RESEARCH

Description of the Immature Stages of *Sigara (Aphelosigara) tucma*

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ABSTRACT. Descriptions of the last three nymphal instars of the water boatman *Sigara (Aphelosigara) tucma* Bachmann (Hemiptera: Heteroptera: Corixidae) are provided, for the first time, for specimens collected in northern Argentina; the egg is redescribed. Adults and nymphs were collected in the field. The eggs were obtained by dissection from females. The immature stages were fixed for microscopic examination and illustration and were described with an emphasis on morphometry and chaetotaxy of selected structures. The last three nymphal instars of *S. tucma* can be easily recognized by the body and head lengths and widths; the number of transverse sulcations of the rostrum; the chaetotaxy of trochanters, protibiotarsus, midlegs, metatibia, and metatarsus; and the grade of development of the wing pads. The eggs of the genus *Sigara* can be distinguished by the size and the chorionic surface. The chaetotaxy of the mesonotum, metafemur, and metatibia distinguish groups of species belonging to the last nymphal instar of the genus *Sigara.* A key to the last three nymphal instars of the species of *Sigara* from Argentina is provided.

Key Words: Heteroptera, Corixidae, egg, nymph, chaetotaxy

The cosmopolitan genus *Sigara* Fabricius (Hemiptera: Heteroptera: Corixidae) includes ~70 species in America of medium- to large-sized water boatmen (Morrone et al. 2004). *Sigara* is placed within the tribe Corixini, subfamily Corixinae and is divided into various subgenera (Hungerford 1948a). The genus *Sigara* is represented in Argentina by 18 species, 17 belonging to the subgenus *Tropocorixa* Hutchinson and one to the subgenus *Aphelosigara* Hungerford (Bachmann 1981). The immature stages of *S. (Aphelosigara) tucma* Bachmann are studied in the present contribution.

The genus in America is distributed from Canada to southern Argentina, in Santa Cruz Province and Malvinas Islands (Hungerford 1948a; Bachmann 1960, 1961b, 1962a, 1979; Hungerford and Matsuda 1961; Contartese and Bachmann 1986; Arnett 1993; Morrone et al. 2004). *S. tucma* is only known from a few localities in Argentina (from Salta to Córdoba Provinces) (Bachmann 1981; Morrone et al. 2004). It seems to be frequent in small lentic water bodies with moderate amounts of submerged vegetation (aquatic mosses mainly), at altitudes of 1,500 m a.s.l. in the mountains of northwestern Argentina (Bachmann 1981).

The systematics of the adults of *Sigara* were studied by Hutchinson (1940), Hungerford (1948a), and Bachmann (1960, 1961a,b, 1962a–d, 1963, 1966, 1979, 1981, 1987), and they are comparatively well known, but there are few descriptions of the immature stages available in the literature. Only the eggs of 12 species of *Sigara* have been described (Poisson 1933; Hungerford 1948b; Fernando 1965; Bachmann 1981; Konopko 2012, 2013b). According to the nymphs, there are brief descriptions of the first nymphal instar emphasizing the chaetotaxy of European species of *Sigara*: *S.* (*Sigara*) *concinna* (Fieber), *S.* (*S.*) *lateralis* (Leach), *S.* (*S.*) *striata* (L.), and *S.* (*Subsigara*) *falleni* (Fieber) (Cobben and Moller Pillot 1960); the last nymphal instar of *Sigara* (*Subsigara*) *fossarum* (Leach), *S.* (*S.*) *scotti* (Douglas & Scott), *S.* (*S.*) *falleni*, *S.* (*S.*) *distincta* (Fieber), *S.* (*Sigara*) *striata*, *S.* (*S.*) *dorsalis* (Leach), *S.* (*S.*) *semistriata* (Fieber), *S.* (*S.*) *venusta* (Douglas & Scott), *S.* (*S.*) *limitata* (Fieber), *S.* (*S.*) *lateralis*, *S.* (*S.*) *nigrolineata* (Fieber), *S.* (*S.*) *concinna*, *S.* (*S.*) *stagnalis* (Leach), *S.* (*S.*) *selecta* (Fieber), and *S.* (*S.*) *hellensi* (Sahlberg) (Cobben and Moller Pillot 1960; Nieser 1969); and the last three nymphal instars of *S.* (*Subsigara*) *fossarum*, *S.* (*S.*) *scotti*, *S.* (*S.*) *falleni*, *S.* (*S.*) *distincta*, *S.* (*Sigara*) *striata*, *S.* (*S.*) *semistriata*, *S.* (*S.*) *limitata*, *S.* (*S.*) *nigrolineata*, *S.* (*S.*) *lateralis*), and *S.* (*Sigara*) *janssoni* Lucas (Jansson 1969; López et al. 1996). Melo and Scheibler (2011) presented descriptions of the five nymphal instars of *S. (Tropocorixa) jensenhaarupi* Jaczewski. All the species mentioned above were treated very superficially and were not described in detail, making comparisons difficult. Recently, Konopko (2012, 2013b) described in detail the five nymphal instars of two species of *Sigara* (*S. (Tropocorixa) schadei* (Hungerford) and *S.* (*T.*) *santiagiensis* (Hungerford)) with an emphasis on morphometry and chaetotaxy. Thus, the last two works and this contribution attempt to study the nymphal morphology of *Sigara* in a broader sense, based on comparative approach.

The main goals of this contribution are: 1) to redescribe the egg and to describe and illustrate, for the first time, the last three nymphal instars of *S. tucma*, including a detailed morphometric and chaetotaxic analysis of selected structures, (2) to compare the eggs and the nymphs of the species of *Sigara* described up to the moment, 3) to establish the nymphal characters useful in identifying instars and species of *Sigara*, and 4) to provide an identification key to the last three nymphal instars of the species of *Sigara* from Argentina.

Material and Methods

Adults and nymphs of *S. tucma* have been collected in the field, fixed, and preserved in 96% ethanol. The eggs were obtained by dissection from females. The material is held in the collection of the División de Entomología, Museo Argentino de Ciencias Naturales 'Bernardino Rivadavia' (MACN), Buenos Aires, Argentina.

The taxonomic descriptions of the eggs and nymphs were performed using a Leitz stereomicroscope (at magnifications up to 144×). For each nymph only differences with the previous nymph description are emphasized. Some nymphal specimens were cleared in lactic acid, dissected, and mounted on glass slides in polyvinyl-lacto-glycerol. Observations (at magnifications up to 1,000×) and drawings were made using an Olympus CX31 compound microscope equipped with a

drawing tube. Drawings were scanned and digitally edited. The key to identify the last three nymphal instars of the species of *Sigara* is based on the Argentinean species described up to now.

Morphometric and Chaetotaxic Analysis

Alcohol-preserved material was observed in a Petri dish with 96% ethyl alcohol. Nymphal structures were measured utilizing a Leitz stereomicroscope equipped with a micrometric ocular. Paired structures of each individual were considered independently. The interpretation of the chaetotaxy of the legs follows the one stated in Konopko et al. (2010a).

The following material was measured: eggs, 10; instar III, one specimen; and instars IV–V, five specimens each (Table 1). The chaetotaxy of the following material was studied: instar III, one specimen; and instars IV–V, five specimens each. Figures 15–16, 18–19, and 21–22 show the position of spines, setae, and bristles on the legs.

Results

Sigara (Aphelosigara) tucma.

Material Examined. Argentina. **Salta Province**: pothole on route 19, near Aguas Blancas, 1 instar IV, 7 instar V, 19.XI.2003, S. Mazzucconi coll. (MACN); National Park El Rey, ditch that empties in Sala stream, 1 instar III, 9 instar IV, 3 instar V, 10.XI.2003, S. Mazzucconi coll. (MACN). **Tucumán Province:** San Javier, 15.III.1961 and 18–28.I.1971, 23 dissected eggs, A. Bachmann coll. (MACN) (Figs. 1–24; Tables 1–3).

Table 1. Measurements (in mm) of nymphal instars III–V of *S.* (*Aphelosigara*) *tucma*

Measure	Instar III	Instar IV	Instar V
BL	2.18	3.50–3.60	4.61–5.03
BW	1.34	1.81–1.88	2.28–2.43
HL	0.50	0.74–0.77	0.97–0.99
HW	1.17	1.59–1.64	1.98–2.11
S	0.50	0.55–0.62	0.60–0.69
eW	0.45	0.57–0.60	0.74–0.84
A1L	0.10	0.12–0.13	0.15–0.17
A2L	0.31	0.45–0.48	0.50–0.57
A2W	0.08	0.10–0.12	0.10–0.12
AL	0.41	0.57–0.60	0.67–0.74
PL	0.55	1.02–1.09	1.24–1.36
FE1L	0.39	0.50–0.57	0.59–0.69
TITA1L	0.50	0.69–0.72	0.82–0.92
TITA1W	0.12	0.17–0.20	0.18–0.28
CLL1	0.11	0.18–0.20	0.20–0.23
L1L	0.88	1.21–1.29	1.42–1.61
FE2L	1.17	1.69–1.71	2.16–2.33
TI2L	0.55	0.77–0.79	0.97–1.07
TA2L	0.49	0.62–0.67	0.72–0.79
CL1L2	0.57	0.77–0.82	0.94–1.09
CL2L2	0.60	0.79–0.84	0.97–1.12
L2L	2.21	3.08–3.15	3.84–4.17
FE3L	0.77	1.04–1.07	1.31–1.36
TI3L	0.69	0.97–1.02	1.22–1.36
TI3W	0.15	0.22–0.27	0.25–0.30
TA3L	1.04	1.36–1.46	1.79–2.03
TA3W	0.15	0.22–0.25	0.27–0.32
CL1L3	0.18	0.18–0.19	0.19–0.21
CL2L3	0.19	0.19–0.20	0.20–0.22
L3L	2.50	3.37–3.55	4.32–4.76
G4	0.09	0.09	0.09–0.10
G5	0.08	0.08–0.09	0.09
D4	0.01	0.02	0.02
D5	0.01	0.01–0.02	0.02

Abbreviations: **A1L, A2L**, lengths of the antennal segments I and II; **A2W,** width of the antennal segment II; **AL**, length of antenna; **BL**, body length; **BW**, body width; **CLL1, CL1L2/CL2L2, CL1L3/CL2L3**, length of the claw(s) of the fore-, mid- and hindlegs; **D4** and **D5**, scent gland openings diameter in segments IV and V; **EL**, egg length; **EW**, egg width; **eW**, width of an eye; **FE1L, FE2L, FE3L**, length of pro-, meso-, and metafemur; **G4** and **G5**, distance between the scent gland openings on segments IV and V; **HL**, head length; **HW**, head width; **L1L, L2L, L3L**, length of fore-, mid-, and hindlegs; **ML**, micropyle length; **OI**, ocular index; **PL**, length of pterothorax; **S**, synthlipsis; **SL**, stalk length; **TA2L, TA3L**, length of mesotarsus and metatarsus; **TITA1L, TI2L, TI3L**, length of protibiotarsus, mesotibia and metatibia; **TITA1W, TI3W, TA3W**, width of protibiotarsus, metatibia, and metatarsus.

Egg (Figs. 1 and 2; $n = 10$)

Egg length (EL): 0.58–0.63 mm. Egg width (EW): 0.49–0.54 mm. Micropyle length: 0.03–0.04 mm. Stalk length: 0.05 mm. Oval shape (Fig. 1), EL/EW: 1.16–1.24, flattened at one side, with a very short stalk (Fig. 1). Color yellow, stalk transparent. Chorionic surface ornamented by smooth hexagons (Fig. 2).

First and second nymphal instars. No specimens were available for study.

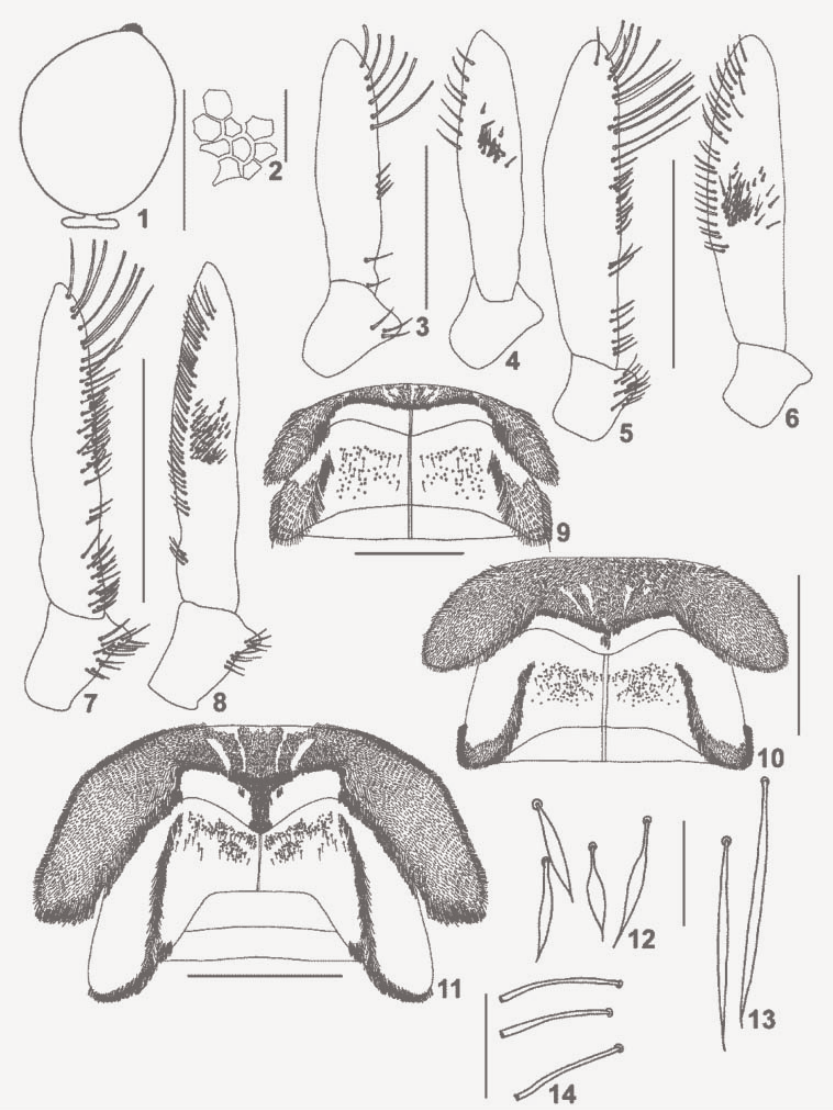
Third nymphal instar (Figs. 3–4, 9, 15, 18–19, 21–22; $n = 1$)

Color. Ground color testaceous with dark markings. Head testaceous with dark markings, except ecdysial line and ventral and lateral surfaces testaceous; posterior margin dark. Eyes reddish brown. Rostrum testaceous, except dark apically. Antennae testaceous with pale setae. Pronotum testaceous. Mesonotum testaceous, with dark setae on anterior half of the segment. Metanotum with a pale eye shaped marking on each side of the notum, near the anterior margin of the segment, which joins to a medial pale inverted triangle marking, near the posterior margin of the segment, forming between the three a single pale marking. Thoracic pleurae and sterna testaceous. Legs testaceous. Abdominal terga I–VII dark with pale markings, and abdominal tergum VIII testaceous; scent glands reddish brown on segments IV and V; abdominal sternites testaceous, except last segment with a rounded, middle, dark area. Connexivum testaceous with dark markings on posterior margin of each segment.

Body. Suboval, body length (BL)/body width (BW): 1.63. Measurements that characterize the body shape are shown in Table 1.

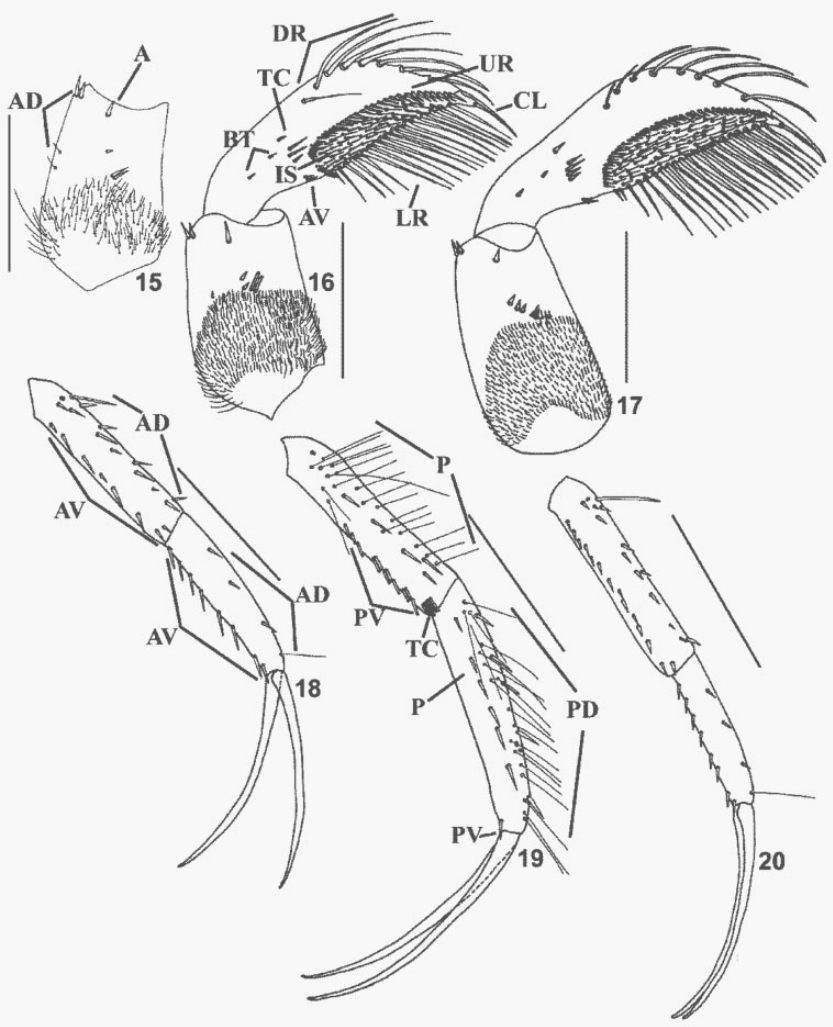
Head. Short, subrectangular, head length (HL)/head width (HW): 0.43; anterior margin rounded; Y-shaped ecdysial line visible; with some long, stout and short, slender setae, trichobothria and chloride cells in frontal view. Synthlipsis (S)/width of an eye (eW): 1.11. Ocular index (OI): 1.48. HW/BL: 0.53. Rostrum short, with five transverse sulcations. Length of antenna (AL)/BL: 0.19; two-segmented; segment II longer than segment I, A1:A2 = 0.32:1.00; A1 subconical with a lateral protuberance; A2 subcylindrical, elongate with a slight constriction in the basal quarter of the segment; A2 width/length: 0.26. A1 dorsal surface with few short, slender setae; A2 dorsal surface with short and long, slender setae and flattened, long, apically serrate setae (Fig. 3); A1 ventral surface bare; A2 ventral surface with a set of short, slender spines and four short, stout spines on the apical half of the segment, ventral margin with short, slender setae (Fig. 4).

Thorax. Pronotum totally hidden by head, posterior margin convex at middle, with long, slender setae (not exposed); posterior half of the segment with short, slender setae. Mesonotum posterior margin convex at middle. Metanotum posterior margin straight to slightly concave at middle. Ecdysial line visible on pro-, meso-, and metanotum (Fig. 9). Meso- and metathoracic wing pads present (Fig. 9). Meso- and metathoracic wing pads and anterior half of the mesonotum with short, slender setae; metanotum with short setae and chloride cells in two areas, on each side of the segment; posterior margin of the setose area of the mesonotum and internal margins of the wing pads with short and long, lanceolate setae, respectively; external and posterior margins of the wing pads with long, slender setae (Fig. 9). Pro-, meso-, and metapleura with short, slender setae. Mesothoracic wing pads reaching the anterior four fifths of pterothorax; metathoracic wing pads surpassing the posterior margin of the urotergite I (Fig. 9). Length of pterothorax (PL)/BL: 0.25. Prosternum posterior margin concave at middle; mesosternum posterior margin convex at middle; metasternum posterior margin straight to slightly convex at middle. Metaxyphus much longer than wide, apically truncate. Thoracic sterna with short, slender setae. Meso- and metathoracic spiracles small and rounded, located ventrally, near posterior margin of each segment. Forelegs short, L1/BL: 0.40; femur



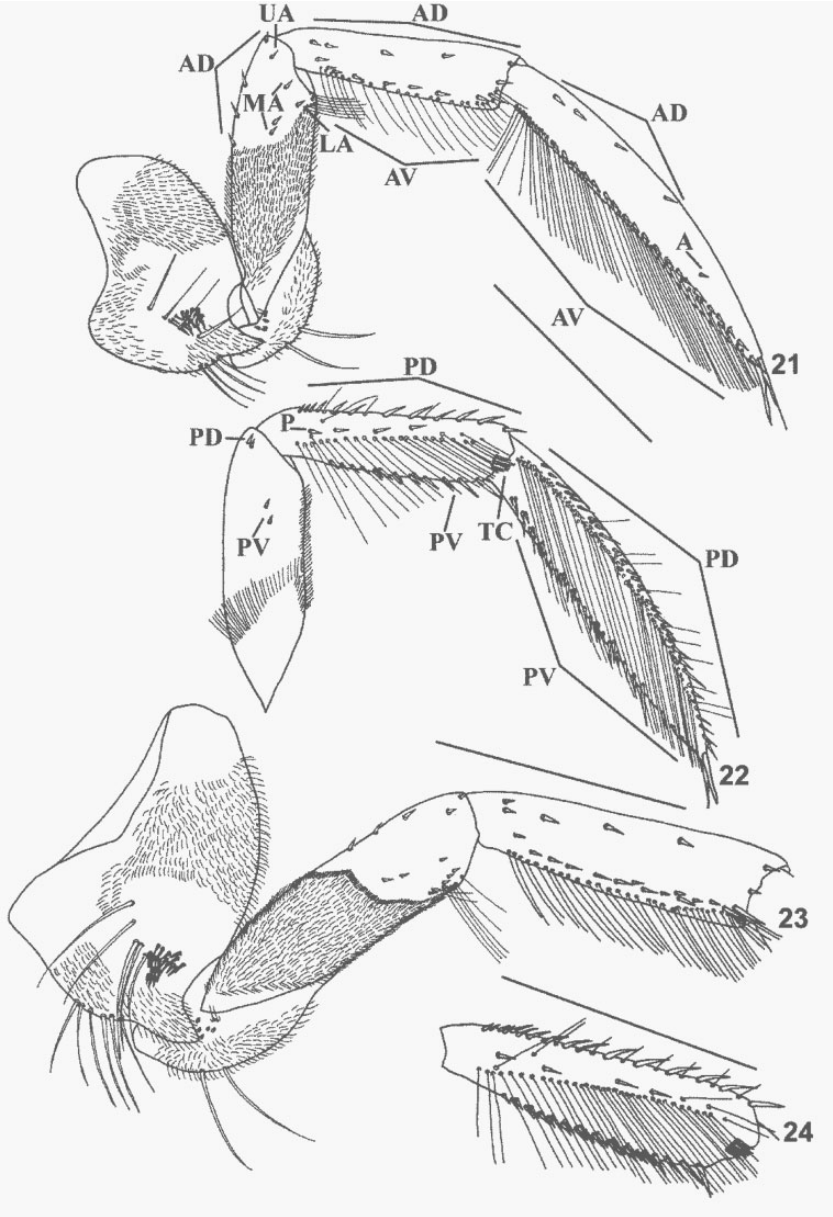
Figures 1–14. *S. (Aphelosigara) tucma*. **1,** Egg. **2,** chorionic surface. **3–4,** antenna, nymphal instar III: **3,** dorsal view; **4,** ventral view. **5–6,** antenna, nymphal instar IV: **5,** dorsal view; **6,** ventral view. **7–8,** antenna, nymphal instar V: **7,** dorsal view; **8,** ventral view. **9–11,** pterothorax: **9,** nymphal instar III; **10,** nymphal instar IV; **11,** nymphal instar V. **12–14,** mesothoracic wing pads, nymphal instar V: **12,** lanceolate, short setae; **13,** lanceolate, long setae; **14,** setae from posterior margin. Scale bars in mm: Figs. 1, 7–8 = 0.40, Fig. 2 = 0.03, Figs. 3–4 = 0.20, Figs. 5–6 = 0.30, Fig. 9 = 0.50, Fig. 10 = 1.00, Fig. 11 = 1.20, Figs. 12–14 = 0.07.

shorter than tibiotarsus, FE1/TITA1: 0.78. Procoxa short, subconical; anterior and posterior surfaces with abundant short, slender setae. Protrochanter short; anterior surface with abundant short, slender setae (two basal), and three basal campaniform sensilla; posterior surface with short, slender setae, and five basal campaniform sensilla. Profemur short and subrectangular; anterior surface with a hydrophobic setose area covering the basal half of the segment and six spines (two short, slender, simple; two long, stout, apically serrate; two simple, stout: one short and one long), and chloride cells (not illustrated; Fig. 15); anterodorsal surface with two short, slender setae, and two short, apical spines; posterior surface with an hydrophobic setose area covering more than the basal half of the segment, and with chloride cells; posterodorsal surface with one long, slender, preapical seta; posteroventral surface with one short, apical spine. Protibiotarsus spoon shaped, elongate, TITA1 width/length: 0.24; anterior surface with nine long setae in dorsal, 23–24 setae in upper and 20–22 bristles in lower rows, tibial comb represented by three spines, and one spine behind the tibial comb; anteroventral surface with two short spines; inner surface with 20–23 slender setae; posterior surface with some long, slender setae. One short, slender, falcate claw. Midlegs long and slender; L2/BL: 1.01; mesofemur longest, tibia longer than tarsus; FE:TI:TA= 1.00:0.48:0.42. Mesocoxa short, subconical; anterior and posterior surfaces with short, slender setae. Mesotrochanter short; anterior surface with four basal campaniform sensilla, and abundant short, slender setae; posterior surface with seven basal campaniform sensilla, and abundant short, slender setae. Mesofemur subcylindrical, straight; anterior surface with a basal hydrophobic setose area of short slender setae; anterodorsal surface with 15–19 spines, and chloride cells; anteroventral surface with 21–23 simple spines, 23–25 apically serrate spines, and chloride cells; posterior surface with a transverse basal row of short slender setae; posterodorsal surface with chloride cells; posteroventral surface with 28–30 short spines, four or five long, slender spines, eight or nine short, slender setae, and chloride cells. Mesotibia subcylindrical, straight (Figs. 18–19); anterior surface with seven or eight spines, one prebasal campaniform sensillum, and chloride cells (not illustrated); anterodorsal surface with five spines (the prebasal longest); anteroventral surface with seven or eight spines; posterior surface with five spines, one prebasal campaniform sensillum, and 18 long, slender



Figures 15–20. *S. (Aphelosigara) tucma*. **15,** profemur, nymphal instar III, anterior surface. **16–17,** foreleg, anterior surface: **16,** nymphal instar IV; **17,** nymphal instar V. **18–19,** midleg, nymphal instar III: **18,** anterior surface; **19,** posterior surface. **20,** midleg, nymphal instar V, anterior surface. A: anterior; AD: anterodorsal; AV: anteroventral; BT: behind tibial comb; CL: claw; DR: dorsal row; IS: inner surface; LR: lower row; P: posterior; PD: posterodorsal; PV: posteroventral; TC: tibial comb; UR: upper row. Scale bars in mm: Fig. 15 = 0.30, Figs. 16–19 = 0.40, Fig. 20 = 0.80.

setae; posteroventral surface with 11 simple spines, and tibial comb represented by five apically serrate spines. Mesotarsus subcylindrical, straight (Figs. 18–19); anterodorsal surface with one long, slender, preapical seta and three spines; anteroventral surface with eight spines; posterior surface with six spines; posterodorsal surface with four or five spines, and 16–19 long, slender setae; posteroventral surface with an apical spine. Two long, slender, falcate claws of different length. TA2/CL1: 0.85; TA2/CL2: 0.82. Hindlegs long, slender; L3/BL: 1.15; tarsus longest, tibia shorter than femur; FE:TI:TA=0.74:0.67:1.00. Metacoxa large, subconical (Fig. 21); anterior surface with abundant short and long, slender, setae, medial to the segment, and with a prebasal set of short and stout spines on a bare area; anteroventral surface with some long, slender setae; posterior surface bare. Metatrochanter short (Fig. 21); anterior surface with abundant short, slender setae (two basal), and four basal campaniform sensilla; anteroventral surface with two long, slender setae; posterior surface with some short, slender setae, and seven basal campaniform sensilla. Metafemur slightly curved and flattened anteroposteriorly (Figs. 21–22); anterior surface with a basal hydrophobic setose area of short setae, reaching the basal half of the segment on the dorsal margin, and the apical fifth of the segment on ventral margin, with five or six short spines in three areas (upper, one; middle, three or four; lower, one), and with chloride cells (not illustrated); anterodorsal surface with four short spines; posterior surface with transverse basal row of long slender setae; posterodorsal surface with two short, apical spines; posteroventral surface with two short spines and chloride cells (not illustrated); ventral surface with seven or eight long, slender, preapical setae. Metatibia subcylindrical, straight, TI3 width/length: 0.21 (Figs. 21–22); anterodorsal surface with five short spines, and with chloride cells (not illustrated); anteroventral surface with nine to 11 short spines, and 26–27 long, slender setae; posterior surface with four short spines, 23–25 long, slender setae and chloride cells (not illustrated); posterodorsal surface with 11–12 spines, and three short, slender setae; posteroventral surface with 16–19 spines (the apical one longest), and apical comb of four (one double and three simple) or five (two double and three simple) spines. Metatarsus slightly curved and flattened anteroposteriorly (Figs. 21–22); TA3 width/length: 0.14; anterior surface with one spine on the apical half of the segment; anterodorsal surface with four or five short spines on the basal half of the segment; anteroventral surface with 22–23 short spines, and 173–177 swimming hairs; posterodorsal surface with 27–29 spines, 10–12 short, slender setae, and 234–244 swimming hairs; posteroventral surface with 35–39 spines. Two short, slender, straight claws of different length. TA3/CL1: 5.85; TA3/CL2: 5.54.



Figures 21–24. *S. (Aphelosigara) tucma*. **21–22,** hindleg, nymphal instar III: **21,** anterior surface; **22,** posterior surface. **23,** hindleg, nymphal instar IV, anterior surface. **24,** metatibia, nymphal instar IV, posterior surface. A: anterior; AD: anterodorsal; AV: anteroventral; LA: lower area; MA: middle area; P: posterior; PD: posterodorsal; PV: posteroventral; TC: tibial comb; UA: upper area. Scale bars in mm: Figs. 21–22 = 0.60, Figs. 23–24 = 0.80.

Abdomen. Ecdysial line visible on segments I–II. Posterior margins of the segments I and VIII straight and segments II–VII concave, dorsal and ventrally. G4/D4 and G5/D5: 9. Spiracles visible on segments I–VIII, small and rounded; located ventrolaterally near posterior margin (I) or located ventrally near anterior margin (II–VIII) of each segment; the one on the segment I is bigger than the others abdominal spiracles. Terga with few short, slender setae, and abundant chloride cells. Lateral spines of the abdominal segments (right side): I, zero; II–III, one short; IV, three short, one long; V, six short, two long; VI, seven short, two long; VII, eight short, six long; VIII, 10 short, seven long. Sterna with abundant short, slender setae. Urosternites without central spines.

Fourth nymphal instar (Figs. 5–6, 10, 16, 23–24; $n = 5$)

Similar to third instar except for the following features:

Color. Posterior margin of pro-, meso-, and metanotum, and mesotarsus apically darker.

Body. Elongate, BL/BW: 1.86–1.97. Measurements that characterize the body shape are shown in Table 1.

Head. HL/HW: 0.45–0.48. S/eW: 0.92–1.09. OI: 1.05–1.22. HW/BL: 0.44–0.47. Rostrum with six transverse sulcations ($N = 3$). Antenna: AL/BL: 0.16–0.17; A1:A2= 0.26–0.28:1.00; A2 width/length: 0.21–0.28; A1 dorsal surface with some short, slender setae; A2 dorsal surface with abundant short and long, slender setae, and flattened, long, apically serrate setae (Fig. 5); A2 ventral surface with seven short, stout spines, on the apical half of the segment, ventral margin with abundant short, slender setae (Fig. 6).

Thorax. Mesonotum with short, slender setae on the anterior four fifths of the segment; short, lanceolate setae of the posterior margin of the setose area of the mesonotum more extended medially than on previous instar, but not reaching the posterior margin of the segment (Fig. 10). PL/BL: 0.28–0.31. The meso- and metathoracic wing pads

Table 2. Summary of characters differentiating the last three nymphal instars of *S. (Aphelosigara) tucma*

Characters	*S. (Aphelosigara) tucma*		
	Instar III	Instar IV	Instar V
Measurements (in mm)			
BL	2.18	3.50–3.60	4.61–5.03
BW	1.34	1.81–1.88	2.28–2.43
HL	0.50	0.74–0.77	0.97–0.99
HW	1.17	1.59–1.64	1.98–2.11
eW	0.45	0.57–0.60	0.74–0.84
Structures			
Rostrum, n° sulcations	5	6	7
Chaetotaxy: number of seta/e (st), spines (sp), swimming hairs (sh) and campaniform sensillum/a (cs); long (L)			
TR1, A, cs	3	5	6
TR1, P, cs	5	7	9
TITA1, TC, sp	3	4	5
TITA1, IS st	20–23	45–47	75–78
TR2, A, cs	4	5	6
FE2, AD, sp	15–19	22	28
TI2, P, L st	18	27–29	37–41
TA2, PD, L st	16–19	29–35	48–53
TR3, A, cs	4	5	6
TI3, AV, L st	26–27	35–40	43–52
TI3, PD, sp	11–12	15–16	19–20
TI3, TC, sp	4–5	6	8
TA3, AV, sp/sh	22–23/173–177	29–32/321–328	35–38/540–550
TA3, PD sp/sh	27–29/234–244	36–38/391–396	44–47/420–426

See list of abbreviations in Table 1.

Table 3. Summary of characters differentiating the last nymphal instar of species of *Sigara*

	BL (mm)	FE3, PV, #sp	TI3, PD, #sp
S. fossarum	4.20	6–12	12
S. scotti	3.70	7–12	12
S. falleni	4.90	6–12	12
S. distincta	5.50	7–12	12
S. striata	4.70–5.20	3–6	16
S. semistriata	3.70–3.90	1–2	10
S. limitata	3.90	2–4	ND
S. lateralis	3.50	4–7	20
S. nigrolineata	3.50–3.90	1–3	12
S. concinna	ND	15	16
S. stagnalis	3.90–4.40	3–5	12
S. hellensi	3.30–3.65	5–6	15–19
S. janssoni	4.60–5.00	3	15
S. jensenhaarupi	3.70–4.11	ND	ND
S. santiagiensis	4.64–5.13	4	14
S. schadei	4.39–4.84	6–10	18–19
S. tucma	4.61–5.03	2	19–20

BL, body length; FE3, metafemur; PD, posterodorsal; PV, posteroventral; TI3, metatibia; sp, spines. ND, no data available. Source of information: Cobben and Moller-Pillot 1960; Jansson 1969; Nieser 1969; López et al. 1996; Melo & Scheibler 2011; Konopko 2012, 2013b; this article.

covering the anterior third of the urotergites I and II, respectively. Forelegs L1/BL: 0.34–0.37; FE1/TITA1: 0.72–0.79. Procoxa anterior and posterior surfaces with abundant short and long, slender setae. Protrochanter anterior and posterior surfaces with five and seven basal campaniform sensilla, respectively. Profemur anterior surface with eight to nine spines (three short, slender, simple; two long, stout, flattened, apically serrate; three or four simple, stout: two or three short and one long); anterodorsal surface with two short, apical spines, and without the two short, slender setae (Fig. 16). Protibiotarsus TITA1 width/length: 0.24–0.28; anterior surface with eight or nine long setae in dorsal, 45–46 setae in upper, 19–20 long setae in lower rows, tibial comb of four (3+1) spines, and two short spines behind the tibial comb; inner surface with 45–47 long, slender setae (Fig. 16). Midlegs L2/BL: 0.86–0.90; FE: TI:TA=1.00:0.45–0.47:0.36–0.40. Mesocoxa anterior and posterior surfaces with abundant short and long, slender setae. Mesotrochanter anterior surface with five basal campaniform sensilla. Mesofemur anterodorsal surface with 22 spines; anteroventral surface with 30 simple spines, and 33–36 apically serrate spines; posteroventral surface with 48–57 short spines, three long, slender spines, and 20–23 short, slender setae. Mesotibia anterior surface with seven to nine spines; anteroventral surface with eight or nine spines; posterior surface with 27–29 long, slender setae; posteroventral surface with 14–15 apically serrate spines, four to five simple spines, and tibial comb of five to six spines (four or five simple, one or two apically serrate). Mesotarsus anteroventral surface with seven or eight spines; posterior surface with five spines; posterodorsal surface with 29–35 long, slender setae. TA2/CL1: 0.81–0.82; TA2/CL2: 0.78–0.79. Hindlegs L3/BL: 0.94–0.99; FE:TI:TA=0.72–0.76:0.69–0.71:1.00. Metatrochanter anterior surface with five basal campaniform sensilla (Fig. 23). Metafemur anterior surface with nine or 10 short spines in three areas (upper, one; middle, three; lower, five or six). Metatibia TI3 width/length: 0.22–0.28 (Figs. 23–24); anterodorsal surface with five or six short spines; anteroventral surface with 11–16 short spines, and 35–40 long, slender setae; posterior surface with three or four short spines, and 28–33 long, slender setae; posterodorsal surface with 15–16 spines, and seven or eight short, slender setae; posteroventral surface with 21–26 spines, and tibial comb of six simple spines. Metatarsus TA3 width/length: 0.15–0.17; anterodorsal surface with five or six short spines on the basal two third of the segment; anteroventral surface with 29–32 short spines, and 321–328 swimming hairs; posterodorsal surface with 36–38 spines, 10–11 short, slender setae, and 391–396 swimming hairs; posteroventral surface with 48 spines. TA3/CL1: 7.65–8.07; TA3/CL2: 7.25–7.65.

Abdomen. G4/D4: 5 and G5/D5: 5–6. Lateral spines of the abdominal segments (right side): I, zero; II–III, one short; IV, four to five short, two long; V, seven to eight short, four long; VI, six short, five to six long; VII, 22 short, five long; VIII, 11–12 short, eight to nine long.

Fifth nymphal instar (Figs. 7–8, 11–14, 17, 20; $n = 5$)

Similar to fourth instar except for the following features:

Color. Posterior margins of the metathoracic wing pads and abdominal sternites I and II medially, and claws of the midlegs apically darker.

Body. BL/BW: 2.01–2.07. Measurements that characterize the body shape are shown in Table 1.

Head. HL/HW: 0.47–0.50. S/eW: 0.74–0.85. OI: 0.83–1.02. HW/BL: 0.42–0.45; with more chloride cells in frontal view than in previous instar. Rostrum with seven transverse sulcations ($N = 3$). Antenna AL/BL: 0.15; A1:A2 = 0.27–0.35:1.00; A2 width/length: 0.18–0.25; A1 ventral surface with some short, slender setae (Fig. 8); A2 ventral surface with 14–15 short, stout spines on the apical half of the segment (Figs. 7–8).

Thorax. Mesonotum with a T-shaped area of short, lanceolate setae (Fig. 12) on posterior margin, reaching the anterior margin of metanotum medially (Fig. 11). PL/BL: 0.27. Posterior margins of the meso- and metathoracic wing pads with flatenned, apically serrate setae (Figs. 11, 14), and long, lanceolate setae (Fig. 13), respectively. Meso- and metathoracic wing pads reaching the anterior margin and covering the anterior half of the urotergite III (Fig. 11), respectively. Forelegs L1/BL: 0.31–0.33; FE1/TITA1: 0.72–0.78. Protrochanter anterior and posterior surfaces with six and nine basal campaniform sensilla, respectively. Profemur anterior surface with 12–13 spines (five short, slender, simple; two long, stout, flattened, apically serrate; five or six simple, stout: four or five short and one long (Fig. 17). Protibiotarsus TITA1 width/length: 0.22–0.31; anterior surface with 48–56 setae in upper, 22–23 long setae in lower rows, tibial comb represented by five spines; inner surface with 75–78 long, slender setae (Fig. 17). Midlegs L2/BL: 0.82–0.88; FE:TI:TA = 1.00:0.45–0.46:0.33–0.34. Mesotrochanter anterior and posterior surfaces with six and nine basal campaniform sensilla, respectively. Mesofemur anterodorsal surface with 28 spines;

anteroventral surface with 26–31 simple spines, and 49–51 apically serrate spines; posteroventral surface with 70–73 short spines, and 32–36 short, slender setae. Mesotibia anterior surface with eight to ten spines (Fig. 20); anteroventral surface with 12–14 spines (Fig. 20); posterior surface with 37–41 long, slender setae; posteroventral surface with 37–42 apically serrate spines, nine to 11 simple spines, and tibial comb represented by five to seven simple spines. Mesotarsus posterior surface with four or five spines; posterodorsal surface with 48–53 long, slender setae. TA2/CL1: 0.70–0.78; TA2/CL2: 0.69–0.74. Hindlegs L3/BL: 0.94–0.95; FE:TI:TA = 0.67–0.74:0.67–0.69:1.00. Metatrochanter anterior and posterior surfaces with six and nine basal campaniform sensilla, respectively. Metafemur anterior surface with 11–13 short spines in three areas (upper, one; middle, three or four; lower, seven or eight); ventral surface with seven to 11 long, slender, apical setae. Metatibia TI3 width/length: 0.18–0.24; anterodorsal surface with seven to nine short spines; anteroventral surface with 26–28 short spines, and 43–52 long, slender setae; posterior surface with four or five short spines, and 31–41 long, slender setae; posterodorsal surface with 19–20 spines, and eight or nine short, slender setae; posteroventral surface with 33–35 spines, and tibial comb represented by eight simple spines. Metatarsus TA3 width/length: 0.13–0.17; anterodorsal surface with five short spines on the basal two third of the segment; anteroventral surface with 35–38 short spines, and 540–550 swimming hairs; posterodorsal surface with 44–47 spines, and 420–426 swimming hairs; posteroventral surface with 45–48 spines. TA3/CL1: 8.95–9.78; TA3/CL2: 8.54–9.34.

Abdomen. G4/D4: 4–5, G5/D5: 5. Lateral spines on the abdominal segments (right side): I, zero; II–III, one short; IV, four to five short, two long; V, five to six short, four to five long; VI, five to seven short, three to four long; VII, 21–23 short, seven to eight long; VIII, nine to 11 short, six to seven long.

Key to the last three nymphal instars of the species of *Sigara* from Argentina

1. Mesothoracic wing pads reaching the posterior margin of pterothorax; metathoracic wing pads reaching the anterior margin of urotergite II (Fig. 9) … **nymphal instar III** … 2
- Mesothoracic wing pads surpassing the posterior margin of pterothorax; metathoracic wing pads surpassing the anterior margin of urotergite II (Figs. 10–11) … **4**
2. Metaxyphus longer than wide and apically truncate … ***S. tucma***
- Metaxyphus wider than long and apically rounded … **3**
3. Hydrophobic setose area on anterior surface of the profemur covering the basal half of the segment; urosternite V with two long central spines (Konopko 2013b: Figs. 1D, 2C) … ***S. santiagiensis***
- Hydrophobic setose area on anterior surface of the profemur covering more than the basal half of the segment (Konopko 2012: Fig. 15); urosternite V without central spines … ***S. schadei***
4. Meso- and metathoracic wing pads not reaching the posterior margin of urotergite II (Fig. 10) … **nymphal instar IV** … **5**
- Meso- and metathoracic wing pads surpassing the posterior margin of urotergite II (Fig. 11) … **nymphal instar V** … **7**
5. Posteroventral surface of the metafemur with two spines (Fig. 22) … ***S. tucma***
- Posteroventral surface of the metafemur with four to five spines (Konopko 2013b: Fig. 3D) … **6**
6. Hydrophobic setose area on anterior surface of the metafemur covering the basal half of the segment (Konopko 2012: Fig. 21) … ***S. schadei***
- Hydrophobic setose area on anterior surface of the metafemur covering more than the basal half of the segment (Konopko 2013b: Fig. 3C) … ***S. santiagiensis***
7. Hydrophobic setose area on posterior surface of the profemur covering the basal half of the segment … ***S. santiagiensis***
- Hydrophobic setose area on posterior surface of the profemur covering more than the basal half of the segment … **8**
8. Posteroventral surface of the metafemur with two spines (Fig. 22) … ***S. tucma***
- Posteroventral surface of the metafemur with six to 10 spines (Konopko 2012: Fig. 24) … ***S. schadei***

Discussion

The eggs of *Sigara* have a very short basal stalk according to Poisson (1933), Hungerford (1948a,b), Fernando (1965), Bachmann (1981), and Konopko (2012, 2013b), based on the following species: *Sigara* (*Allosigara*) *decorata, S.* (*Aphelosigara*) *tucma, S.* (*Phaeosigara*) *paludata, S.* (*Sigara*) *striata, S.* (*S.*) *stagnalis, S.* (*Subsigara*) *distincta, S.* (*Tropocorixa*) *schadei, S.* (*T.*) *meridionalis, S.* (*T.*) *irrorata, S.* (*T.*) *pruthiana, S.* (*T.*) *santiagiensis,* and *S.* (*Vermicorixa*) *alternata*. The short basal stalk is also present in the eggs of other genera of Corixidae as *Arctocorisa* Wallengren, *Callicorixa* White, *Cenocorixa* Hungerford, *Centrocorisa* Lundblad, *Corisella* Lundblad, *Corixa* Geoffroy, *Dasycorixa* Hungerford, *Ectemnostega* Enderlein, *Graptocorixa* Hungerford, *Hesperocorixa* Kirkaldy, *Krizousacorixa* Hungerford, *Neosigara* Lundblad, *Orocorixa* Nieser & Padilla-Gil, *Palmacorixa* Abbott, *Pseudocorixa* Jaczewski, *Ramphocorixa* Abbott, *Stenocorixa* Horvath, *Trichocorixa* Kirkaldy, and *Xenocorixa* Hungerford (Hungerford 1948a,b; Cobben 1968; Padilla-Gil and Nieser 1994; Konopko and Melo 2009; Konopko et al. 2010b, 2011; Konopko and Mazzucconi 2011; Konopko 2012, 2013a,b); and in Micronectidae, in the eggs of the subgenera of *Tenagobia* Bergroth: *Incertagobia* Nieser and *Tenagobia* (Cobben 1968; Bachmann 1979, 1981, 1983; Konopko et al. 2010a). The eggs of *S. decorata* (EL: 0.96 mm; EW: 0.86 mm) and *S. meridionalis* (EL: 0.86 mm; EW: 0.72 mm) are bigger than the ones of *S. alternata* (EL: 0.55 mm; EW: 0.35 mm), *S. distincta* (EL: 0.68 mm; EW: 0.60 mm), *S. irrorata* (EL: 0.75 mm; EW: 0.50 mm), *S. paludata* (EL: 0.65 mm; EW: 0.50 mm), *S. santiagiensis* (EL: 0.71–0.77 mm; EW: 0.50–0.57 mm), *S. schadei* (EL: 0.72–0.77 mm; EW: 0.57–0.62 mm) and *S. tucma* (EL: 0.58–0.63 mm, EW: 0.49–0.54 mm) (Hungerford 1948a,b; Konopko 2012, 2013b). The shape of the egg of *S. tucma* described in this work is similar to the one studied by Bachmann (1981). The ratio length/width is smaller in *S. decorata* (1.12) and *S. distincta* (1.13) than in the other species (*S. alternata*: 1.57; *S. irrorata*: 1.50; *S. meridionalis*: 1.19; *S. paludata*: 1.30; *S. santiagiensis* 1.31–1.47; *S. schadei*: 1.18–1.29; and *S. tucma:* 1.16–1.24) (Hungerford 1948a,b; Konopko 2012, 2013b). The ratio length/width of the eggs of the genus *Neosigara* (*N. murilloi* Hungerford, 1.24; *N. columbiensis* Lundblad, 1.20; *N. aristera* Nieser & Padilla, 1.28; *N. sterea* Nieser & Padilla, 1.20) are similar to the ones of *S. tucma* (1.16–1.24), *S. meridionalis* (1.19), *S. schadei* (1.18–1.29), and *S. paludata* (1.30) (Hungerford 1948a; Konopko 2012; Padilla-Gil and Nieser 1994). The ratio length/width of the egg of *S. tucma* studied in this work is different (1.16–1.24) from the one published by Bachmann (1981; 1.40). The chorionic surface of the eggs of *S. tucma* and *S. santiagiensis* are similar as they are ornamented by smooth hexagons, and they can be distinguished from the ones of *S. schadei* as they have protuberances delimiting small areas on them (Konopko 2012, 2013b). According to Hungerford (1948a,b) the eggs of *S. alternata, S. decorata,* and *S. distincta* are not sculptured, whereas the ones of *S. irrorata, S. meridionalis,* and *S. paludata* have a minutely wrinkled surface.

The last three nymphal instars of *S. tucma* can be easily recognized by (Table 2): the body and head lengths; the body, head, and eye widths; the number of transverse sulcations of the rostrum; the number of campaniform sensilla on anterior and posterior surfaces of the protrochanter; the number of setae on the inner surface of the protibiotarsus (Figs. 16–17); number of spines on the tibial comb of the protibiotarsus and metatibia (Figs. 16–17, 22, 24); the number of campaniform sensilla on anterior surface of the meso- and metatrochanter (Figs. 21, 23); the number of spines on anterodorsal surface of the mesofemur; the number of long, slender setae on posterior and posterodorsal surfaces

of the mesotibia and mesotarsus, respectively (Fig. 19); the number of long setae on the anteroventral and posterior surfaces and the number of spines on the posterodorsal surface of the metatibia (Figs. 21–24); the number of spines and swimming hairs on anteroventral and posterodorsal surfaces of the metatarsus (Figs. 21–22); and the grade of development of the wing pads (Figs. 9–11).

The last three nymphal instars of *S. tucma, S. santiagiensis,* and *S. schadei* can be separated from each other based on: the hydrophobic setose area on anterior surface of the profemur covering the basal half of the segment (*S. santiagiensis* and *S. tucma*) or more than the basal half (*S. schadei*); the hydrophobic setose area on posterior surface of the profemur covering the basal half of the segment (*S. santiagiensis*) or more than the basal half (*S. schadei* and *S. tucma*); the hydrophobic setose area on the anterior surface of the metafemur covering the basal half of the segment (*S. schadei* and *S. tucma*) or more than the basal half (*S. santiagiensis*); the number of spines on posteroventral surfaces of the metafemur (III: *S. tucma*, two, *S. santiagiensis*, four to five, *S. schadei*, seven to eight; IV: *S. tucma*, two, *S. santiagiensis*, five, *S. schadei*, four; V: *S. tucma*, two, *S. santiagiensis*, four, *S. schadei*, six to 10); the number of swimming hairs on anteroventral surface of the metatarsus (III: *S. tucma*, 173–177, *S. santiagiensis*, 106–108, *S. schadei*, 198–200; IV: *S. tucma*, 321–328, *S. santiagiensis*, 260–265, *S. schadei*, 210–214; V: *S. tucma*, 540–550, *S. santiagiensis*, 344–348, *S. schadei*, 260–265); the shape of the metaxyphus (longer than wide and apically truncate in *S. tucma,* and wider than long and apically rounded in *S. santiagiensis* and *S. schadei*); and the presence or absence of central spines on the urosternite V in nymphs III (two long spines in *S. santiagiensis*; and without spines in *S. schadei* and *S. tucma*) (Konopko 2012, 2013b).

The chaetotaxy of the mesonotum, metafemur, and metatibia distinguish group of species belonging to the last nymphal instar of the genus *Sigara* (Table 3): short, lanceolate setae on posterior margin of the setose area of the mesonotum reaching the anterior margin of the metanotum medially, covering the segment in a narrow T shape (*S.* (*Subsigara*) *fossarum*, *S.* (*Subsigara*) *scotti, S.* (*Subsigara*) *falleni, S.* (*Subsigara*) *distincta, S.* (*Tropocorixa*) *santiagiensis, S.* (*Sigara*) *striata, S.* (*Sigara*) *semistriata, S.* (*Sigara*) *hellensi, S.* (*Sigara*) *janssoni, S.* (*Tropocorixa*) *schadei,* and *S.* (*Aphelosigara*) *tucma*) or in a V shape (*S.* (*Sigara*) *limitata, S.* (*Sigara*) *lateralis, S.* (*Sigara*) *nigrolineata, S.* (*Sigara*) *concinna* and *S.* (*Sigara*) *stagnalis*); number of spines on posteroventral surface of the metafemur (one to four in: *S. (Sigara) semistriata, S.* (*Sigara*) *limitata, S.* (*Sigara*) *nigrolineata, S.* (*Sigara*) *janssoni, S.* (*Tropocorixa*) *santiagiensis,* and *S.* (*Aphelosigara*) *tucma*; 15 in: *S.* (*Sigara*) *concinna*); and number of spines on posterodorsal surface of the metatibia (10–12 in: *S.* (*Subsigara*) *fossarum, S.* (*Subsigara*) *scotti, S.* (*Subsigara*) *falleni, S.* (*Subsigara*) *distincta, S.* (*Sigara*) *semistriata, S.* (*Sigara*) *nigrolineata,* and *S.* (*Sigara*) *stagnalis*; 14–20 in: *S.* (*Sigara*) *striata, S.* (*Sigara*) *lateralis, S.* (*Sigara*) *concinna, S.* (*Sigara*) *hellensi, S.* (*Sigara*) *janssoni, S.* (*Tropocorixa*) *santiagiensis, S.* (*Tropocorixa*) *schadei* and *S.* (*Aphelosigara*) *tucma*) (Cobben and Moller-Pillot 1960; Jansson 1969; Nieser 1969; López et al. 1996; Konopko 2012, 2013b).

Further research including elaborated descriptions of the nymphs of other species of the genus *Sigara* is needed. Future studies should focus on providing useful morphological data, which with molecular data, will improve the resolution of the analyses of the phylogeny of the Corixidae.

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References is cited

Arnett, R. H. 1993. American insects. A handbook of the insects of America north of Mexico. The Sandhill Crane Press, Gainesville, FL.

Bachmann, A. O. 1960. Notas sobre Corixidae (Hemiptera). Revista de la Sociedad Entomológica Argentina 22: 34–40.

Bachmann, A. O. 1961a. Apuntes para una hidrobiología argentina. III. Notas sobre distribución de Corixidae (Hemiptera). Actas y Trabajos del Primer Congreso Sudamericano de Zoología 3: 11–19.

Bachmann, A. O. 1961b. Notas sobre Corixidae (Hemiptera) (2ª serie). Neotropica 7: 19–24.

Bachmann, A. O. 1962a. Notas sobre Corixidae (Tercera serie). Acta Zoológica Lilloana 18: 139–145.

Bachmann, A. O. 1962b. Catálogo de las Corixidae de la República Argentina (Insecta, Hemiptera). Neotropica 8: 91.

Bachmann, A. O. 1962c. Clave para la determinación de las subfamilias, géneros y especies de las Corixidae de la República Argentina (Insecta, Hemipt.). Physis 23: 21–25.

Bachmann, A. O. 1962d. Apuntes para una hidrobiología argentina. V. Los hemípteros acuáticos de los parques nacionales Lanín, Nahuel Huapi y Los Alerces y zonas vecinas (Insecta – Hemipt.). Physis 23: 103–107.

Bachmann, A. O. 1963. Apuntes para una hidrobiología argentina. VI. Los Hemiptera Cryptocerata de la Patagonia extracordillerana. Physis 24: 35–37.

Bachmann, A. O. 1966. Presencia de *Sigara (Tropocorixa) hungerfordi* Jaczewski en la República Argentina (Hemiptera, Corixidae). Revista de la Sociedad Entomológica Argentina 28: 44.

Bachmann, A. O. 1979. Notas para una monografía de las Corixidae argentinas (Insecta, Heteroptera). Acta Zoológica Lilloana 35: 305–350.

Bachmann, A. O. 1981. Insecta Hemiptera Corixidae. Fauna de Agua Dulce de la República Argentina 35: 1–270.

Bachmann, A. O. 1983. Notas sobre Corixidae (Heteroptera) (Cuarta Serie). Revista de la Sociedad Entomológica Argentina 41: 197–200.

Bachmann, A. O. 1987. Notas sobre Corixidae (Heteroptera) (Quinta serie). Revista de la Sociedad Entomológica Argentina 44: 33–36.

Cobben, R. H. 1968. Evolutionary trends in Heteroptera. Part I: Eggs, architecture of the shell, gross embryology, and eclosion. Centre for Agricultural Publishing and Documentation, Wageningen, The Netherlands.

Cobben, R. H., and H. Moller-Pillot. 1960. The larvae of Corixidae and an attempt to key the last larval instar of the Dutch species (Hemp., Heteroptera). Hydrobiologia 16: 323–356.

Contartese, A. M., and A. O. Bachmann. 1986. Distribución geográfica de las Corixidae argentinas (Insecta, Heteroptera). Physis 43: 89–92.

Fernando, C. H. 1965. A preliminary account of the water bugs of the family Corixidae in Ceylon. J. Bombay Natl Hist. Soc. 61: 603–613.

Hungerford, H. B. 1948a. The Corixidae of the Western Hemisphere (Hemiptera). Univ. Kansas Sci. Bull. 32: 1–827.

Hungerford, H. B. 1948b. The eggs of Corixidae (Hemiptera). J. Kansas Entomol. Soc. 21: 141–146.

Hungerford, H. B., and R. Matsuda. 1961. A new corixid from Guatemala. J. Kansas Entomol. Soc. 34: 176–178.

Hutchinson, G. E. 1940. A revision of the Corixidae of India and adjacent regions. Trans. Connecticut Acad. Arts Sci. 33: 339–476.

Jansson, A. 1969. Identification of larval Corixidae (Heteroptera) of Northern Europe. Annales Zoologici Fennici 6: 289–312.

Konopko, S. A. 2012. Description of the immature stages of *Sigara (Tropocorixa) schadei* (Hungerford) (Hemiptera: Heteroptera: Corixidae). Zootaxa 3487: 41–57.

Konopko, S. A. 2013a. Immature stages of the genus *Ectemnostega* Enderlein (Hemiptera: Heteroptera: Corixidae), with an identification key to instars and redescription of the nymphs of *E. (Ectemnostega) quadrata* (Signoret). Stud. Neotrop. Fauna Environ. 48: 40–55.

Konopko, S. A. 2013b. Description of the immature stages of *Sigara (Tropocorixa) santiagiensis* (Hungerford, 1928) (Insecta: Heteroptera: Corixidae). J. Natl Hist. 47: 1959–1982.

Konopko, S. A., and S. A. Mazzucconi. 2011. Morphometry and chaetotaxy of the nymphs of *Ectemnostega (Ectemnostegella) quechua* (Bachmann 1961) (Insecta: Hemiptera: Heteroptera: Corixidae). J. Natl Hist. 45: 1995–2014.

Konopko, S. A., S. A. Mazzucconi, and A. O. Bachmann. 2010a. Description of the nymphs of *Tenagobia (Incertagobia) incerta* Lundblad 1929 and *Tenagobia (Schadeogobia) schadei* Lundblad 1929 (Hemiptera: Heteroptera: Micronectidae), with emphasis on morphometry and chaetotaxy. Zootaxa 2511: 39–58.

Konopko, S. A., S. A. Mazzucconi, and A. O. Bachmann. 2010b. Description of the nymphs of *Ectemnostega (Ectemnostegella) stridulata* (Hungerford 1948) (Hemiptera: Heteroptera: Corixidae). Zootaxa 2639: 19–34.

Konopko, S. A., S. A. Mazzucconi, and A. O. Bachmann. 2011. Description of the immature stages of *Trichocorixa mendozana* Jaczewski (Hemiptera: Heteroptera: Corixidae). Zootaxa 3060: 47–61.

Konopko, S. A., and M. C. Melo. 2009. Larval morphology of *Ectemnostega (Ectemnostegella) montana* (Lundblad 1928) (Hemiptera: Heteroptera: Corixidae: Corixinae), with an emphasis on chaetotaxy. Zootaxa 2315: 1–18.

López, T., M. Costas, and M. A. Vázquez. 1996. Fenología y estadios juneviles de *Sigara (Sigara) janssoni* Lucas, 1983 (Heteroptera: Corixidae). Boletín de la Asociación Española de Entomología 20: 19–29.

Melo, M. C., and E. E. Scheibler. 2011. Description of the immature stages of *Sigara (Tropocrixa) jensenhaarupi* (Hemiptera: Heteroptera: Corixidae: Corixini), with ecological notes. Revista Mexicana de Biodiversidad 82: 117–130.

Morrone, J. J., S. A. Mazzucconi, and A. O. Bachmann. 2004. Distributional patterns of Chacoan water bugs (Heteroptera: Belostomatidae, Corixidae, Micronectidae and Gerridae). Hydrobiologia 523: 159–173.

Nieser, N. 1969. The Heteroptera of the Netherlands Antilles – VII Corixidae. Stud. Fauna Curaçao Other Caribbean Islands 28: 135–164.

Padilla-Gil, D. N., and N. Nieser. 1994. A new *Neosigara* from Colombia with a key to species and ecological notes (Heteroptera: Corixidae). Aquat. Insects 16: 37–53.

Poisson, R. 1933. Quelques observations sur la structure de l'oeuf des insectes Hémiptères-Hétéroptères. Bulletin de la Societe Scientifique de Bretagne 10: 38.

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