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Article

First records of *Erythrodiplax melanorubra* Borror, 1942 and *Micrathyria catenata* Calvert, 1909 in Colombia and comments on the distribution of *Acanthagrion williamsoni* Leonard, 1977 (Odonata: Libellulidae, Coenagrionidae)

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Abstract

Presence of *Micrathyria catenata* and *Erythrodiplax melanorubra* is reported for the first time in Colombia, as part of a series of studies conducted in the municipality of La Vega, Cundinamarca department. A list of the species that share the habitat in the sampled area is provided. Records of *Acanthagrion williamsoni* are analyzed and actualized for the country and a map with its distribution is presented.

Additional keywords: Cundinamarca, damselflies, dragonflies, faunistics, insects, La Vega, Neotropics, Odonata.

Resumen

Se reporta la presencia de *Micrathyria catenata* y *Erythrodiplax melanorubra* por primera vez para Colombia, como parte de una serie de estudios llevados a cabo en el municipio de La Vega, departamento de Cundinamarca; además, se proporciona un listado de las especies con las que comparten el hábitat en la zona muestreada. Se analizan y actualizan los registros de *Acanthagrion williamsoni* para el país y se proporciona un mapa de su distribución.

Palabras clave adicionales: Cundinamarca, caballitos del diablo, faunística, insectos, La Vega, libélulas, Neotrópico, Odonata.

Introduction

The study of dragonflies and damselflies in Colombia has increased in the last years as evidenced by the publication of new species, ecological, taxonomic and genetic studies (for some examples see Herrera *et al.* 2010, Altamiranda and Ortega 2012, Altamiranda-Saavedra *et al.* 2014, Bota-Sierra 2014a, Palacino-Rodriguez and Contreras-Sanchez 2014). For a country with a high biodiversity like Colombia, knowledge of the number of species present and information of their range has important implications for the understanding of biodiversity and its conservation (Primack and Ros 2002). Maps of the distribution of individual species not only show where a species occurs, or has occurred in the past, but are used to monitor changes in the geographical range and distribution of species over time, identify relationships between species distributions, climate, and other environmental variables, and to predict changes in species distributions as a consequence of climate change and habitat loss (Samways *et al.* 2010).

In Colombia, Cundinamarca department has one of the largest number of records of dragonflies (95 species), surpassed only by Meta department (144 species) (Realpe 2009, Palacino-Rodríguez 2013). Although these departments have been of the most studied in the country, it is expected that the species number is still higher in Cundinamarca department due to its geographical position in the eastern cordillera (bordering to the east with the llanos orientales and to the west with the valley of the Magdalena River), and because holding a diversity of wetlands, swamps, pools, and rivers, favorable habitats for these organisms.

The genus *Micrathyria* Kirby, 1889 has 48 species in the new world, 38 of which are present in the neotropical region (Costa *et al.* 2002). In Colombia this genus is represented by 10 species, two of which (*Mi. aequalis* and *Mi. didyma*) are present in Cundinamarca department.

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The genus *Acanthagrion* Selys, 1876 is exclusive of the neotropical region, and includes 44 species which are found from United States to Argentina (Lozano 2013). The genus has 17 species reported in Colombia, of which *A. inexpectum*, *A. vidua* and *A. williamsoni* have been recorded in Cundinamarca department (Realpe 2009, Rojas and Sánchez 2009, Pérez-Gutiérrez and Palacino-Rodríguez 2011).

Here, two new records of dragonflies are presented for the country, and reports and distribution of *A. williamsoni*, endemic to Colombia, are discussed.

Materials and Methods

The sampled area corresponds to a lentic aquatic system of 40 m^2, located at 1 150 meters above sea level (lat 5°0'9,02"N, long 74°19'16,56"W), and to a lotic system located at 1 130 m (lat 5°0'2,13"N, long 74°19'10,30"W), both in the department of Cundinamarca, municipality of La Vega, rural zone, called vereda La Alianza. According to Holdridge life zones system, this municipality correspond to the ecological formation of lower montane moist forest, with an average annual temperature between 18 and 24°C, rainfall between 2 000-4 000 mm, and altitude between 1 000-2 000 m (Perea 2009).

Two samples of adults were made on July 27 of 2014, and march 7 of 2016 respectively, for four hours (10:00 to 14:00 hours) in each case, using an entomological net (jama) 36 cm in diameter and 1,2 m. Twenty four hours after capture, five specimens were deposited in 96% alcohol and the remaining specimens were immersed in acetone for 18 to 24 hours for preservation, then air dried and deposited in polypropylene bags with their collecting data (Garrison *et al.* 2010). For taxonomic determination specimens were observed under a stereomicroscope and genital exposure was made using 7% ammonia to allow their recognition through keys by Borror (1942) Leonard (1977), Donnelly (1992), Garrison (1996), Costa *et al.* (2002), Paulson (2003), Heckman (2006, 2008), Garrison and von Ellenrieder (2007), Garrison (2009), Garrison *et al.* (2006, 2010), and Garrison and von Ellenrieder (2014).

Results and Discussion

A total of 53 specimens were collected, 14 of them belonging in suborder Anisoptera and 39 in suborder Zygoptera. The specimens belong to ten genera and thirteen species (Table 1). 57% of the species were associated to the Lentic system and 43% to the lotic system. *Argia oculata* and *Acanthagrion williamsoni* were the most abundant species.

The Odonata list from Colombia published by Pérez-Gutiérrez and Palacino-Rodríguez (2011) recorded 335 species for the country, this number has increased to 400 since the discovery of new species, of which 19 belong to the suborder Anisoptera and 46 to the suborder Zygoptera (Table 2).

Table 1. Dragonflies collected in two aquatic systems: lotic (Lo) and lentic (Le), at the municipality of La Vega, Cundinamarca department.

Suborder	Species	Individuals	Aquatic system
Anisoptera	*Cannaphila vibex*	1♂, 1♀	Lo
	Erythemis attala	1♂	Le
	Erytrodiplax fusca	3♂, 2♀	Le
	Erytrodiplax melanorubra	3♂, 1♀	Le
	Micrathyria catenata	2♂	Le
Zygoptera	*Acanthagrion williamsoni*	8♂, 1♀	Le
	Argia fissa	5♂	Lo
	Argia indicatrix	3♂, 1♀	Lo
	Argia oculata	11♂, 2♀	Lo
	Hetaerina occisa	2♂	Lo
	Homeoura chelifera	1♀	Le
	Ischnura sp.	1♀	Le
	Telebasis salva	4♂	Le

Table 2. New species of dragonflies reported from Colombia since the publication of the checklist by Pérez-Gutiérrez and Palacino-Rodríguez (2011).

Suborder	Family	Species	Reference
Anisoptera	Aeshnidae	*Rhionaeschna caligo*	Bota-Sierra 2014b
		Gynacantha klagesi	Bota-Sierra *et al.* 2015
		Gynacantha litoralis	Bota-Sierra *et al.* 2015
	Corduliidae	*Aeschnosoma forcipula*	Rache 2015
		Gomphomacromia fallax	Bota-Sierra *et al.* 2010
	Gomphidae	*Aphylla boliviana*	Bota-Sierra *et al.* 2015
		Diaphlebia angustipennis	Rache *et al.* 2013
		Diaphlebia richteri	Bota-Sierra *et al.* 2015
		Zonophora wucherpfennigi	Bota-Sierra *et al.* 2015
	Libellulidae	*Argyrothemis argentea*	Rache *et al.* 2013
		Diastatops pullata	Bota-Sierra *et al.* 2015
		Fylgia amazonica lychnitina	Rache *et al.* 2013
		Misagria parana	Bota-Sierra 2014b
		Oligoclada monosticha	Bota-Sierra *et al.* 2015
		Oligoclada pachystigma	Bota-Sierra *et al.* 2015
		Oligoclada walkeri	Bota-Sierra *et al.* 2015
		Perithemis bella	Bota-Sierra 2012
		Perithemis thais	Bota-Sierra 2014b
		Zenithoptera lanei	Bota-Sierra 2014b
Zygoptera	Coenagrionidae	*Acanthagrion lancea*	Bota-Sierra 2012
		Aeolagrion dorsale	Bota-Sierra *et al.* 2015
		Aeolagrion inca	Bota-Sierra 2012
		Anisagrion inornatum	Rojas-Riaño 2011
		Argia appendiculata	Garrison and von Ellenrieder 2014
		Argia cuneifera	Garrison and von Ellenrieder 2014
		Argia loutoni	Garrison and von Ellenrieder 2014
		Calvertagrion charis	Tennessen 2015
		Denticulobasis garrisoni	Bota-Sierra *et al.* 2015
		Inpabasis nigridorsum	Bota-Sierra *et al.* 2015
		Mesamphiagrion gaudiimontanum	Bota-Sierra and Echeverry 2013
		Mesamphiagrion nataliae	Bota-Sierra and Echeverry 2013
		Mesamphiagrion rosseri	Bota-Sierra and Echeverry 2013
		Mesamphiagrion santainense	Bota-Sierra and Echeverry 2013
		Mesoleptobasis elongata	Bota-Sierra *et al.* 2015
		Metaleptobasis incus	Bota-Sierra 2012
		Metaleptobasis mauffrayi	Bota-Sierra *et al.* 2015
		Oxyallagma colombianum	Bota-Sierra 2014a
		Phoenicagrion flammeum	Bota-Sierra *et al.* 2015

Table 2. Cont. New species of dragonflies reported from Colombia since the publication of the checklist by Pérez-Gutiérrez and Palacino-Rodríguez (2011).

Zygoptera	Coenagrionidae	*Telebasis corbeti*	Bota-Sierra *et al.* 2015
		Telebasis dunklei	Bota-Sierra *et al.* 2015
		Telebasis inalata	Bota-Sierra *et al.* 2015
		Telebasis obsoleta	Bota-Sierra *et al.* 2015
		Telebasis rubricauda	Bota-Sierra 2014b
		Tuberculobasis williamsoni	Machado 2009
	Protoneuridae	*Drepanoneura muzoni*	Bota-Sierra *et al.* 2015
		Neoneura rufithorax	Bota-Sierra 2012
		Protoneura paucinervis	Bota-Sierra *et al.* 2015
		Proneura prolongata	Bota-Sierra 2012
		Protoneura scintilla	Bota-Sierra *et al.* 2015
		Psaironeura tenuissima	Bota-Sierra *et al.* 2015
	Heteragrionidae	*Heteragrion bariai*	Bota-Sierra 2014b
		Heteragrion inca	Bota-Sierra *et al.* 2015
		Oxystigma cyanofrons	Bota-Sierra 2014b
	Lestidae	*Archilestes chocoanus*	Pérez-Gutiérrez 2012
		Lestes helix	Bota-Sierra 2014b
		Lestes jerrelli	Bota-Sierra 2014b
		Lestes minutus	Bota-Sierra 2014b
	Megapodagrionidae	*Heteropodagrion croizati*	Perez-Gutierrez and Montes-Fontalvo 2011
		Megapodagrion megalopus	Bota-Sierra *et al.* 2015
	Perilestidae	*Perissolestes cornutus*	Bota-Sierra *et al.* 2015
	Platystictidae	*Palaemnema peruviana*	Bota-Sierra *et al.* 2015
	Calopterygidae	*Hetaerina westfalli*	Bota-Sierra *et al.* 2015
	Philogeniidae	*Philogenia berenice*	Bota-Sierra *et al.* 2015
	Polythoridae	*Chalcopteryx scintillans*	Bota-Sierra *et al.* 2015
	Pseudostigmatinae	*Mecistogaster lucretia*	Bota-Sierra *et al.* 2015

This shows that knowledge of dragonflies in Colombia is still in its beginnings, and there are still many species waiting for being discovered. This becomes obvious when comparing the species listed in other countries of the region, as Costa Rica (265 spp), Venezuela (527 spp), Perú (384 spp) and Brazil (667 spp) (Paulson 2004a, Kalkman *et al.* 2008, De Marmels 2016).

For the Colombian department of Cundinamarca, 33 species of Anisoptera and 62 of Zygoptera have been recorded so far (Realpe 2009, Pérez-Gutiérrez and Palacino-Rodríguez 2011). Here, two new reports for the country and the department are added:

Erythrodiplax melanorubra Borror, 1942

Known from Ecuador, Peru, Bolivia, Venezuela, French Guyana, Brazil, Paraguay, Argentina and Chile (Paulson 2004b). In Borror (1942) this species appears with potential distribution in Colombia. However, it was excluded from the list of dragonflies for the country because its presence could not be verified and its locality data here was considered incorrect (Pérez-Gutiérrez and Palacino-Rodríguez 2011). Being found in the same habitat with *E. fusca* it may be easily confounded. However, males can often be distinguished by two characteristics: (a) the basal spot in the hind wing is smaller, more triangular, and very dark brown in *E. melanorubra* (Figure 1 A), and usually

larger, more rounded distally, and dark red in *E. fusca* (Figure 1 B); (b) the size of the penis (vesica spermalis): >1,4 mm in *E. melanorubra* (Figure 2 A) and <1-3 mm in *E. fusca* (Figure 2 B) (Borror 1942, Paulson 2003).

Micrathyria catenata Calvert, 1909

This species is found in Central America, Ecuador, Peru, Venezuela, Trinidad and Tobago, Suriname, French Guyana, Brazil and Argentina (Paulson 2004b). Habitat includes ponds, pools and swamps (von Ellenrieder 2009). The collected individuals have small yellow spots dorsally on abdominal segments four to five, and a larger yellow twin spot on the seventh segment which occupies three quarters of it (Figure 3); penis vesicle with a group of six to ten stiff setae located distally on each side (Figure 4); total length including cerci 34,0 to 36,5 mm, forewing 27,0 to 27,3 mm, hindwing 26,5 to 26,8 mm, pterostigma 2,6 to 2,7 mm, and abdomen 25,0 to 23,7 mm.

Comments on the distribution of *Acanthagrion williamsoni* Leonard, 1977 in Colombia

Five reports of *A. williamsoni* are known in the literature for Colombia. The first is attributed to specimens collected by Bouis (no date) with a note related to Cauca. According to Leonard (1977), "the exact locality for the specimens collected by Bouis is not known. It is probable that the single word "Cauca" refers to some collecting station along the Rio Cauca". This river is, with 1300 km, the second largest river of the country and runs through the departments of Cauca, Valle, Risaralda, Caldas, Antioquia, Sucre and Bolivar. Therefore, it may be erroneous to assign this report to the department of Cauca as was done by Pérez-Gutiérrez and Palacino-Rodríguez (2011).

The second record corresponds to a collection brought together by Edward Bruce Williamson in 1917 (Leonard 1977, Garrison *et al.* 2003), three km south of the town of Mariquita (Tolima). According to Leonard (1977), in his field notes Williamson establishes an altitude of 1 500 m for the collecting locality, but this information must be wrong for two reasons: (1) the town of Mariquita has an altitude ranging from 300 to 1 300 m and (2) the highest altitude within 7 km radius of the urban area is 900 m. This indicates that if the specimens were collected in the place indicated above, they should be in a site located between 500 to 900 m.a.s.l. The third report was made

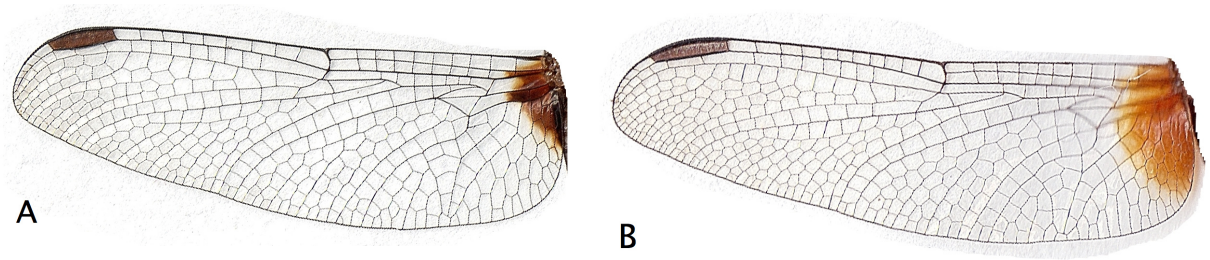

Figure 1. Basal spot in the hindwing of *E. melanorubra* (A) and *E. fusca* (B).

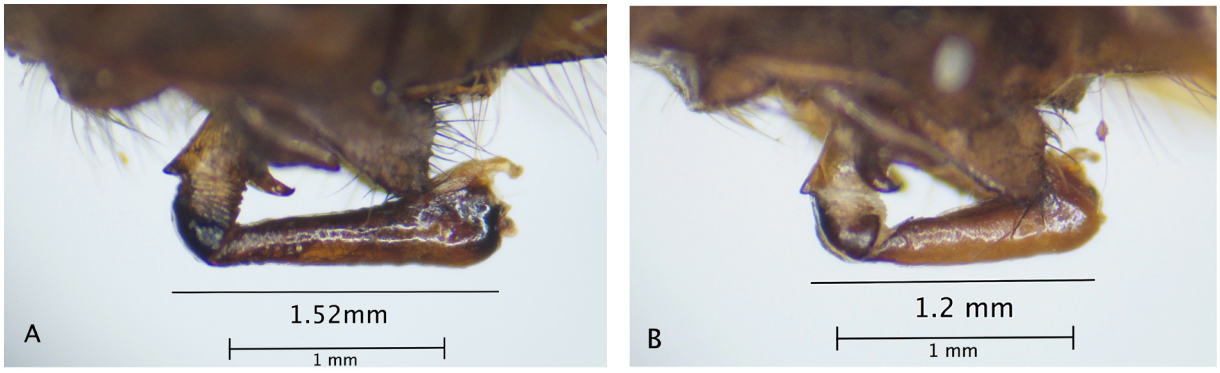

Figure 2. Comparison in vesica spermalis size between *E. melanorubra* (A) and *E. fusca* (B). Lateral view 4.5X.

by Realpe (2009), being this the first record of this species for the department of Cundinamarca. He found the species in the municipality of La Mesa, in a lentic system al 1 100 m.a.s.l. The fourth record is attributed to Amaya-Perilla and Palacino-Rodríguez (2012), reporting the species in Meta department; however, this record is not correct because after a review of the material these authors didn't find any reliable information on the presence of *A. williamsoni* in Meta department (Palacino-Rodríguez, pers. comm.).

The last record belongs to Salazar *et al.* (2015), in a lentic aquatic system of a tropical dry forest located in the "Centro de Investigación y Educación Ambiental (CIEA) La Tribuna", in a rural area called Vereda Tamarindo, at 530 m.a.s.l., in the city of Neiva, Huila department. This represents the first report of this species in this department.

From the reports presented above for *A. williamsoni* only the four belonging to the departments of Cundinamarca, Huila and Tolima are here considered to be correct. To these reports, an additional finding should be added based on samples made by Cornelio Bota-Sierra (pers. comm.) from 25 to 29 November 2014 at a temporary pond of a stream, in the protected area called Reserva Mana Dulce (Cundinamarca department, municipality Agua de Dios), located at lat 4°21'4.32"N, long 74°39'5.08"W, 385 m.a.s.l., in the tropical life zone of dry forest.

The above shows that *A. williamsoni* is a species of lentic systems (ponds, pools and swamps), its altitudinal ranges between 350 to 1 200 m.a.s.l (although these values can vary with increasing availability of samples). It has been found in two life zones: tropical dry forest and lower montane moist forest. Moreover, the geographical distribution analysis locates the species in the south of the Magdalena Valley between the western slope of the Cordillera Oriental and the eastern slope of the Cordillera Central (Figure 5).

Conclusions

Taking into account the recent publications on new species and the records gven in the present work, the number of dragonfly species for Colombia is expanded to 402, including *M. catenata* and *E. melanorubra*.

Five records of *A. williamsoni* in three departments (Cundinamarca, Huila and Tolima) are considered valid. This species represents a case of particular interest to the country for being endemic, so that it is necessary to increase the research aimed to establish its population structure, ecological requirements, life cycle among others, in order to preserve its habitat.

Figure 3. Dorsal view of the abdominal segments S4-S7 showing the yellow spots.

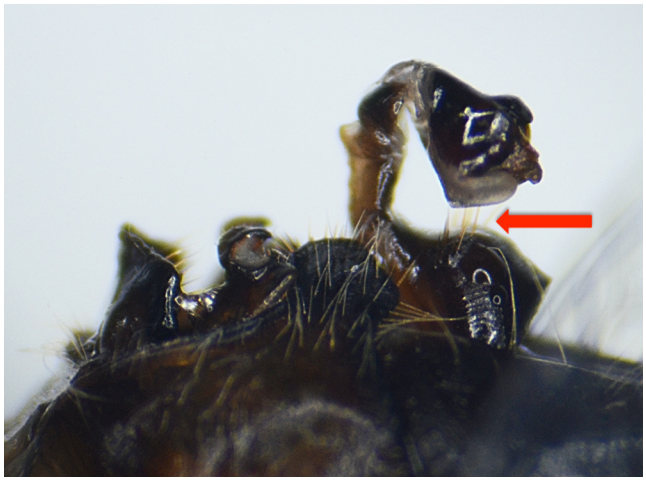

Figure 4. Genital fossa and vesica spermalis of *M. catenata* in lateral view, the arrow indicate the stiff setae on the penis vesicle.

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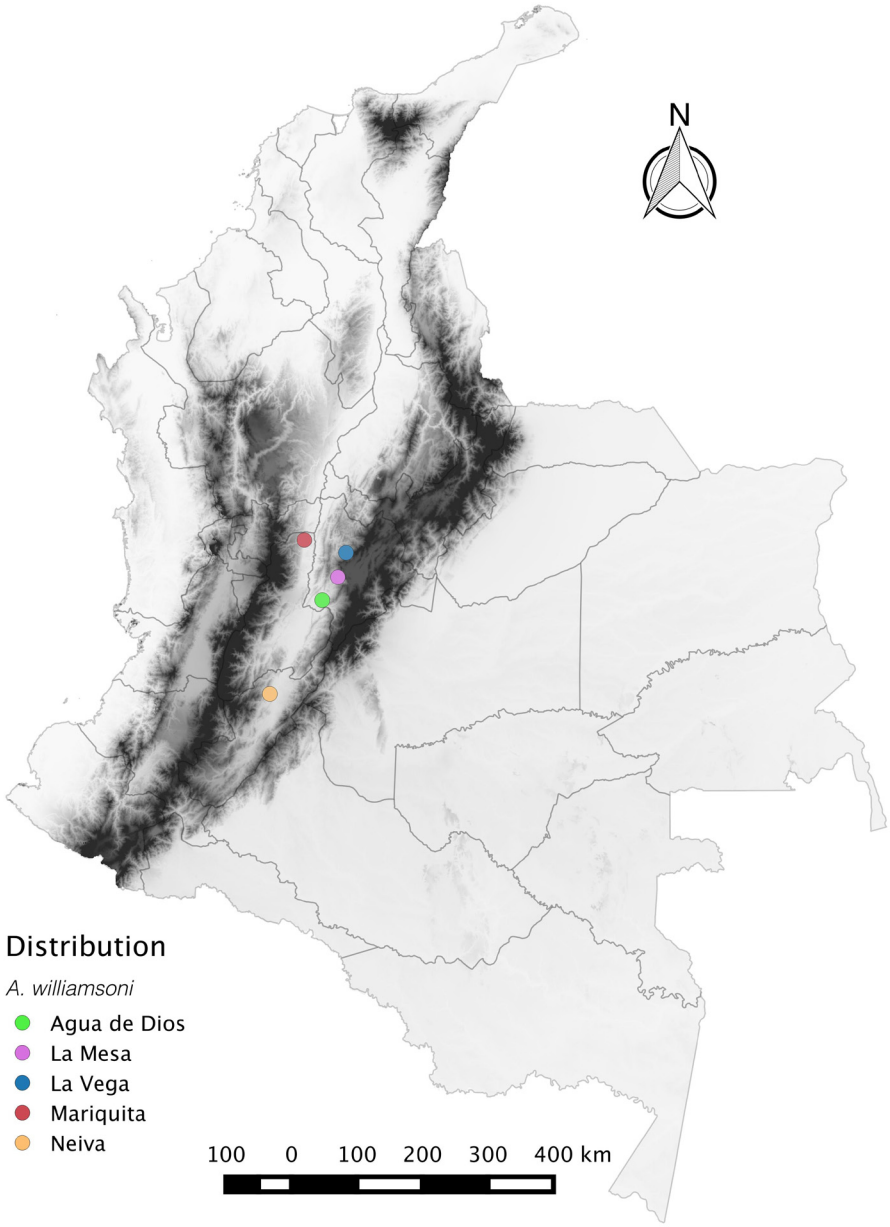

Figure 5. Updated map for the records of *Acanthagrion williamsoni* in Colombia.

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