for the two subgenera, and elevated each to the genus level. Eight of the nine species now constituting *Caenocentron* are endemic to the Neotropics (Vilarino *et al*. 2021). Two species were previously known from Panama. Herein, we record two additional species as new to Panama.

Caenocentron immaculatum Flint 1991

New Record (1 locality). PANAMA—Chiriqui Province: Cuenca 108; Dolega District, Río Majagua, Banquito de Palmira, Potrerillos; 8.68083°N and 82.53250°W; 840 m a.s.l.; 28 February–14 March 2019, Y. Aguirre, T. Ríos, leg.; Malaise trap (M001); in alcohol; 1 male; MUPADI-YA-2020-336.

Distribution. Colombia (type country), Panama.

Identification. This species was identified using the descriptions and illustrations by Flint (1991), Schmid (1982), and Vilarino *et al*. (2021). *Caenocentron immaculatum* is most similar to *C. galesus* Schmid 1982. However, the apical segment of each inferior appendage in *C. immaculatum* is broader and more strongly arched, and the basal segment bears a strong tooth near the ventral margin.

Caenocentron lausus Schmid 1982

New Record (1 locality). PANAMA—Chiriqui Province: Cuenca 102; Renacimiento District; Landis Private Reserve; Quebrada sin nombre; 8.643769°N and 82.829749°W; 755 m a.s.l.; 15–31 March 2020; M. Landis, leg.; Malaise trap; 1 male, MUPADI-YA-2021-78.

Distribution. Nicaragua (type country), Panama.

Identification. This species was identified using the descriptions and illustrations by Schmid (1982) and Vilarino *et al*. (2021). *Caenocentron lausus* is most similar to *C. galesus* Schmid 1982 but differs in the shape of the inferior appendage and in the lower piliferous area composed of setae of very different lengths.

Genus *Xiphocentron* Brauer 1870

The genus *Xiphocentron* is represented in the Neotropics by about 53 species distributed among five subgenera (Schmid 1982). Four species in three subgenera were previously known from Panama. Here we add one more species in a fourth subgenus, *Glyphocentron*.

Xiphocentron (*Glyphocentron*) *alcmeon* Schmid 1982

New Record (1 locality). PANAMA—Chiriqui Province: Cuenca 102; Renacimiento District; Landis Private Reserve; Quebrada sin nombre; 8.643769°N and 82.829749°W; 755 m a.s.l.; 27 February–16 March 2020; M. Landis, leg.; Malaise trap; 1 male, MUPADI-YA-2021-189 • ibid., 17–31 March 2020; 1 male; MUPADI-YA-2021-193. Ibid., 13–21 April 2020; 1 male; MUPADI-2021-195. Ibid., 11–16 July 2020; 1 male; MUPADI-2021-197. Ibid., 12–17 August 2020; 1 male; MUPADI-YA-2021-190.

Distribution. Guatemala (type country), Panama.

Identification. *Xiphocentron alcmeon* was identified by using keys, descriptions, and illustrations by Schmid (1982). This species is most closely related to *X. euryale*, but differs in the apical points of tergum X and in the general shape of the inferior appendages.

Discussion

Only two species (*Protoptila bicornuta* and *Chimarra angustipennis*) of the twelve new records for Panama have a wide distribution, ranging from the U.S.A. or Mexico down to Panama or Colombia. Nine species are shared between Costa Rica and Panama. Three others are shared with a surrounding country (Guatemala, Nicaragua, or Colombia). No doubt these distinctions will blur as more collections are made throughout Central America and northern South America with multiple collection methods.

The addition of these 12 species brings the total number of caddisfly species known from Panama to 473. We are currently preparing two manuscripts which should add 40+ species (37+ new and 3 country records). Thus, within a short period, Panama's fauna will exceed 515 species, more than double the total when we began our work here in 2014 (n = 246 species). Yet, there are no indications of an endpoint. As suggested in a recent publication (Armitage *et al*. 2022), it is not inconceivable that 700–750 species, or more, will eventually be described or recorded from this amazingly diverse country.

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