

Description of the eggs and immature stages of *Rhagovelia gastrotricha* Padilla-Gil, 2011 and *Paravelia daza* Padilla-Gil & Moreira, 2011 (Hemiptera: Heteroptera: Veliidae)

Descripción de los huevos y estados inmaduros de *Rhagovelia gastrotricha* Padilla-Gil, 2011 y *Paravelia daza* Padilla-Gil & Moreira, 2011 (Hemiptera: Heteroptera: Veliidae)

Dora N. Padilla-Gil

Universidad de Nariño, Ciudad Universitaria Torobajo, Departamento de Biología, Bloque 3, piso 4, San Juan de Pasto, Nariño, Colombia. E mail: dnpadilla@udenar.edu.co

RESUMEN

Los estadios de huevo y los estadios ninfales I-V de *Rhagovelia gastrotricha* Padilla-Gil, 2011 y *Paravelia daza* Padilla-Gil & Moreira, 2011, especies del suroeste de Colombia, son descritas e ilustradas por primera vez. Los estadios inmaduros I-III de *R. gastrotricha* son muy similares pero difieren en las medidas morfométricas principalmente en el ancho de la cabeza y ancho del pronoto; los estadios IV y V se caracterizan por los parches de color oscuro en el abdomen ventral, en el desarrollo del abdomen, de las antenas y por los caracteres sexuales de los últimos segmentos abdominales. Los estadios inmaduros de *P. daza* se distinguen principalmente por las setas oculares en todos los estadios y fovea dorsal en la esquina de cada ojo; las medidas morfométricas del ancho de la cabeza y del pronoto, así como por la disposición de las placas torácicas dorsales; los estadios IV y V por su dimorfismo sexual y parches de color oscuro en el abdomen ventral.

Palabras clave: Gerromorpha, huevos, ninfas, arañas acuáticas, Andes, Región Neotropical.

ABSTRACT

The eggs and nymphal stages I-V of *Rhagovelia gastrotricha* Padilla-Gil, 2011 and *Paravelia daza* Padilla-Gil & Moreira, 2011, species from southwestern Colombia, are described and illustrated for first time. Immature stages I-III of *R. gastrotricha* are very similar but differ in the morphometric measures mainly in the width of the head and the width of the pronotum; stages IV and V are characterized by patches of dark color on the ventral abdomen, in the development of the abdomen, of the antennae and the sexual characters of the last abdominal segments. Immature stages of *P. daza* are distinguished by ocular setae in all instars and by having a dorsal pit on the corner of each eye; the morphometric measures of the width of the head and the width of the pronotum, and the location of the dorsal thoracic plates; stages IV and V by its sexual dimorphism and patches of dark color on the ventral abdomen.

Key words: Gerromorpha, eggs, nymphs, waterstriders, Andes, Colombia, Neotropical Region.

INTRODUCTION

Three subfamilies of Veliidae occur in South America: Rhagoveliinae, Veliinae and Microveliinae. Rhagoveliinae is represented only by the genus *Rhagovelia* Mayr, 1865; Veliinae by the genera *Oiovelia* Drake & Maldonado-Capriles, 1952, *Paravelia* Breddin, 1898, *Platyvelia* Polhemus & Polhemus, 1993, *Steinovelia* Polhemus & Polhemus, 1993, *Stridulivelia* Hungerford, 1929, and *Veloidea* Gould, 1934; and Microveliinae by *Microvelia* Westwood, 1834, *Euvelia* Drake, 1957, and *Husseyella*, Herring, 1955.

The nymphs of the Gerromorpha of South America, and of the Neotropical Region as a whole, are very poorly studied, and most of the species have undescribed immature stages (Heckman 2011). An exception is the important work concerning the immature stages of the species *Oiovelia cumucumana* Drake & Capriles, 1952 from Argentina, published by Mazzucconi & Bachmann (1997).

Immature stages of North American species *Platyvelia brachialis* Stal, 1860 and *Rhagovelia obesa* Uhler, 1871 were described by Korch *et al.* (1999) and Cheng & Fernando (1971) respectively. There are not descriptions of immature stages of

Neotropical species of the genera *Paravelia* and *Rhagovelia*.

The genus *Rhagovelia* is currently represented in Colombia by 51 species in nine species groups, and exhibits a wide distribution along the geographical regions of the country (Padilla-Gil 2012). Out of these species, *Rhagovelia gastrotricha* Padilla-Gil, 2011 was recently described and belongs to the *bisignata* group. *Paravelia* is less diverse in Colombia, comprising only six species: *P. recens* (Drake & Harris, 1935), *P. flavomarginata* (Hungerford, 1930), *P. columbiensis* (Hungerford, 1930), *P. fanera* Padilla-Gil, 2013, *P. acantha* Padilla-Gil, 2013 and *P. daza* Padilla-Gil & Moreira, 2011 (Padilla-Gil 2012, 2013). Both *R. gastrotricha* and *P. daza* are exclusive from the Andes of southwestern Colombia (Padilla-Gil 2011; Padilla-Gil & Moreira 2011). In the present paper the eggs and five nymphal instars of these two species are described and illustrated for the first time, based on recently collected material.

The description of the immatures of *R. gastrotricha* is based on nymphs that developed into apterous adults, in addition to fifth instar nymphs of a macropterous female and an apterous male. As for *P. daza*, representatives of the immature stages

analyzed developed into apterous adults. Both species have five instars, which are similar within each species. The differences among immature instars are mostly quantitative.

MATERIAL AND METHODS

Morphology was studied and measurements were taken on specimens preserved in 70% alcohol. Whenever available, at least three nymphs of each instar and one adult female were selected for each species. Ripe ovarian eggs were dissected from the adult female abdomen.

All measurements are given in millimeters. Specimens are deposited at the Colección de Entomología, Universidad de Nariño (PSO-CZ).

Abbreviations used are: egg length (EL), egg width (EW), body length (L), body width (W), head width (wh), lengths of antennomeres I–IV (An I–IV), width of pronotum (wp), width of mesonotum (wm), length/ width of abdomen (Ab L/W).

RESULTS

Rhagovelia gastrotricha Padilla-Gil 2011

Material examined. COLOMBIA, Nariño, Barbacoas, Altaquer, Río Nembi, 29.IX.2010, D. N. Padilla leg., 2 specimens of first instar, 2 of second instar, 4 of third instar, 3 of fourth instar, 2 of fifth instar (macropterous), 4 of fifth instar (apterous).

Egg (Fig. 1), EL: 1.02, EW: 0.40. Elongate oval in shape with ventral side flat and of white color. Three females dissected have 5 to 7 eggs.

Nymphal instars. First instar (Fig. 2). L: 1.10, W: 0.70, wh: 0.52, An I–IV: 0.28, 0.12, 0.20, 0.34, wp: 0.60, wm: 0.70, Ab L/W: 0.42/0.60. Eyes red; fourth segment rostral, antennae, dorsum of body and legs brown; pleural region, connexives and venter of body pale yellow. Ventral region lacking darker spots.

Second instar (Fig. 3). L: 1.50, W: 0.92, wh: 0.62, An I–IV: 0.30, 0.14, 0.24, 0.36, wp: 0.74, wm: 0.92, Ab L/W: 0.68/0.88. Similar to first instar, dorsum dark brown, with abdominal tergites well developed.

Third instar (Fig. 4). L: 1.86, W: 1.08, wh: 0.76, An I–IV: 0.48, 0.26, 0.36, 0.44, wp: 0.90, wm: 1.08, Ab L/W: 0.80/0.98. Similar to previous in color, with more developed and darker thorax. The genital segments start to be defined.

Fourth instar (Fig. 5). L: 2.32, W: 1.36, wh: 0.96, An I–IV: 0.68, 0.32, 0.52, 0.52, wp: 1.16, wm: 1.36, Ab L/W: 0.88/1.24. Dorsum, greater part of antennae, rostrum, legs (except coxae and trochanters of foreleg and hind leg yellow) and outer rim of connexiva dark brown. Genital segments with sexual dimorphism (similarly to fifth instar).

Fifth instar, apterous form (Fig. 6). L: 3.68, W: 1.72, wh: 1.08, An I–IV: 1.00, 0.60, 0.72, 0.68, wp: 1.40, wm: 1.72, Ab L/W: 1.96/1.56. Similar to fourth instar in color. Female with slightly rounded abdomen and male with segment VIII and proctiger more pronounced (Figs. 9, 10).

Fifth instar, macropterous form (Fig. 7). L: 3.68, W: 1.76, wh: 1.08, An I–IV: 0.96, 0.56, 0.68, 0.64, wp: 1.60, wm: 1.76, length of wing pads: 1.76, Ab L/W: 1.88/1.68. Dorsum dark brown to black, wing pads extending beyond posterior thoracic

border.

Ventral aspect of nymphs. From second to fourth instars the venter of nymphs has darker spots on ventrites IV–VII (Fig. 8). On the fifth instar, the ventrites VI and VII have one spot on ventral middle line (Fig. 9). Nymphs of female and male have different shapes (Figs. 9, 10).

Ecology. Nymphs were found more commonly in fresh, clear, flowing, permanent, and exposed waters. They were observed on aggregations of 10 to 15 individuals near the shore of rivers or streams.

Comparative notes. It was found that the wh and wp of the first instar nymph increased in a ratio of about 1.2 times between each instar.

Paravelia daza Padilla-Gil & Moreira 2011

Material examined. COLOMBIA, Nariño, Pasto, Daza, km 3 vía Buesaco, 27.V.2009, D. N. Padilla, leg., 1 specimen of first instar, 4 of second instar, 3 of third instar, 3 of fourth instar, 4 of fifth instar.

Egg (Fig. 11), EL: 2.20, EW: 0.92. Elongate oval in shape with ventral side flat and of white color. The female dissected had 4 eggs.

Nymphal instars. First instar (Fig. 12). L: 2.20, W: 1.12, wh: 0.76, An I–IV: 0.36, 0.32, 0.40, 0.60, wp: 1.00, wm: 1.08, Ab L/W: 1.08/1.12. Eyes red; fourth rostral segment, antennae, dorsum of the body and legs pale brown; pleural region, connexives and ventral body pale yellow. Body oval. Head rounded anteriorly, excluding eyes subtriangular; ecdysial lines pale brown, Y-shaped, stem wider than arms, arising from posterior margin of head, arms extending to anterior margin of eyes. Eyes globose, ocular setae present and 3 pairs of trichobothria present, first pair posterior to anteclypeus, second pair posterolateral to first pair and third pair medial to inner margin of eyes. Dorsal pit on corner of each eye. Antenna 4-segmented, brown, I article curved and IV longest and tapered apically. Beak 4-segmented, segments I–III pale brown, IV brown, length of segments III > IV > I > II. Thoracic nota with two pair of sclerotized, pale brown, subrectangular plates covering most of dorsum, an anterior pair of plates will form the anterior lobe of the pronotum and posterior pair the posterior lobe and the margin of metanotum; all plates separated in the midline by ecdysial membrane that extends until the end of the abdomen. Abdomen nota with a pair of rectangular mediotergites separated by medial ecdysial membrane, laterotergites absent.

Second instar (Fig. 13). L: 2.92, W: 1.40, wh: 0.92, An I–IV: 0.40, 0.40, 0.44, 0.72, wp: 1.20, wm: 1.40, Ab L/W: 1.68/1.40. Similar to first instar, dorsum dark brown, with thorax and abdomen well developed. Eyes globose, dark brown. Thoracic nota of stages II–V with sclerotized, pale brown, subrectangular plates covering most of dorsum, separated in the midline by ecdysial membrane that extends until the end of the thorax. Metanotal plate oval, narrow. Abdomen nota of stages II–V with a rectangular mediotergite separated by medial ecdysial membrane; laterotergites absent except in stage V.

Third instar (Fig. 14). L: 3.76, W: 1.68, wh: 1.08, An I–IV: 0.64, 0.56, 0.60, 0.80, wp: 1.48, wm: 1.60, Ab L/W: 2.00/1.68. Thoracic and abdominal tergites darker brown, legs pale

brown.

Fourth instar (Fig. 15). L: 5.33, W: 2.16, wh: 1.24, An I–IV: 0.92, 0.68, 0.72, 0.88, wp: 1.64, wm: 1.84, Ab L/W: 2.96/2.16. Dorsum, greater part of antennae, rostrum, legs and outer rim of connexiva dark brown; fourth rostral segment black; dorsum of legs yellow to pale brown.

Fifth instar (Fig. 16). L: 6.93, W: 2.80, wh: 1.36, An I–IV: 1.12, 1.0, 0.88, 1.08, wp: 2.00, wm: 2.28, Ab L/W: 4.00/2.8. Anterior half of pronotum dark brown, posterior half yellow; first abdominal segment yellow with three dark spots; pleura and connexives yellow. Body more elongated. Metanotal plate semitrapezoidal and abdominal tergites slightly decreasing in size and with oblique lateral margins. Laterotergites present more marked in the female nymphs.

Ventral aspect of nymphs. Ventral region yellow. Venter of first to third instars with pale brown spots in ventrites IV–VII (Fig. 17). Fourth and fifth instars all ventrites showing black spots (Fig. 18). Male and female nymphs of V instar with sexual dimorphism (Figs. 18, 19)

Ecology. Nymphs were found more commonly in fresh, clear, flowing, permanent, exposed waters, with very few nymphs collected in temporary, shaded waters. They do not usually inhabit the water surface, being found hidden under rocks or camouflaged with the flats. The nymphs live solitary or in small groups of up to 4 individuals; they are not associated to any other veliid species.

Comparative notes. It was found that the wp of the first instar nymph increased in a ratio of about 1.20 times between each instar.

DISCUSSION

Immature stages of *Rhagovelia gastrotricha*

All measurements increase during development, in all stages the width of the head, the width of the pronotum, and the width of the body from stage III to V are increasing at a rate of 1.2. The length of the body presents a greater growth in the passage of stages I to II (ratio of 1.3) and IV to V (ratio of 1.5). The length of the abdomen takes only proportions similar to the adult in stage V. From the fourth stage the antennomere III is equal to IV and in the fifth stage the antennomere III > IV, condition that remains in the adult.

Rhagovelia gastrotricha has five distinct stages, however, the number of these may vary in other species as in the case of *Rhagovelia obesa* with four stages (Cheng & Fernando 1971). The reduction of number of stages in *R. obesa* is likely to be associated with seasonal environmental conditions from North America and related to its genetics. *R. gastrotricha* lives in the Neotropic and probably is multivoltine. On the other hand the two species do not have many phylogenetic affinities, since *R. obesa* belongs to *obesa* group and *obesa* complex and *R. gastrotricha* belongs to *bisignata* group and *angustipes* complex according to Polhemus (1997).

Morphometric differences showing here for *R. gastrotricha* are not comparable with *R. obesa* because such measures were not taken by Cheng & Fernando (1971). Both species shared some characteristics as the plan of development of structure of the sutures of the head and pronotum as well as the development

of sexual dimorphism from stage IV.

The patches of dark color on the abdominal venter of the stages IV and V and characters considered diagnostics for male adult as the swelling and setae of the ventral abdomen, were not observed on immature of *R. gastrotricha*.

Paravelia daza

Immature stages of *P. daza* are characterized by ocular setae and dorsal fovea on corner of each eye both features have been preserved in the adult. Immature of the genera *Platyvelia* and *Steinovelina* lack ocular setae (Korch *et al.* 1999).

ACKNOWLEDGEMENTS

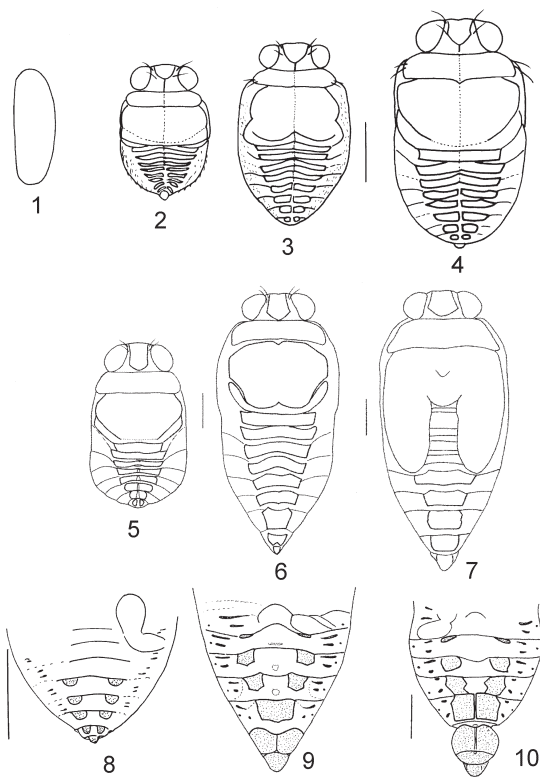
Thanks to Monika Springer, Eduardo Domínguez and two reviewers for their comments on the manuscript and to the Universidad de Nariño.

LITERATURE CITED

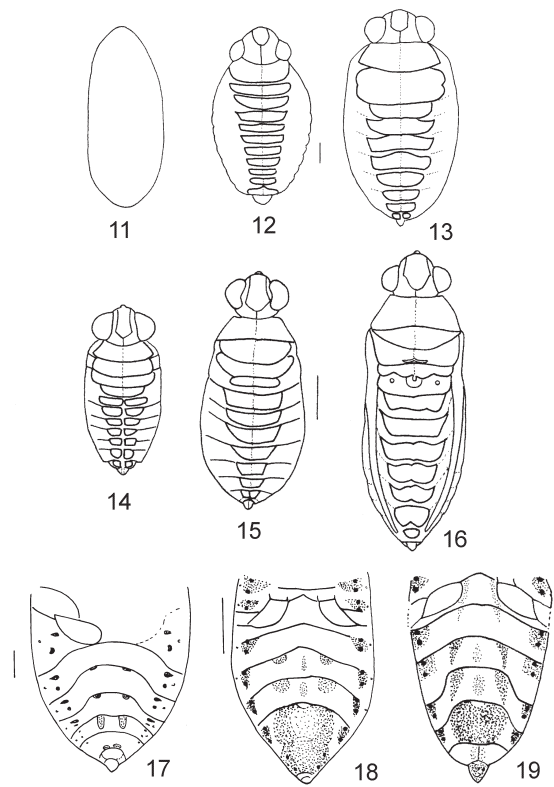
- Cheng, L. & C.H. Fernando. 1971. Life history and biology of the riffle bug *Rhagovelia obesa* Uhler (Heteroptera: Veliidae) in Southern Ontario. *Canadian Journal of Zoology*, 49: 435-442.
- Heckman, C.W. 2011. *Encyclopedia of South American Aquatic Insects: Hemiptera-Heteroptera Illustrated Keys to Known Families, Genera, and Species in South America*. Springer. Dordrecht, Heidelberg, London, New York.
- Korch, P. P., L. Keffer & E. Winter. 1999. Description of immature stages of *Platyvelia brachialis* (Stal) (Heteroptera: Veliidae). *Proceedings of Entomological Society of Washington*, 101: 372-378.
- Mazzucconi, S. A. y A. O. Bachmann. 1997. Notas sobre larvas de heterópteros acuáticos argentinos. Familia Veliidae: *Oiovelia*. *Neotrópica*, 43(109-110): 57-71.
- Padilla-Gil, D.N. 2011. Ten new species of *Rhagovelia* in the *R. angustipes* complex from Colombia (Heteroptera: Veliidae). *Aquatic Insects*, 33(3): 203-231.
- Padilla-Gil, D.N. 2012. Las Veliidae (Heteroptera: Gerromorpha) de Colombia, lista de chequeo y distribución geográfica y altitudinal (pp. 1-20). En: *Memorias 39 Congreso Sociedad Colombiana de Entomología* SOCOLEN. Ibagué, Tolima, Colombia.
- Padilla-Gil, D.N. 2013. Two new species of *Paravelia* Breddin, 1898 (Hemiptera: Heteroptera: Veliidae) from Colombia, with a key to Colombian *Paravelia* species. *Zootaxa*, 3693 (4): 491-502.
- Padilla-Gil, D.N. & F.F.F. Moreira. 2011. A new species of *Paravelia* Breddin, 1898 (Hemiptera: Heteroptera: Veliidae) from Colombia, with a key to Colombian *Paravelia* species. *Zootaxa* (3065): 14-26.
- Polhemus, D.A. 1997. *Systematics of the Genus Rhagovelia Mayr (Heteroptera: Veliidae) in the Western Hemisphere (Exclusive of the angustipes complex)*. Thomas Say Publications in Entomology: Monographs, Lanham, Maryland: Entomological Society of America.

Recibido: 11 de diciembre 2012

Acceptedo: 26 de octubre 2013



Figures 1–10. *Rhagovelia gastrotricha*, immature stages, 1, egg; 2–7; nymphal instars without appendages, dorsal view. 2, first instar; 3, second instar; 4, third instar; 5, fourth instar; 6, fifth instar of apterous form; 7, fifth instar of macropterous form. 8–10, abdomen in ventral view: 8, second instar, 9, fifth instar of macropterous female, 10, fifth instar of apterous male. Figs. 1–10, scale bars 0.5 mm.



Figures 11–19. *Paravelia daza*, immature stages. 11, egg; 12–16, nymphal instars without appendages, dorsal view. 12, first instar; 13, second instar; 14, third instar; 15, fourth instar; 16, Fifth instar; 17–19, abdomen in ventral view: 17, second instar; 18, fifth instar of female; 19, fifth instar of male. Scale bars: Figs. 11–13, 0.025 mm; 14–16 1.0 mm; Fig. 17, 0.025 mm; Figs. 18–19, 1mm.