



A NEW SPECIES OF *NEONEMURA* (PLECOPTERA: NOTONEMOURIDAE), AND RECORDS OF STONEFLIES FROM AISÉN PROVINCE, REGION XI, CHILE

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ABSTRACT

Neonemura copa sp. nov. is described from a male specimen collected from a tributary to Lago Copa in Aisén Province (Region XI), Chile, and records for nine additional stonefly species are presented for the province.

Keywords: *Neonemura*, Lago Copa, Cisnes Municipality, distribution

INTRODUCTION

Vera & Camousseight (2006) summarized the state of knowledge for Chilean stoneflies, reporting 63 species and 33 genera for the entire country. A few additional species, or records, have since been added by McLellan et al. (2005), McLellan & Zwick (2007), Vera (2006a, 2006b, 2008a, 2008b, 2009, 2011, 2012), and Vera et al. (2012) bringing the number of species to 72 and the number of genera to 36. Vera & Camousseight (2006) also reported distributions by political region in their Table 1, and 17 species are included from Region XI in which Aisén Province is located. Recently, one of us (JCM) had the opportunity to collect from streams entering Lago Copa in Cisnes Municipality of Aisén Province over the period of 8-18 December 2009, and several new stonefly records for this province were found, including a new species of *Neonemura* Navás. We describe the new species and report the new records to provide additional data on the distribution and diversity of Chilean Plecoptera.

MATERIALS AND METHODS

Most adult samples were collected in Townes Malaise traps but ultraviolet light traps were used at four sites for three trap nights. Larvae were collected by visual inspection of rocks and other substrate from streams. All specimens are preserved in 75% ethanol and most are archived in the Stark collection, Mississippi College, Clinton, Mississippi, ultimately to be deposited in the R.W. Baumann Collection, M.L. Bean Museum, Brigham Young University, Provo, Utah. Specimens were compared with material identified by C. Froehlich and P. Zwick on loan from the United States National Museum. The holotype of the new species is deposited in the United States National Museum of Natural History, Washington, D.C (NMNH).

RESULTS AND DISCUSSION

Thirty-seven adult and 34 larval specimens were collected from nine sites during the study period. A minimum of 10 species were present in these samples, however a few larval and female specimens could not be identified to species. Six species represent new records for Aisén Province and Region XI.

Family Diamphipnoidae

Diamphipnoa sp.

Material. Examined. CHILE: Provincia Aisén, Municipalidad Cisnes, Area Protegida Lago Copa; S side W Lago Copa, unnamed 2nd order stream from cascade 1 km W Cliffs Lodge, 44.88752° S, 72.63573° W, elevation 42 m, 13-14 December 2009, J. Morse, J. Rios, 1 larva.

Comments. Three of the four known species of *Diamphipnoa* are reported from Chile and one of these, *D. annulata* (Brauer), is known to occur in Aisén Province (Vera & Camousseight 2006).

Diamphipnopsis sp.

Material examined. CHILE: Provincia Aisén, Municipalidad Cisnes, Area Protegida Lago Copa: S side of W Lago Copa, unnamed 2nd order stream from cascade 1 km W Cliffs Lodge, 44.88752° S, 72.63573° W, elevation 42 m, 13-14 December 2009, J. Morse, J. Rios, 4 larvae.

Comments. Both species, *D. beschi* Illies and *D. samali* Illies included in this genus are known from Chile (Regions IX and X) but the genus has not been previously reported from Aisén Province or Region XI (Vera & Camousseight 2006).

Family Eustheniidae

Neuroperla schedingi (Navas 1929)

Material examined. CHILE: Provincia Aisén, Municipalidad Cisnes, Area Protegida Lago Copa: S side of E Lago Copa, unnamed 1st order stream from cascade 200 m E Cliffs Lodge, 44.89155° S, 72.62070° W, elevation 25-35 m, 15-18 December 2009, Townes trap, A. Jayakaran, N. Gonzalez, 4♂, 1♀. Same location, 13-15 December 2009, Townes trap, J. Morse, G. Rao, P. McMillan, 1♂. S side of W Lago Copa, unnamed 2nd order stream from cascade 1 km W Cliffs Lodge, 44.88752° S, 72.63573° W, elevation 42 m, 13-14 December 2009, Townes trap, J. Morse, J. Rios, 4♂.

Comments. Published Chilean records for this species are available for Regions IX and X (Illies 1960; Vera & Camousseight 2006). The new records

represent the first report for Aisén Province and Region XI.

Family Gripopterygidae

Alfonsoperla flinti McLellan & Zwick 2007

Material examined. CHILE: Provincia Aisén, Municipalidad Cisnes, Area Protegida Lago Copa: S side of W Lago Copa, unnamed 2nd order stream from cascade 1 km W Cliffs Lodge, 44.88752° S, 72.63573° W, elevation 42 m, 13-14 December 2009, ultraviolet trap, J. Morse, J. Rios, 1♂.

Comments. This recently described species is known from scattered sites in Argentina and Chile but this is the first record of the species from Aisén Province and Region XI. Most collections consist of single specimens.

Antarctoperla michaelsoni (Klapálek 1904)

Material examined. CHILE: Provincia Aisén, Municipalidad Cisnes, Area Protegida Lago Copa: N side of E Lago Copa, 1st unnamed 3rd order tributary E of lake rapids, 44.88642° S, 72.60822° W, elevation 30-40 m, 9-10 December 2009, ultraviolet trap, H₂O 4.5°C, J. Morse, N. Gonzalez, A. Jayakaran, G. Rao, 2♂. S side W Lago Copa, unnamed 2nd order stream from cascade 1 km W Cliffs Lodge, 44.88752° S, 72.63573° W, 42 m, Townes trap, J. Morse, J. Rios, 1♂. Lago Copa, Estero El Quinque, 44.89531° S, 72.59202° W, elevation 35-45 mm, 10-11 December 2009, Townes trap, H₂O 5°C, J. Morse, G. Rao, 1♀.

Comments. Illies (1963) and Vera & Camousseight (2006) list this species from several Chilean sites including locations in Region XI.

Araucanioperla brincki (Froehlich 1960)

Material examined. CHILE: Provincia Aisén, Municipalidad Cisnes, Parque Nacional Lago Copa: S side of E Lago Copa, dock @ Cliffs Preserve, 44.89178° S, 72.62252° W, elevation 25-35 m, 16-18 December 2009, Townes trap, J. Morse, 4♂. Same site, 14-16 December 2009, Townes trap, J. Morse, 4♂, 1♀. Same site, 8-10 December 2009, Townes trap, H₂O 11°C, J. Morse, N. Gonzalez, 3♂.

Comments. Vera & Camousseight (2006) list Region

X as the only area from which this species is known. These records extend its range southward into Aisén province of Region XI.

Aubertoperla illiesi (Froehlich 1960)

Material examined. CHILE: Provincia Aisén, Municipalidad Cisnes, Area Protegida Lago Copa: Lago Copa, Estero El Quinque, 44.89531° S, 72.59202° W, elevation 35-45 m, 10-11 December 2009, Townes trap, H₂O 5°C, J. Morse, G. Rao, 3♂, 2♀.

Comments. Both species of *Aubertoperla* (*A. illiesi* and *A. kuscheli* Illies) are reported for southern Chile, including Region XI (Stark et al. 2009; Vera & Camousseight 2006).

Family Notonemouridae

Austronemoura encoensis Aubert 1960

Material examined. CHILE: Provincia Aisén, Municipalidad Cisnes, Area Protegida Lago Copa: N side of E Lago Copa, 1st unnamed 3rd order tributary E of lake rapids, 44.88636° S, 72.60836° W, elevation 30-40 m, 10-11 December 2009, Townes trap, H₂O 4.5°C, J. Morse, N. Gonzalez, G. Rao, 1♂.

Comments. This species was previously known from Regions IX and X (Vera & Camousseight 2006).

Neofulla areolata (Navás 1929)

Material examined. CHILE: Provincia Aisén, Municipalidad Cisnes, Area Protegida Lago Copa: S side E Lago Copa, unnamed 1st order stream from cascade 200 m E Cliffs Preserve at Patagonia, 44.89155° S, 72.62070° W, elevation 25-35 m, 11-13 December 2009, Townes trap, J. Morse, G. Rao, 1♂. S side of W Lago Copa, unnamed 2nd order stream from cascade 1 km W Cliffs Lodge, 44.88752° S, 72.63573° W, elevation 42 m, 13-14 December 2009, Townes trap, J. Morse, J. Rios, 1♀.

Comments. *Neofulla* currently includes three species, all known from Chile but with none reported from Aisén Province. Aubert (1960) described two of these (in genus *Illiesia*); *N. spinosa* (Aubert) has two pairs of slender, upwardly directed spines on the lateral margins of the upper paraproct lobes and the lower lobes appear relatively unarmed, and *N. biloba*

(Aubert) also bears prominent spines on the upper paraproct lobes, but lack a pair of spines on the apex. Illies (1961) redescribed *N. areolata* Navas, and his redescription is consistent with our male specimen in having the lateral margins of the lower paraproct lobes sinuate along the entire length.

Neonemura copa sp. n.

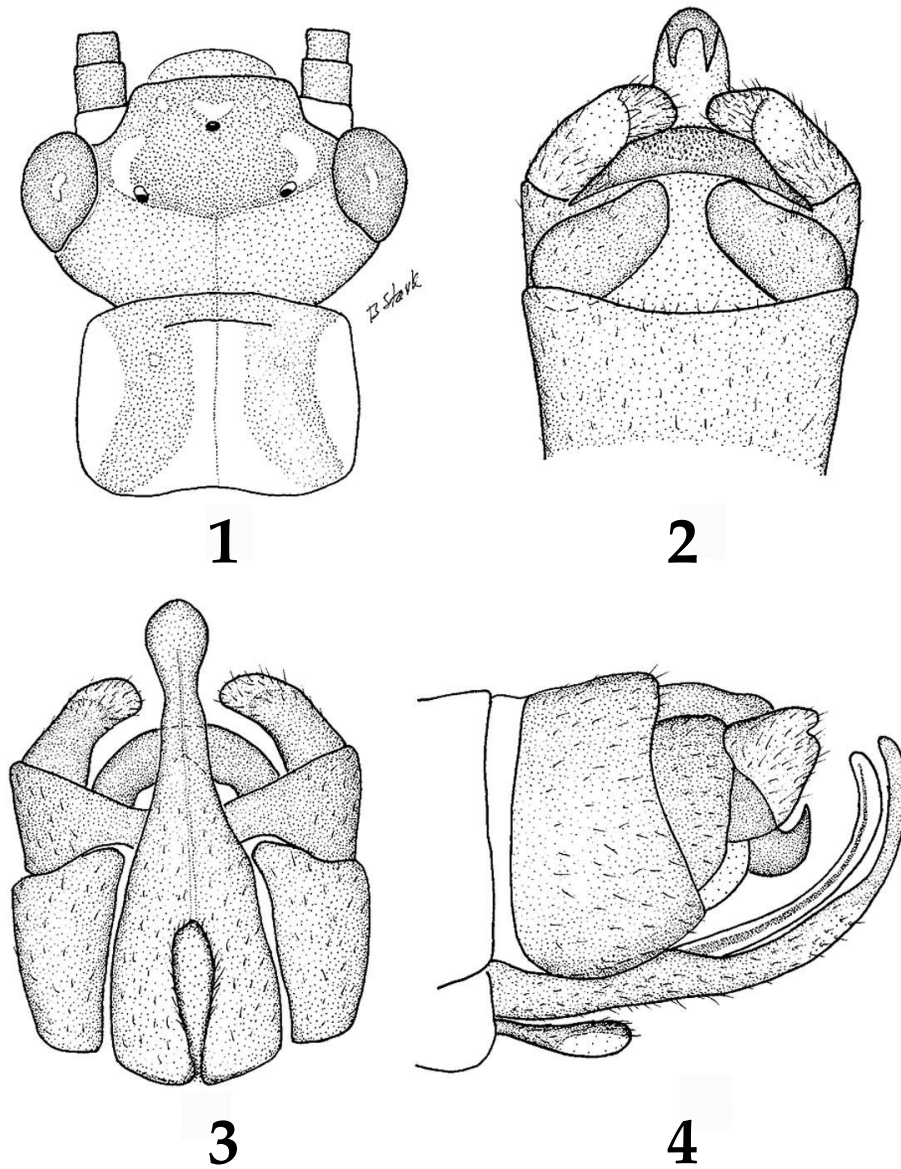
(Figs. 1-4)

Material examined. Holotype ♂ from CHILE: Provincia Aisén, Municipalidad Cisnes, Area Protegida Lago Copa: S side E Lago Copa, springbrook at Cliffs Preserve, 44.89227° S, 72.62291° W, elevation 25-35 m, 8-9 December 2009, ultraviolet trap, H₂O 6°C, J. Morse, G. Vazquez, N. Gonzalez (NMNH).

Adult habitus. General color brown with scattered pale areas. Head dark brown over most of surface, but with a pair of parenthesis-shaped pale spots anterolateral to posterior ocelli, and with three additional pale spots on anterior region of frons (Fig. 1); pronotum brown with pale median band and lateral margins. Femora banded, hind femora each with dark basal and apical bands, fore- and mid-femora each without basal band; all tibiae dark at knee, hind tibiae also with apical dark band. Wing membrane pale brown, veins brown.

Male. Macropterous. Forewing length 6.5 mm. Tergum 10 divided into a pair of lateral sclerites and a median posterior one; median sclerite covered over much of surface with small spines (Fig. 2). Epiproct a slender, curved, hook-like process, thick basally and barely visible in dorsal aspect at the base of median sclerite. Cerci each bearing a low dorsal ridge in apical third and a pale membranous area anterior to ridge; cerci not markedly bilobed in lateral aspect (Fig. 4). Sternum 9 prolonged into an upwardly curved subgenital plate, bifid at tip in dorsal or caudal aspect (Figs. 2-4); margins of plate broad in basal third, then significantly narrowed, but width variable to apex (Fig. 3). Paraprocts mostly membranous but bearing slender sclerite extending almost to apex; tips of paraprocts not exceeding apex of sternum 9. Vesicle relatively long and slender, club-shaped and narrowly attached to base of subgenital plate (Fig. 3).

Female. Unknown.



Figs. 1-4. *Neonemura copa*. 1. Head and pronotum. 2. Male terminalia, dorsal. 3. Male terminalia, ventral. 4. Male terminalia, lateral.

Larva. Unknown.

Etymology. The species name is based on the type locality, a small springbrook entering Lago Copa, and is used as a noun in apposition.

Diagnosis. *Neonemura* currently includes only three species (Froehlich 2010), all known from Chile or Chile and Argentina. *Neonemura copa* lacks the spiny

dorsal patches found on the bases of the paraprocts of *N. illiesi* Zwick (Zwick 1972), and it is a much paler species than *N. maculata* Vera (Vera 2008a), however it is similar to the widely distributed species, *N. barrosi* (Navás) (Aubert 1960; Stark et al. 2009). Males of these two species have similarly shaped subgenital plates in ventral aspect but the paraprocts exceed the

subgenital plate apex in *N. barrosi* and the cerci are strongly bilobed in lateral aspect in that species.

Habitat. The type locality is a shallow, first order rheocene springbrook providing water for the Cliffs Preserve Lodge beside Lago Copa. The light trap was located over the springbrook about 70 m west of the lodge, about 30 m from the edge of the lake and about 10-20 m below the spring head. Water temperature at the time of collection was 6°C.

The forest surrounding the Cliffs Preserve Lodge consists of *Bosque siempreverde laurifolio* (Evergreen Laurel-leaf Temperate Rainforest). The forest is original growth and consists of a canopy overwhelmingly dominated by *Laureliopsis philipiana* (Looser) R. Schodde, and *Weinmannia trichosperma* Ruiz & Pav. Smaller numbers of *Nothofagus betuloides* (Mirb.) Blume and *N. nitida* Ann. K.K. Hofmus are found in areas immediately adjacent to the lake, or directly adjacent to its larger tributary rivers where disturbance is frequent (P. McMillan, personal communication).

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REFERENCES

Aubert, J. 1960. Contribution á l'étude des Notonemourinae (Plecoptera) de l'Amérique du Sud. *Mitteilungen der Schweizerischen Entomologischen Gesellschaft*, 33:47-64.

Froehlich, C.G. 1960. Some gripopterygids and notonemourines (Plecoptera) from South America. *Lunds Universitets Arsskrift*, 56:3-24.

Illies, J. 1960. Archiperlaria, eine neue Unterordnung der Plecoptera. (Revision der Familien Eustheniidae und Diamphipnoidae) (Plecoptera). *Beiträge zur Entomologie*, 10:661-697.

Illies, J. 1961. Südamerikanische Notonemourinae

und die Stellung der Unterfamilie im System der Plecopteren. *Mitteilungen der Schweizerischen Entomologischen Gesellschaft*, 34:97-126.

Illies, J. 1963. Revision der südamerikanischen Gripopterygidae (Plecoptera). *Mitteilungen der Schweizerischen Entomologischen Gesellschaft*, 36:145-248.

Klapálek, F. 1904. Plecopteren. *Hamburger Magalhaenische Sammelreise*, 7:2-13.

McLellan, I.D. & P. Zwick. 2007. New species of and keys to South American Gripopterygidae (Plecoptera). *Illiesia*, 3:20-42.

McLellan, I., M. Mercado, & S. Elliott. 2005. A new species of *Notoperla* (Plecoptera: Gripopterygidae) from Chile. *Illiesia*, 1:1-7

Navás, L. 1929. Plecópteros. – *In: Insectos del Museo de Hamburgo: Boletín de la Sociedad Entomológica de España*, 12:75-83.

Stark, B.P., C. Froehlich, & M. del C. Zúñiga. 2009. South American stoneflies (Plecoptera). *Aquatic Biodiversity in Latin America, Volume 5*. Pensoft, Sofia-Moscow. 154 pp.

Vera, A. 2006a. A new species of *Teutoperla* Illies, 1963 from Chile: *Teutoperla maulina* n. sp. (Plecoptera, Gripopterygidae), with comments about its biology. *Acta Entomológica Chilena*, 30:29-38. [Spanish with English abstract].

Vera, A. 2006b. New species of Gripopterygidae of Chile, *Potamoperla testacea* n. sp. (Insecta: Plecoptera). *Gayana*, 70:168-175. [Spanish with English abstract].

Vera, A. 2008a. New species of Notonemouridae (Plecoptera) from Chile, *Neonemura maculata* n. sp. *Acta Entomológica Chilena*, 32:23-26. [Spanish with English abstract].

Vera, A. 2008b. A new species of *Chilenoperla* (Plecoptera: Gripopterygidae) and the taxonomic consequence of the discovery of its nymph. *Gayana*, 72:144-156. [Spanish with English abstract].

Vera, A. 2009. *Pehuenioperla llaima*, a new genus and species of Gripopterygidae (Plecoptera) from South America. *Revista de la Sociedad Entomológica Argentina*, 68:317-327. [Spanish with English abstract].

Vera, A. 2011. New distributional records of *Notoperla* Enderlein (Insecta: Plecoptera), with taxonomic and biological comments. *Anales*

Stark, B.P. & J.C. Morse. 2013. A New Species of *Neonemura* (Plecoptera: Notonemouridae), and Records of Stoneflies from Aisén Province, Region XI, Chile. *Illiesia*, 9(10):110-115. Available online: <http://www2.pms-lj.si/illiesia/Illiesia09-10.pdf>

- Instituto Patagonia (Chile), 39:109-112. [Spanish].
- Vera, A. 2012. A new species of *Chilenoperla* (Plecoptera: Gripopterygidae) from the Andes of South America. *Zootaxa*, 3268:63-68.
- Vera, A. & A. Camousseight. 2006. Current state of knowledge of Plecoptera of Chile. *Gayana*, 70:57-64. [Spanish with English abstract].
- Vera, A., A. Zuñiga-Reinoso & C. Muñoz-Escobar. 2012. Historical perspective on the distribution of *Andiperla willinki* "Patagonian Dragon" (Plecoptera: Gripopterygidae). *Revista Chilena de Entomología*, 37:87-93. [Spanish with English abstract].
- Zwick, P. 1972. On *Neonemura illiesi* nov. spec. and some other stoneflies from Chile (Ins., Plecoptera). *Studies on the Neotropical Fauna*, 7:95-100.

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