



## The presence of species of *Pseudochironomus* Malloch 1915 (Diptera: Chironomidae) in watercourses of Chaco Serrano Ecoregion (Argentina, South America)

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### Abstract

Male imagos of *Pseudochironomus viridis* (Kieffer) are redescribed, the immature stages are described and figured for the first time. During this study, larva and pupal exuviae associated to *P. richardsoni* (Malloch) were recorded for the first time for South America. The specimens were collected from a stream and a river in the Pampasic Hills System in the Chaco Serrano ecoregion of Argentina.

**Key words:** *Pseudochironomus*, redescription, first record, Chaco Serrano, Argentina, Neotropical Region

### Introduction

The Genus *Pseudochironomus* (Malloch) has a wide distribution in North America, 13 species presently described (Sæther 1977). Two of the three species of *Pseudochironomus* described by Edwards (1931) for Argentina and southern Chile currently belong to the genus *Riethia* Kieffer, 1917 of Gondwanan distribution. *Pseudochironomus* is represented in South America only by *P. viridis* Kieffer (1925) for the Alta Gracia locality in the Province of Córdoba, Argentina. Roback (1960) in his Catherwood Expedition also recorded and redescribed the male and female imagos from Peru.

The aim of this work was to extend the description of the adult male and describe for the first time the pupae and larvae of *P. viridis* from samples collected in the province of Catamarca and San Luis, Argentina.

During the analysis of this material pupal and larval associated exuviae of *P. richardsoni* (Malloch) were also found, being the first record of the species for South America.

### Material and methods

Larvae, pupae with pharate imagos were obtained from driftnets and surber samplers and male adults were collected with light trap. The material was preserved in ethanol 80 % cleared in 10% KOH and slide-mounted in Canada balsam and Euparal for microscopic observation. General terminology and abbreviations follow Sæther (1980). Total and wing lengths are given in mm, other measurements in µm; the measurements are given as range, followed by mean, and the number of specimens in parenthesis. The coloring of the figures follow Gilka (2008).

Material examined was deposited at the La Plata Museum of Natural Science (MLP), La Plata, Argentina and at the Institute of Limnology “Dr. R. A. Ringuelet” (ILPLA), La Plata, Argentina.

## *Pseudochironomus viridis* (Kieffer, 1925)

*Pseudochironomus viridis* (= *Proriethia viridis*) Kieffer 1925: 79–81.

*Pseudochironomus viridis* Roback 1960: 98.

**Diagnostic characters.** Males of *P. viridis* can be distinguished from other *Pseudochironomus* species by having thorax and abdomen almost uniformly brownish with pale areas at setae bases; all legs with pale femur, tibia of PI entirely brown, tibia of PII and PIII and basal 2/3 of  $ta_1$  of PIII pale, rest of all tarsi brownish. Third palpomere with a slight fingerlike process. Total length 5.23–5.96. AR 1.41–1.63. VR 1.12–1.14. LR (PI) 0.96–1.00, (PII) 0.50–0.57, (PIII) 0.58–0.62. Thorax with about 15 dorsocentrals in one row. Gonostylus smaller than gonocoxite, HR 1.44–1.53. HV 3.93–4.24. Pars ventralis divided only join at base. Superior volsella curved toward each other, apically concave ending as two points, completely naked.

The **pupa** is brown yellowish, 5.33–6.93 long, thoracic horn 414–580 long, smooth, shorter branch not discernible, probably not present. Abdomen with TI with two patches of shagreen well defined or slightly produced; TII with 84–124 posterior hooklets; SI with one pair of tubercles fully covered with spines and the other granulate or with few and very small spines; segments V–VIII with 3, 4, 4, 5 L *taeniate* setae; anal lobe with 257–356 in a double fringe of taeniate setae and a pair of dorsal setae, SVIII with 3–8 comb-like caudo lateral spines.

The **larva** has a slightly arcuate mentum with 13 teeth, second lateral tooth small, fifth very wide tooth and sixth normal laterally displaced. AR 1.7–2.5, basal antennal segment 73–89 long, third antennal segment 0.6 times as long as second, antennal blade equal or slightly longer than segments 2–5. Parapods with about 15 claws.

**Material examined.** ARGENTINA, Catamarca Province, El Simbolar stream (28° 39'02, 21' S and 66° 03'11.69' W) located at 980 m a s l; one male and pupal exuviae associated, 13.vii.12, drift net (MLP); one male, 26.v.12, light trap; two pupal exuviae, 13.vii.12, (El Simbolar pools) hand net; two associated larval and pupal exuviae, 11.viii.06, drift net, Rodriguez Garay col., (ILPLA); San Luis Province, Rio Grande river (32°50'S and 66°05'O) located at 1600 m a s l one male and pupal exuvia, two larval exuviae, one pupal exuvia, 11.v.06; one male, 17.xi.06; one pupal exuvia, 27.ii.08; two pupal exuvia, 16.xi.08, Paggi & Medina col. (ILPLA).

**Description** (Figs 1–17).

**Male** (n = 4 except when otherwise stated)

Total length 5.23–5.96, 5.49; wing length 2.59–2.86, 2.75 (3); total length / wing length 1.97–2.16, 2.09 (3); wing length / length of profemur 2.38–3.01, 2.76 (3).

**Coloration:** General coloration uniformly brown. Wing hyaline with yellow veins. Fore leg with femur yellow, tibia and tarsi all brown; mid leg with femur yellow, tibia light brown and tarsi all brown; hind leg with femur yellow, tibia and proximal 2/3 of  $ta_1$  yellow to light brown, distal part of  $ta_1$  and  $ta_{2-5}$  brown (Fig. 1).

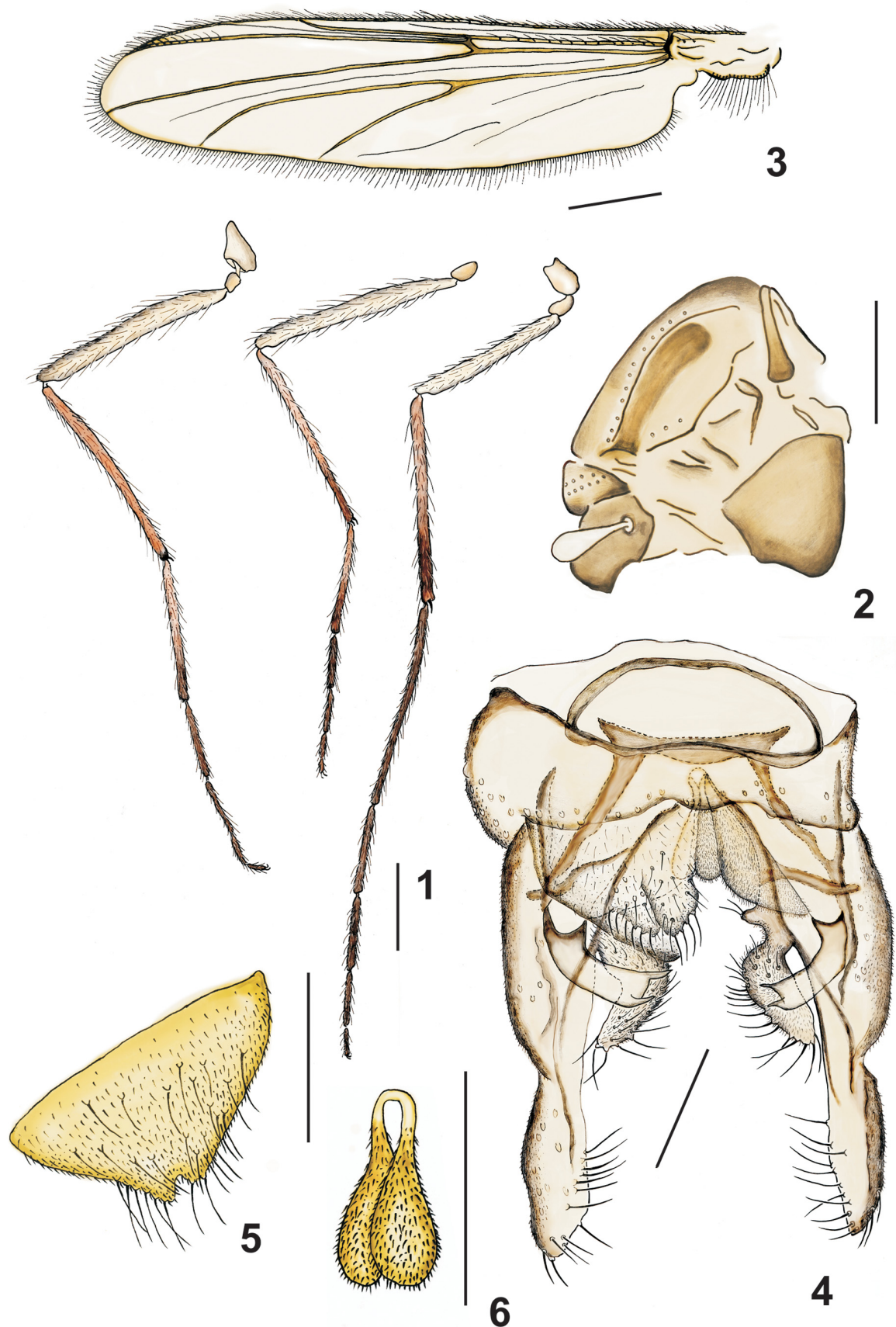
**Head.** AR = 1.41–1.63, 1.53 (3); last flagellomere length 654–696, 679 (3); temporal setae 25–33, 30. Clypeus with 10–17, 14 setae. Tentorium 182–199, 190 (3) long. Palpomere -lengths ( $\mu\text{m}$ ) 58–75, 66; 58–75, 67; 116–166, 137; 124–215, 174; 182–273, 242. Third palpomere with a slight fingerlike process.

**Thorax.** Anteprenotals 6–8, 7, small; dorsocentrals 14–16, 15 in a single row, arising from pale areas; prealars 3–5, 5; scutellum with 19–24, 22 setae irregularly distributed (Fig.2).

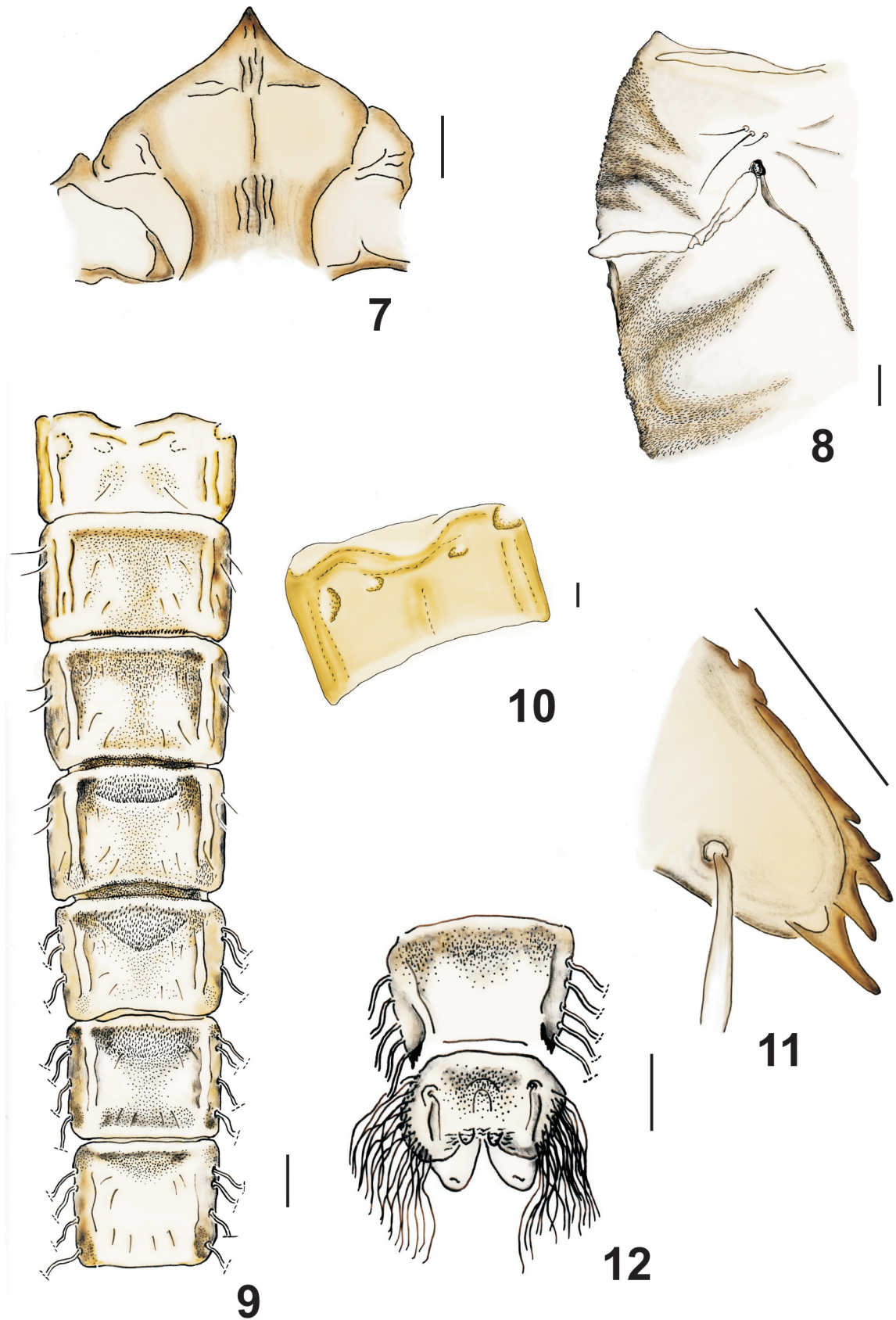
**Wing** (Fig. 3). VR = 1.12–1.14 (3); brachiolum with 2 setae, R with 13–17 setae,  $R_1$  with 1 sensitive organ,  $R_{4+5}$  10–11 apical setae. Squama with 16–18, 17 (3) setae.

**Legs.** Spur of foretibia 57–61, 58 (3) long; spurs of midtibia 55–65, 58 (3) and 49–61  $\mu\text{m}$  long; spurs of hind tibia 57–91, 73 and 63–65 long. Sensilla chaetica 7–8 on  $ta_1$  of each PII and PIII. Length (in  $\mu\text{m}$ ) and proportions of legs as in Table 1.

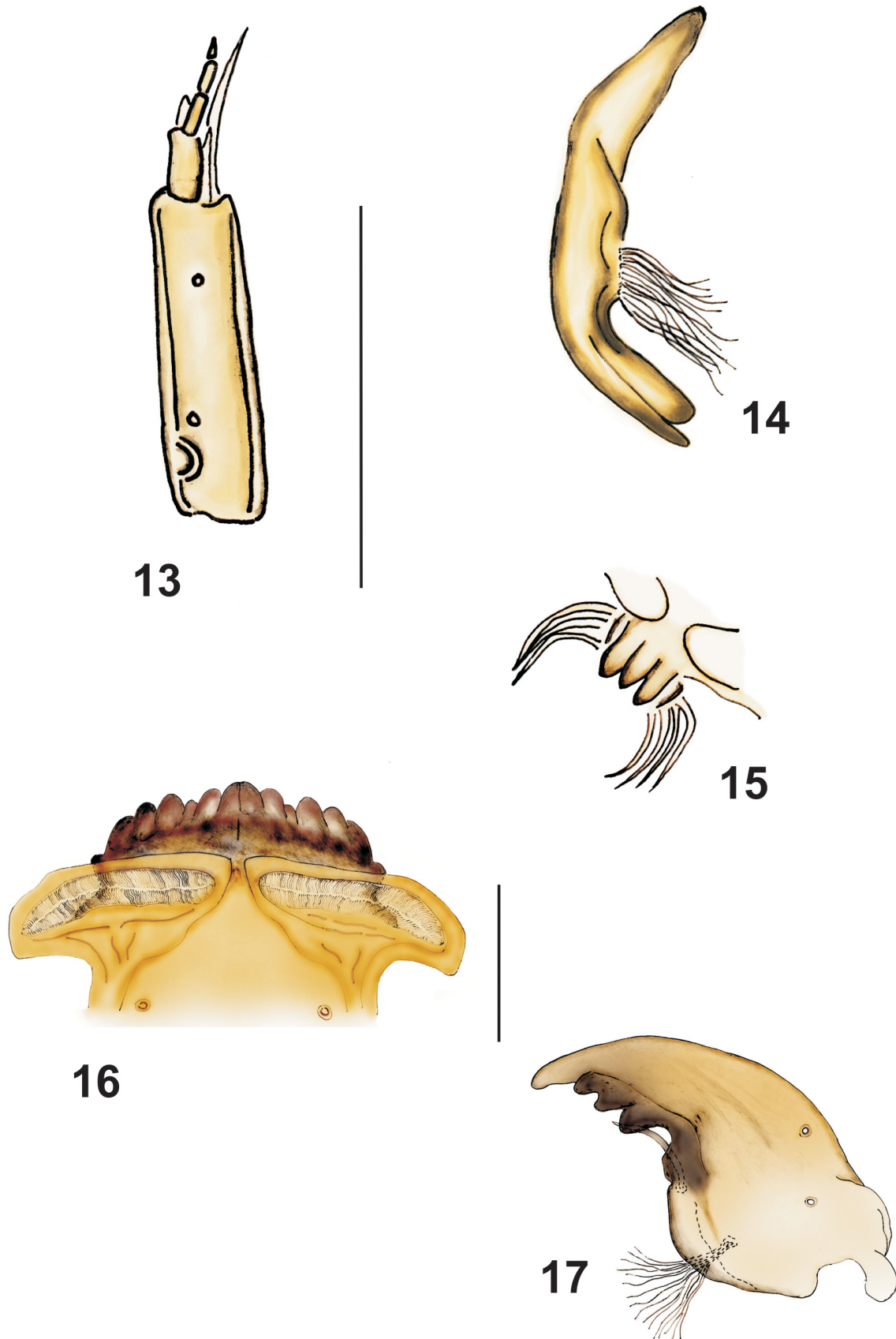
**Abdomen.** Dark brown colored with pale areas in the base of setae which are homogeneously distributed in all the segments. *Hypopygium* (Fig. 4). Posterior margin of tergite IX with median notch (Fig. 5) with 32 setae. Laterosternite IX with 9 setae. Phallapodeme 83–91, 85 long. Transverse sternapodeme 83–157, 126 long. Superior volsella 81–101, 87 long curved toward each other, apically concave ending as two points, totally naked; inferior volsella foot shaped, 75–83, 79 long, with microtrichia and long setae, longest apical setae 51 long, median volsella (2a) 8  $\mu\text{m}$  long bears 1 apical setae and 1 subapical setae 30  $\mu\text{m}$  long. Gonocoxite 199–215, 207  $\mu\text{m}$  long. Gonostylus 133–149, 139 long. HR = 1.44–1.53, 1.49; HV = 3.93–4.24, 4.04. Pars ventralis divided into two 49–61, 56 long and 14–18, 16 wide lobes, join at base (Fig. 6).



**FIGURES 1–6.** *Pseudochironomus viridis* (Kieffer), **male**: 1, color pattern of legs, anterior to posterior from right to left (scale= 500  $\mu$ m); 2, thorax (scale= 100  $\mu$ m); 3, wing (scale = 500  $\mu$ m); 4, hypopygium, dorsal view, half right tergite IX removed (scale= 100  $\mu$ m); 5, detail of posterior margin of tergite IX (scale= 100  $\mu$ m); 6, pars ventralis (scale= 100  $\mu$ m).



**FIGURES 7–12.** *Pseudochironomus viridis* (Kieffer), pupa: 7, frontal apotome; 8, thorax frontal part with thoracic horn; 9, tergites I–VII shagreen; 10, detail of tubercles of SI; 11, caudolateral spines of sternite VIII; 12, tergite VIII and anal lobus (scales = 100  $\mu$ m).



**FIGURES 13–17.** *Pseudochironomus viridis* (Kieffer), larva: 13, antenna; 14, premandible; 15, pecten epipharyngis; 16, mentum; 17, mandible (scales = 100  $\mu$ m).

**TABLE 1.** Lengths (in  $\mu\text{m}$ ) and proportions of legs of *Pseudochironomus viridis* (Kieffer) (male,  $n = 3$ ).

	Fe	Ti	Ta <sub>1</sub>	Ta <sub>2</sub>	Ta <sub>3</sub>
P <sub>1</sub>	934–1100, 1010	1141–1370, 1259	1100–1328, 1231	498–540, 519	394–436, 415
P <sub>2</sub>	1058–1245, 1162	1079–1204, 1155	540–685, 629	291–311	228–249
P <sub>3</sub>	1100–1307, 1176	1141–1411, 1266	664–872, 754	311–457, 401	228–353, 304

continued.

	Ta <sub>4</sub>	Ta <sub>5</sub>	LR	BV	SV
P <sub>1</sub>	270–332, 311	166–187, 173	0.96–1.00, 0.98	2.39–2.54, 2.47	1.79–1.89, 1.84
P <sub>2</sub>	145	125	0.50–0.57, 0.54	3.39–3.78	3.56–3.96, 3.70
P <sub>3</sub>	125–208, 180	104–145, 125	0.58–0.62, 0.59	2.74–3.81, 3.23	3.12–3.41, 3.25

**Female** only pharate not well discernible.

**Pupa** ( $n = 8$  except when otherwise stated)

Total length 5.33–6.93, 6.41 mm. Exuviae brownish yellow.

*Cephalotorax*. Frontal apotome as in figure 7, frontal setae absent. Thoracic horn (Fig. 8), 414–580, 511 (3) long, smooth, shorter branch not discernible. Three precorneals, anterior 53–108, 73 (5), median 122–172, 154 (5), posterior 41–81, 66 (5) long; 2 median antepnotals 99–157, 127 (5(not drawn), dorsocentrals, 1<sup>st</sup> 33–83, 52 (3), 2<sup>nd</sup> 37–50, 43 (3), 3<sup>th</sup> 31–50, 41 (3), 4<sup>th</sup> 31–41, 38 (3), 1<sup>st</sup>–2<sup>nd</sup> separated from 3<sup>th</sup>–4<sup>th</sup> by 373 long.

*Abdomen*. (Fig. 9). TI with 2 patches of shagreen, patches weakly visible in the specimens from San Luis; TII with 84–124, 109 posterior hooklets; TII–TVI covered with shagreen except postero lateral margins, oral shagreen stronger; T III–VII with antero median patch of spinules over a light pigmentation background; TVI with posterior band of strong spinules; TVIII with antero median and lateral shagreen. Paratergites V–VII with anterior field of fine shagreen. Conjunctives III/IV to IV/V with 3–5 rows of sclerotized spinules with light base. SI with one pair of tubercles fully covered with spines, the other granulose (San Luis specimens) or with few and very small spines (Catamarca specimens) (Fig. 10); SII, III with anterior transverse band of spinules; V–VIII with anterolateral patch of spinules. Pedes spurii A on SIV–VII. Segment VIII with 3–8, 5 comb-like caudolateral spines 8–30  $\mu\text{m}$  long (Fig. 11). Segment II–IV with 2 small L setae and a 3<sup>rd</sup>. dorsolateral, segment V–VIII with 3, 4, 4, 5 L taeniate setae. Anal lobe 257–356, 315  $\mu\text{m}$  long, with 25–54, 35 double fringe of taeniate setae and a pair of dorsal setae (Fig. 12).

**Larval exuviae** ( $n = 4$  except when otherwise stated)

*Coloration*. Head brown; mentum, mandibular teeth except apical tooth and occipital margin dark brown.

*Head*. Antenna (Fig.13), with 5 segments, length of antennal segments 73–89, 78; 16–20, 18; 10–14, 11; 8–6, 7; 4, AR = 1.7–2.5, 1.8; second antennal segment 1.4–1.6 times as long as third; blade equal or slightly longer than segments 2–5, 41–45, 43 long; basal antennal segment 20–22, 21 wide, distance from base to ring organ 12–14, 13, to basal mark of setae 18–22 to distal mark 57–61. Premandible 106–108 long as in Fig. 14. Pecten epipharyngis as in figure 15. Mentum (Fig. 16), with median tooth and 6 lateral teeth, second lateral tooth small, fifth very wide that makes sixth appeared like separated, ventromental plates narrow. Mandible (Fig. 17), 173–203, 192 long.

*Abdomen*. Not measurable in the exuviae.

### ***Pseudochironomus c.f. richardsoni* Malloch**

*Pseudochironomus richardsoni* Malloch 1915: 500; Saether, 1977: 66; Jacobsen 2008: 16.

**Material examined.** ARGENTINA, 1 larval and pupal exuvia associated, San Luis, Carolina stream, 18.i.07; Rio Grande river, 1 pupal exuvia, 16.xi.08; A. C. Paggi and A. I. Medina col. (ILPLA).

**Pupal exuvia** ( $n = 2$ ): The following measurements are different from the original description. Total length 5.85. Cephalotorax: Thoracic horn with longer branch about 870, maximum width about 149, shorter branch not well discernible. Precorneal setae, anterior about 112; median about 150; posterior about 76; antepnotal setae about 102–122 long; Dc<sub>1-2</sub> and Dc<sub>3-4</sub> 10–12 apart, Dc<sub>3</sub> separate 265–376 of Dc<sub>2</sub>.

Abdomen: Tergite II with 65–80 posterior hooklets. Sternite VIII with 5 caudolateral spines. Anal lobe 298–373 long with 14 fringe setae.

**Larva** (n=1): (The following measurements are different from the original description). Total length about 4.15. Length of antennal segment ( $\mu\text{m}$ ): 77:16:10:7:4; AR = 2.1; basal antennal segment 22 wide, distance from base to ring organ 12, to basal mark of seta 20, to distal mark 55; premandible 97.44 long; mandible 179 long.

Abdomen: Procercus 41 high, 30 wide, with 8 apical setae about 331 long; supraanal setae about 50 long. Each parapod with 15 claws.

**Remarks.** The studied specimens share widely the diagnostic characters of *P. richardsoni* except the larval mentum which has 13 teeth instead of 9, and each posterior parapod with 15 claws instead of 55 of the Nearctic specimens (Saether, 1977), these differences probably represent a geographic variation within the same species. The presence of *P. richardsoni* in Argentina represents a wide distribution of this species from the Nearctic to the Neotropical Region.

## Discussion

The presence of a slight fingerlike lobe on the third palp suggests a relation between *P. viridis* and *P. fulviventr* (Joh.) (Saether, 1977), but the former differs from the latter in having TIX of the hypopygium apically emarginated with a median notch and a superior volsella apically concave appearing as separated into two lobes, pars ventralis completely divided, with a narrow base, parallel sided and hairy.

The pupa differs in having SI with one pair of tubercles covered with spines and the other granulose; only 35 taeniate setae in a double row of the anal lobe instead of 60–70 setae of *P. fulviventr*, lobes underneath gonopodal sheaths without spines and SVIII with 3–8 comb-like spines caudolaterally without lateral spinules.

The larva differs in having a slightly arcuate mentum with fifth very wide lateral tooth and sixth normal or both normal teeth.

The tribe Pseudochironomini was erected by Saether (1977) to group the genera *Manoa* Fittkau, *Riethia* Kieffer, *Aedokritus* Roback and *Pseudochironomus* Malloch on the basis of male characters.

Recently Trivinho–Strixino *et al* (2009) have described a species of the genus *Riethia*, *R. truncatocaudata* (= *Pseudochironomus truncatocaudatus* Edw. 1931) in all its life history stages with a complete diagnosis.

The present description in all life stages of *Pseudochironomus viridis* allows us to discuss its relation with *Riethia* and confirm the presence of both genera in South America as was suspected thanks to the description of some isolated immatures (Wiedenbrug, 2000). The adults of *Pseudochironomus* differ from *Riethia* by the parallel-sided extension of eyes separated by more than the diameter of one scape, thorax without acrostichals, legs with pulvilli and sensilla chaetica, pseudospurs absent. Hypopygium presents volsellae without pectinate scales, pars ventralis is present.

The pupae share with *Riethia* the unbranched, tubular, smooth thoracic horn instead of two branches described in Saether (1977), though Jacobsen (2008) in his key described this character also for *Pseudochironomus*. The presence of two pairs of tubercles in sternite I and the presence of dorsal setae in anal lobe separate this genus from *Riethia*. The larvae share most of the characters among them.

**Study area.** The Chaco Serrano is a district that corresponds to the phytogeographic province of Chaco and the Chaco domain (Cabrera & Willink, 1980). The so-called Chaco Serrano extends from north to south over the Subandean and Pampean Hills System. It occupies the lower slopes of hills and ravines, forming a broad ecotone within the Yungas and Monte and reaching about 1800 m a s l.

The Simbolar stream belongs to the secondary basin of the Del Valle River framed by the Ambato Hills System. It presents on its way until reaching the 811 m a s l a dendritic drainage type, the climate is semi-arid of hills and “bolsons” with rainfall between 450 and 550 mm annual type torrential, being December, January and February the rainiest of the year. The Simbolar stream is characterized by depositional areas (pools) with low flow velocity (0.07–0.10  $\text{cm/s}^2$ ) and predominant sand substrate (92%) and riffle areas with higher flow velocity (0.26–0.40  $\text{m/s}^2$ ) and predominant gravel substrate (39%) with sand and pebble in lower proportion (Rodríguez–Garay & Paggi, in press). *Pseudochironomus viridis* was found in both areas.

The Rio Grande belongs to the upper basin of the Quinto River which drains on the eastern slope of the San Luis Hills. It is located in the wettest area of the province considered semi-arid, with an annual average rainfall of

550–700 mm, having a moisture gradient from high to low from the headwaters to the foothills. It travels around 24 km before being regulated by the reservoir Esteban Agüero, with an average annual flow rate of 2.81 m<sup>3</sup> s<sup>-1</sup> within the vegetal formation called grassland and mountain forests. The Rio Grande is characterized by a substrate consisting mainly of medium and coarse particles (pebble, cobble and gravel) and a lower proportion of small and fine particles (Medina *et al.*, 2008).

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## Literature cited

- Cabrera, A.L. & Willink, A. (1980) Biogeografía de América Latina, OEA, *Ser. Biol., Monogr.*, 13, 1–122.
- Edwards, F.W. (1931) *Diptera of Patagonia and South Chile. Part II. Fascicle 5. - Chironomidae*. Trustees of the British Museum (Natural History), London, pp. 233–331.
- Gilka, W. (2008) A rapid technique of producing spatial colour illustrations of diagnostic structures in small dipterans. *Dipteron*, 24, 8–10.
- Jacobsen, R.E. (2008) A Key to the Pupal Exuviae of the Midges (Diptera: Chironomidae) of Everglades National Park, Florida. *U.S. Geological Survey Scientific Investigations Report*, 2008–5082, 119 pp.
- Kieffer, J.J. (1917) 'Chironomides d'Amérique conservés au Musée National Hongrois de Budapest', *Annales Historico-naturales Musei Nationalis Hungarici*, 15, 292–364.
- Kieffer, J.J. (1925) Chironomidae de la République Argentine. *Annals Société Scientifique Bruxelles*, 1925, 73–92.
- Malloch, J.R. (1915) The Chironomidae, or midges of Illinois, with particular reference to the species occurring in the Illinois River. III. *State Laboratory Natural History Bulletin*, 10, 275–543.
- Medina, A.I., Scheibler, E.E. & Paggi, A.C. (2008) Distribución de Chironomidae (Diptera) en dos sistemas fluviales ritrónicos (Andino-serrano) de Argentina. *Revista de la Sociedad Entomológica Argentina*, 67 (1–2), 69–79.
- Roback, S.S. (1960) Results of the Catherwood Peruvian- Amazon Expedition. New species of South American Tendipedidae (Diptera). *Transactions of American Entomological Society*, 86, 87–107.
- Rodríguez-Garay, G.N. & Paggi, A.C. (2015) Chironomidae (Diptera) en cursos de agua de Puna y Chaco Serrano de Catamarca (Argentina): primeros registros y distribución de géneros y especies. *Revista de la Sociedad Entomológica Argentina*. [in press]
- Sæther, O.A. (1977) Taxonomic studies on Chironomidae: *Nanocladius*, *Pseudochironomus*, and the *Harnischia* complex. *Bulletin of the Fisheries Research Board of Canada*, 196, 1–143.
- Sæther, O.A. (1980) Glossary of chironomid morphology terminology (Chironomidae: Diptera), *Entomologica Scandinavica*, 14 (Supplement), 1–51.
- Trivinho-Strixino, S., Roque, F.O. & Cranston, P.S. (2009) Redescription of *Riethia truncatocaudata* (Edwards, 1931) (Diptera: Chironomidae), with description of female, pupa and larva and generic diagnosis for *Riethia*. *Aquatic Insects*, 31 (4), 247–259.  
<http://dx.doi.org/10.1080/01650420902787556>
- Wiedenbrug, S. (2000) 'Studie zur Chironomidenfauna aus Bergbächen von Rio Grande do Sul, Brasilien', doctoral dissertation, Ludwig-Maximilians-Universität München, München, 444 pp.