



Description of the larva and pupa and redescription of the adults of *Isostomyia paranensis* (Brèthes) (Diptera: Culicidae)

RAÚL E. CAMPOS¹ & THOMAS J. ZAVORTINK²

¹Instituto de Limnología “Dr. Raúl A. Ringuelet”, Universidad Nacional de La Plata-CONICET, cc 712 (1900) La Plata, Argentina. E-mail: rcampos@ilpla.edu.ar

²Bohart Museum, Department of Entomology, University of California, One Shields Avenue, Davis, CA 95616, USA. E-mail: tjzavortink@ucdavis.edu

Abstract

The present study includes descriptions of the larva and pupa and a redescription of the adults of *Isostomyia paranensis* (Culicidae: Sabethini), comparison of the species to *Is. lunata*, and discussion of its taxonomic position.

Key words: Culicidae, Sabethini, *Runchomyia*, *Isostomyia*, *Isostomyia paranensis*, *Isostomyia lunata*, Argentina

Introduction

Isostomyia paranensis (Brèthes, 1910) is a little known sabethine mosquito from southern South America. The species was described from females collected at Tuyupare, Argentina, and was long confused with *Isostomyia lunata* (Theobald, 1901), which was described from females collected at Maua, Rio de Janeiro, Brazil. Some of the confusion resulted from the fact that females of these species are so similar that it is not immediately obvious that two species are involved, and some resulted from uncertainty over the identity of *Is. lunata*. Theobald (1901) contributed to the uncertainty over the identity of *Is. lunata* both by erroneously describing the species as having setae on the clypeus, thus misleading others into believing it was allied to species currently placed in the genus *Trichoprosopon*, and by misidentifying *Runchomyia frontosa* Theobald, 1903 as *Is. lunata*. Dyar and his associates also consistently misapplied the name *Is. lunata* to species currently placed in *Runchomyia sensu stricto*. When Dyar and Knab (1906) described the genus *Lesticocampa*, they designated *Wyeomyia lunata* as type, but the specimens before them were actually a species of *Runchomyia* (later described as *Lesticocampa rapax* Dyar & Knab, 1906, currently considered being a synonym of *Runchomyia frontosa*). Even in his last major work, Dyar (1928) described and illustrated a species of *Runchomyia* (apparently *Runchomyia reversa* Lane & Cerqueira, 1942) as *Is. lunata*. During the time when the name *Is. lunata* was misused for species now placed in *Runchomyia sensu stricto*, the name *Is. paranensis* was applied to both *Is. paranensis* and *Is. lunata*. The male genitalia illustrated as *Is. paranensis* by Dyar (1928) are actually those of *Is. lunata*.

Both Edwards (1932) and Lane (1939) listed *Is. lunata* and *Is. paranensis* as separate species of *Goeldia* in their catalogs, but neither provided characters to distinguish them. Lane and Cerqueira (1942) determined the true identity of *Is. lunata*, associated the sexes through progeny rearings, provided a detailed illustration of the male genitalia, and synonymized *Is. paranensis* with it. García and Casal (1965) studied a male from Argentina, determined that it had genitalia distinctly different from the true *Is. lunata*, and restored *Is. paranensis* to specific rank on this basis.

The generic placement of *Is. paranensis* has changed numerous times as it has become better known and as generic concepts for the more generalized American sabethine mosquitoes have changed. *Isostomyia paranensis* was initially described in the genus *Lynchiaria* Brèthes, but it came to reside in *Lesticocampa*

Dyar & Knab (Dyar 1919) and *Goeldia* Theobald (Bonne-Wepster & Bonne 1921) through synonymy of the generic names. Even though the male of *Is. paranensis* was unknown, Brèthes (1912) included the species with others having a short male palpus in his key to the mosquitoes of Argentina. Perhaps based on this, Dyar and Shannon (1924) suggested that *Is. paranensis* might be included in the genus *Isostomyia* Coquillett, which at the time included only species with a short male palpus, and for several years thereafter the species was placed in that genus. Edwards (1930), who collected a male *Is. paranensis* in Argentina in 1926, correctly reported that the palpus was long and returned the species to *Goeldia sensu stricto*, all other species of which, including *Is. lunata*, had a long male palpus. In their reclassification of American sabethine mosquitoes, Lane and Cerqueira (1942) placed the species included in *Goeldia sensu stricto* by Edwards (1932) into three subgenera of the genus *Trichoprosopon* Theobald: *Hyloconops* Lutz, *Shannoniana* Lane & Cerqueira, and *Vonplessenia* Lane & Cerqueira. *Trichoprosopon lunatus*, with *Is. paranensis* as a synonym, was included in subgenus *Hyloconops*. Stone (1944) determined that *Runchomyia* Theobald should be used in place of *Hyloconops*, resulting in the combination *Trichoprosopon (Runchomyia) lunatum*. Zavortink (1979) reclassified all species included in *Trichoprosopon* by Lane and Cerqueira (1942), placing them into four genera and three subgenera. He allied *Is. lunata* and *Is. paranensis*, which have a long male palpus, with *Is. perturbans* (Williston, 1896) and *Is. espini* (Martini, 1914), which have a short male palpus, in the subgenus *Isostomyia* of genus *Runchomyia*. Harbach and Peyton (1993), who studied the morphology of the maxilla of sabethine larvae, elevated *Isostomyia* to generic rank, stating “it is apparent from maxillary structure that it does not belong in the genus *Runchomyia*.”

In this study we describe the larva and pupa, redescribe the adults, and discuss the taxonomic status of *Is. paranensis*.

Material and methods

All specimens of *Is. paranensis* examined during this study were collected from Buenos Aires Province, Argentina. Immature stages were collected from leaf axils of *Scirpus giganteus* Kunth (Cyperaceae) with a pooter (aspirator) attached to a lift pump. Adults were reared from larvae and pupae and were collected at human bait. Additional specimens were borrowed from the Museo de Ciencias Naturales de La Plata, Universidad Nacional de la Plata.

The descriptions are composite, that is, based on more than one specimen. Drawings were prepared from a single specimen and then corrected to show the modal condition of several specimens for the taxonomically important features. Measurements are expressed as mean \pm standard deviation on the basis of *n* individuals (accuracy of 0.01 mm). Morphological terminology follows Wood *et al.* (1979) for adults and Belkin (1962) for immatures.

Adults (both sexes) and microscope slides of male genitalia, larval and pupal exuviae, and whole larvae were deposited in the collection of Museo de Ciencias Naturales de La Plata (MLP), Argentina.

Results

Taxonomic treatment

Isostomyia paranensis (Brèthes)

1910. *Lynchiaria paranensis* Brèthes 1910: 471. TYPE: *Lectotype* female, Tuyupare [small watercourse in Delta del Parana], Buenos Aires, Argentina, 25 Jan 1908, J. Brèthes [Museo Argentino de Ciencias Naturales; designation by Casal in Belkin *et al.* 1968: 11].

Lynchiaria paranensis: Brèthes 1912: 40; Pennington 1919: 600.

Lesticocampa paranensis: Dyar 1919a: 10; 1919b: 85.

Goeldia paranensis: Bonne-Wepster and Bonne 1921: 18; Dyar 1921: 149; Bonne-Wepster and Bonne 1922: 38; Dyar 1922: 99; Dyar 1923: 81; Petrocchi 1923: 91.

Isostomyia paranensis: Dyar and Shannon 1924: 482; Shannon and Del Ponte 1928: 97; Dyar 1928: 93 (in part); Shannon 1931: 499; Costa Lima 1931: 68; Campos and Maciá 1998: 301, 302; Marti *et al.* 2007: 252–258.

Goeldia (Goeldia) paranensis: Edwards 1930: 301; Edwards 1932: 72; Lane 1939: 164.

Trichoprosopon (Hyloconops) lunatus: Lane and Cerqueira 1942: 515 (in part); Duret 1949: 124; Martínez 1949: 43; Duret 1950: 313; Duret 1951: 373.

Trichoprosopon (Rhunchomyia) lunatus: Lane 1953: 842 (in part); Prosen *et al.* 1960: 112.

Trichoprosopon (Runchomyia) lunatum: Stone *et al.* 1959: 77 (in part).

Trichoprosopon (Runchomyia) lunatus: Castro *et al.* 1960: 560.

Trichoprosopon (Runchomyia) paranensis: García and Casal 1965: 14–16; Stone 1967: 202; Belkin *et al.* 1968: 11; Knight and Stone 1977: 314.

Runchomyia (Isostomyia) paranensis: Zavortink 1979: 59; Ward 1984: 249.

Runchomyia (Runchomyia) paranensis: Darsie 1985: 160, 188, 210; Mitchell and Darsie 1985: 326; Ronderos *et al.* 1992: 4, 6, 7, 8; Maciá 1997: 143, 144.

? *Goeldia lunata*: Shannon 1931: 499.

Female (fig. 1). Medium-sized, scarcely ornamented mosquitoes with mainly yellowish to amber integument. **Head**: Covered with broad flat scales; scales large dorsally, brown with very slight blue, blue-green or purple iridescence, sometimes appearing lustrous cream-colored to pale golden at some angles of observation; scales on sides and underside lustrous cream-colored to pale golden. Occiput with row of long dark brown erect scales posteriorly. Ocular setae numerous; interocular setae long, curved. Eyes contiguous above antennae. Clypeus bare, yellowish-golden to brown. Proboscis 2.5 ± 0.29 mm long ($n = 6$), 1.3–1.4 length of femur I, slender, with dark brown scales above, paler scales beneath. Palpus short, 0.12–0.15 length of proboscis, apparently with 2 palpomeres, brown scaled. Pedicel of antenna without scales; flagellomeres with 6–8 setae in basal whorl. **Thorax**: Mesonotal integument amber to light brown anteriorly, becoming yellowish-golden posteriorly, scutellum yellowish to straw-colored. Anterior promontory with a few median and lateral setae; antear area with a few setae; supraalar area with numerous setae; a few widely-spaced dorsocentral setae sometimes developed. Scutum with broad flat dull brown scales, mainly moderate in size, enlarged on supraalar and prescutellar areas. Scutellum with 4,5 long and a few shorter setae on each lobe; all lobes with large broad flat dull brown scales. Postnotum yellowish-golden, with 3,4 pairs of dark setae, without scales. Paratergite bare. Anteprepronota conspicuous, not approximated above, with row of numerous long dark setae; scales broad, flat, dull brown above, silvery-white to lustrous cream-colored below. Postpronotum without setae; covered with broad flat scales, brown above, silvery-white to lustrous cream-colored below. Pleural integument slightly shining, yellowish-golden to amber, without extensive bare areas. Prespiracular area with 2,3 setae; upper proepisternum with 3–5 setae; prealar knob with 4–6 weak and strong setae; lower katepisternum with 2,3 setae far below level of lower edge of mesepimeron; upper mesepimeron with 4–6 setae. Most pleural scale-patches dense and well defined; scales broad, flat, imbricated, silvery-white to lustrous cream-colored; hypostigmal, subspiracular and postspiracular areas with scales; katepisternum with scales dense above, sparse below; mesepimeron largely covered with scales; upper proepisternal scales few or none; upper part of anteprocoxal membrane with a few scales. Mesomeron small, its upper edge above base of coxa III, bare. **Legs**: Coxae with silvery-white to lustrous cream-colored scales. Coxal setae strong, long; coxa-I with 7–12 setae. Femora and tibiae dark brown scaled with cream-colored to yellowish scales on ventral and/or posterior surfaces. Tarsi dark brown scaled with light brown to creamy-brown scales on ventral and/or posterior surfaces. Claws simple as in figure 1. **Wing**: (3 ± 0.31 mm long; $n = 6$). Dark scaled. Veins Rs and M with narrow spreading scales basally, broader scales distally. Vein 1A ending far distad of branching of Cu. Upper calypter with long row of setae. Alula with narrow marginal scales distad. **Halter**: Knob dark scaled, lateral surface and underside sometimes creamy-brown. **Abdomen**: Tergite I laterally and laterotergite with silvery-white scales. Tergites II–VII brown scaled with cream-colored scales laterally on II or II, III and in triangular apicolateral patches on III–VII or IV–VII. Sternites with scales entirely cream-colored.

Male (fig. 1). Essentially as in female except for sexual characters. **Head**: Palpus 0.8 ± 0.04 ($n = 16$) length of proboscis; slender; dark scaled; palpomeres IV, V darker with relatively few setae. Antenna 0.6 ± 0.04 ($n = 16$) length of proboscis; pedicel very large; flagellum densely plumose. **Legs**: Anterior claw I enlarged, with submedian secondary tooth; claws II, III small, simple.

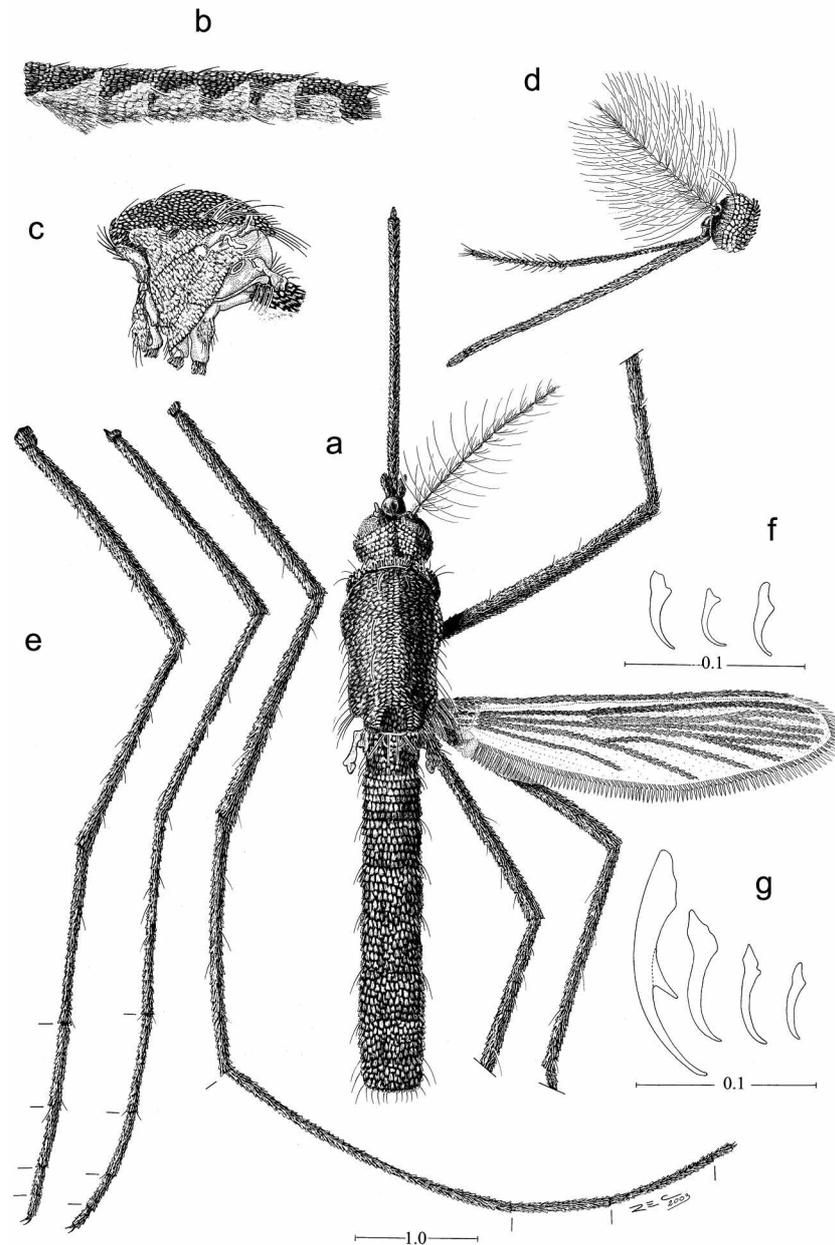


FIGURE 1. *Isostomyia paranensis* adult. A, Dorsal aspect of female; B, lateral aspect of abdomen of female; C, lateral aspect of thorax of female; D, lateral aspect of head of male; E, lateral aspect of legs of female; F, claws of female; G, claws of male.

Male genitalia (fig. 2). **Segment IX:** Tergite with pair of lobes, each lobe about as long as wide and with 5–7 moderately strong, short, weakly curved setae. Sternite large. **Gonocoxite:** Stout; setae and scales numerous, but without patches of specialized setae. **Basal Mesal Lobe:** Well developed; an elongate, oblique, sclerotized plaque bearing about 20–25 strong, attenuate, non-hooked setae distad; setae curved mesad, not extending to apex of gonocoxite. **Gonostylus:** Simple; strongly developed, moderately long, stout basally, strongly curved; with a few fine setae apically. Spiniform straight, slender, short, pigmented. **Phallosome:** Aedeagus weakly pigmented; distal lateral margin convex in dorsal aspect; with narrow pointed apical beak; without preapical teeth, serrations or spicules. **Proctiger:** Paraproct with 3,4 moderately large, dorsally curved apical teeth. Cercal setae 6–10.

Pupa (fig. 3). **Cephalothorax:** Very weakly pigmented. Seta 1-C strong, long, usually double, sigmoidally curved. Seta 5-C strong, as long as or longer than trumpet, 12–18b. **Trumpet:** Very weakly

pigmented. Moderately long, narrow, gradually widening from base to apex, pinna short. **Abdomen:** Very weakly pigmented. Tergite VIII very strongly produced caudolaterally, extending to or beyond apex of median caudal lobe. Dorsal sensillum present on tergites III–V. Seta 3-I-III relatively well developed, as strong as seta 6 on segment I, longer than seta 7 on segment II, longer than seta 6 on segment III. Seta 5-IV strong, long, single; seta 5 on other segments much weaker and shorter; seta 5-V larger than seta 6-V. Seta 6-II strong, long, single; 6-VII weak, single or double, cephalad and usually slightly laterad of 9-VII. Seta 9-VII, VIII strong, long; 9-VII 24–29b, nearly as large as 9-VIII; 9-VIII 20–25b. **Terminal Segments:** Male genital lobe large, extending to or beyond apex of paddle. **Paddle:** Very weakly pigmented. Small, shorter than minimum length of tergite VIII, apex produced; midrib represented by spiculate strip; surface irregular but not spiculate; distal inner margin and apex with small spicules.

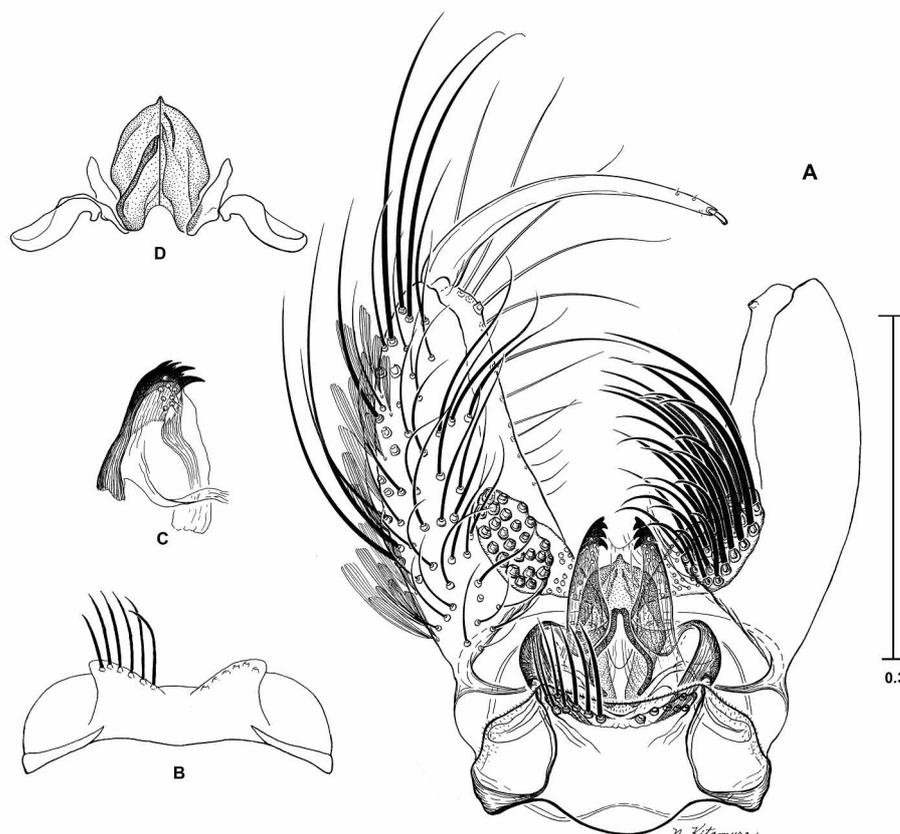


FIGURE 2. *Isostomyia paranensis* male genitalia. A, Dorsal view; B, tergite IX; C, proctiger; D, aedeagus, with parameres and basal pieces. Scale in mm.

Larva (fig. 4). Head: 1.18 ± 0.11 mm. Siphon: 0.53 ± 0.04 mm. Anal Saddle: 0.71 ± 0.04 mm ($n = 12$). **Head:** Weakly pigmented, with moderately long transverse slit-like occipital foramen, usually dark at both extremes. Hypostomal sutures straight or nearly so, subparallel, extending to posterior tentorial pits. Anterior margin of labiogula strongly produced laterally, inner edge of projection with long spicules. Dorsosentum with 7 (6–8) teeth on each side of median tooth. Maxilla modified for grasping, elongate, with short non-articulated apical process and long, simple articulated maxillary claw. Seta 1-C strong. Setae 4-7-C single. Seta 5-C caudolaterad of 6-C, cephalad of level of 7-C. Seta 9-C closer to 8-C than to posterior margin of head. Seta 14-C weak, single. **Antenna:** Without spicules. **Thorax:** Seta 4-P specialized, its branches strong and strongly and densely aciculate basally, weak and weakly aciculate or smooth apically, not flame-shaped, and as long as or longer than 0-P. Seta 11-M,T strong. **Abdomen:** Seta 6-I, II usually 10b (9–11); seta 6-III usually double (double, triple). Seta 7-I,II 4-7b. Seta 3-VII strong, long, single. **Segment VIII:** Comb scales 13–23, in single regular to irregular row, each scale usually evenly fringed. **Siphon:** Very weakly pigmented, with small spicules. Index 2.3–2.9. Pecten filamentous, midventral, filaments about 30, distal ones shorter and

stronger. Seta 1-S strong, long, 4–6b, inserted at base of siphon. Seta 1a-S 2,3b, inserted 0.75 (0.70–0.79) distance from base of siphon. Seta 2-S stout, short, apex unequally bifid and curved. Accessory setae 2a-S usually 7,8 (7–11), multiple branched beyond base. Seta 6-S relatively strong, stiff, apex recurved. **Anal Segment:** Very weakly pigmented, with small spicules. Seta 1-X strong, long, single. Seta 2,3-X strong, long, usually 3,4b (3–5). Seta 4-X strong, long, 4,5b.

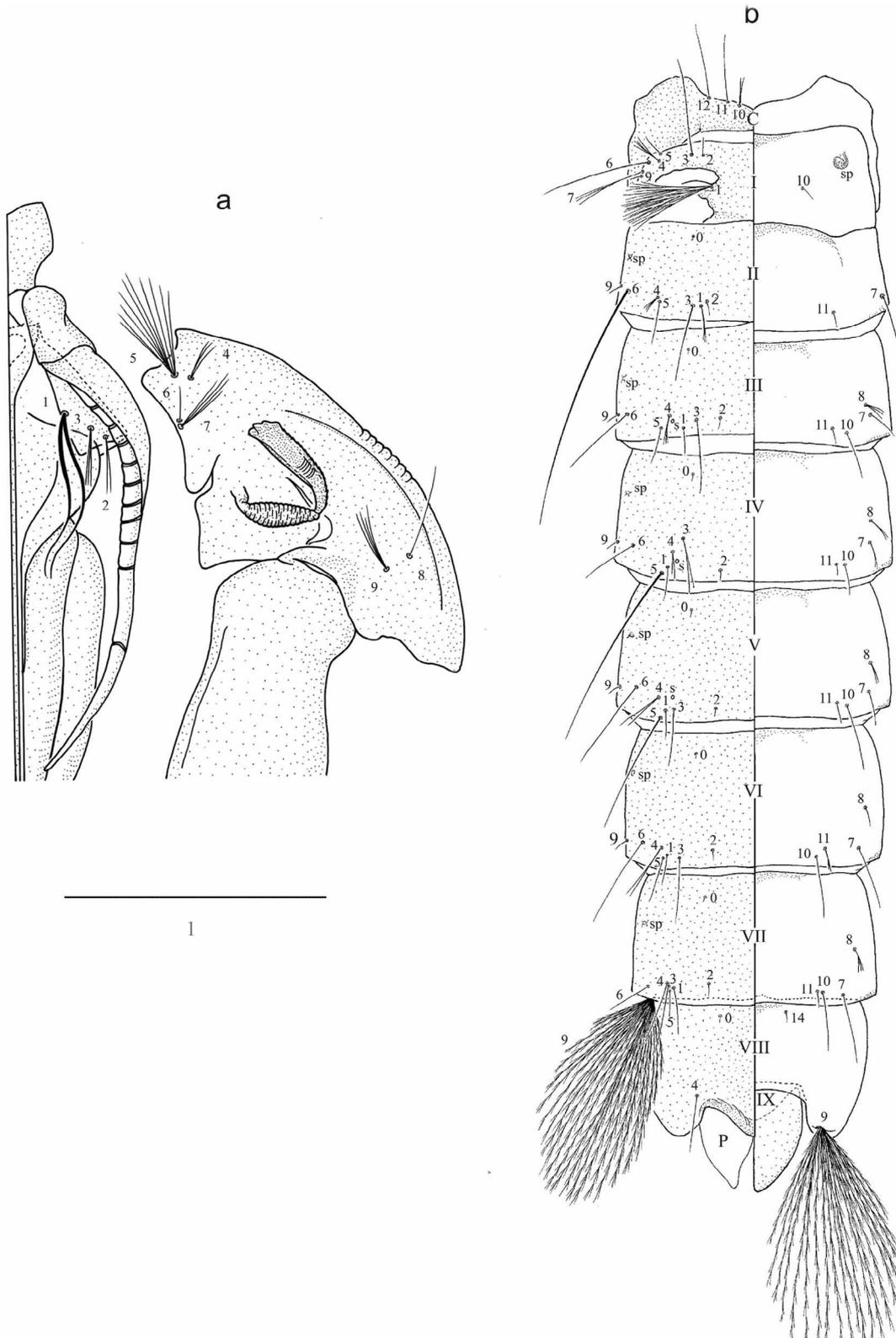


FIGURE 3. *Isostomyia paranensis* pupa. A, Cephalothorax; B, abdomen and paddle (P) of male. Scale in mm.

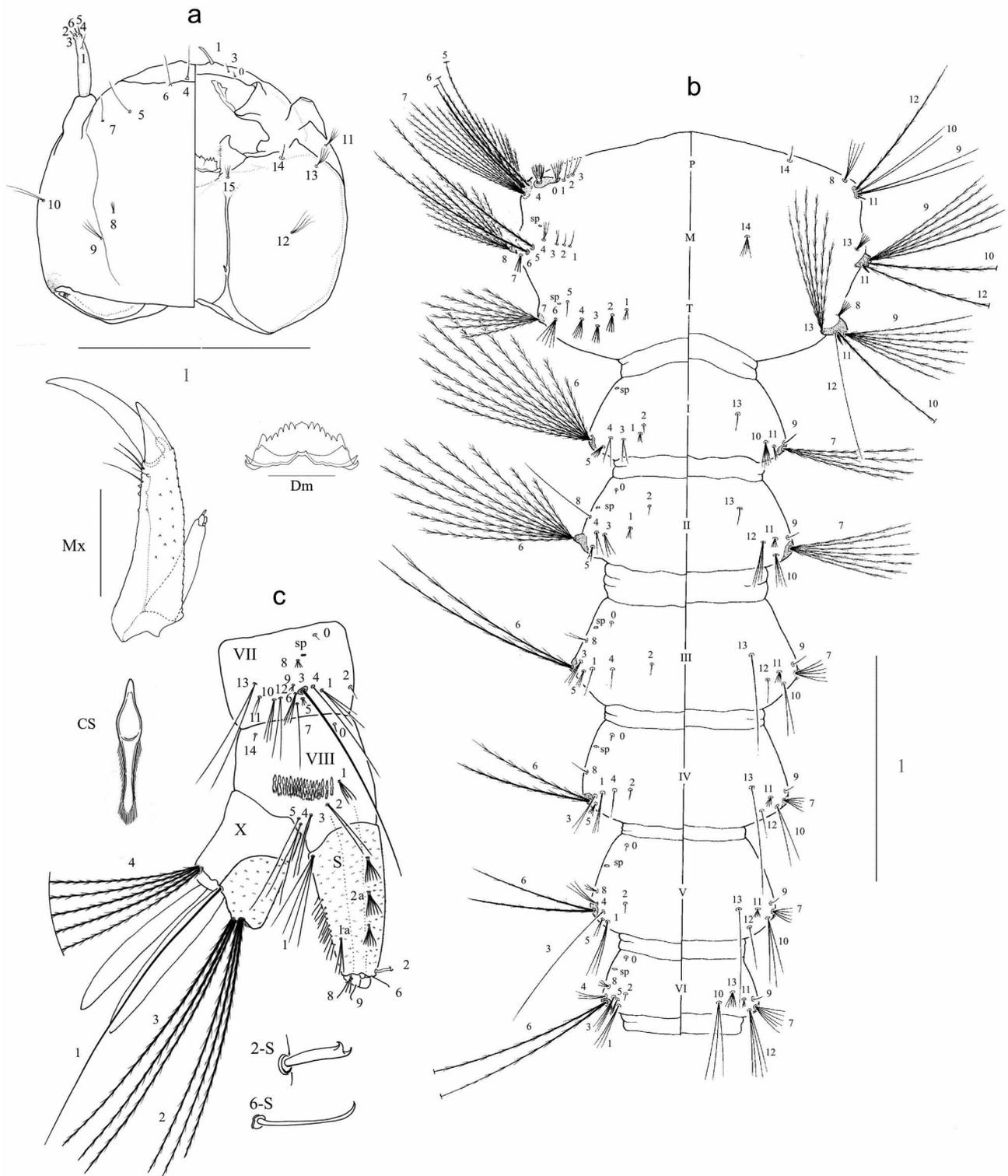


FIGURE 4. *Isostomyia paranensis* larva. A, Head, Dm: dorsomentum, Mx: maxila; B, thorax and abdominal segments I–VI; C, abdominal segments VII, VIII and X with siphon (S), CS: comb scale. Scales in mm.

Systematics. Females of *Isostomyia lunata* and *Is. paranensis* can apparently be distinguished by the color of the scales on the upper part of the antepronotum. In *Is. lunata*, these scales are described as being dark with blue and violet iridescence (Lane 1953, García & Casal 1965). In *Is. paranensis*, however, these scales are dull brown, without any iridescence.

The male genitalia of *Is. lunata* and *Is. paranensis* differ conspicuously in the development of the large setae of the basal mesal lobe. In *Is. lunata*, these setae are relatively few (6–9), long (extending to or beyond the apex of the gonocoxite), and remain coarse to near their apices, where they are flattened and sharply bent or hooked. In *Is. paranensis*, these setae are more numerous (about 20–25), shorter (not extending to apex of gonocoxite), attenuate, and are not sharply bent or hooked at the apex.

Pupae of *Is. lunata* and *Is. paranensis* appear to differ by: (1) the length of seta 5-C, which is shorter than the trumpet in *Is. lunata*, but as long as or longer than the trumpet in *Is. paranensis*; (2) the size of seta 3 on the anterior abdominal segments, seta 3-I weaker than seta 6-I in *Is. lunata* but as strong as seta 6-I in *Is. paranensis*, seta 3-II smaller than seta 7-II in *Is. lunata* but larger than seta 7-II in *Is. paranensis*, and seta 3-III smaller than seta 6-III in *Is. lunata* but larger than seta 6-III in *Is. paranensis*; and (3) the size of seta 5-V, which is subequal to or smaller than seta 6-V in *Is. lunata*, but larger than seta 6-V in *Is. paranensis*.

Larvae of the species appear to differ by: (1) the form of seta 1-P, which is shorter than seta 0-P and flame-shaped in *Is. lunata* but longer than seta 0-P and not flame-shaped in *Is. paranensis*; (2) the form of the comb scales in the dorsal part of the row, which have a distinct, large, spine-like apical projection in *Is. lunata* but are evenly fringed in *Is. paranensis*; (3) the number of pecten elements, which are about 13–21 in *Is. lunata* but closer to 30 (27–30) in *Is. paranensis*; (4) the branching of seta 1-X, which has 3 or 4 branches in *Is. lunata* but is single in *Is. paranensis*; and possibly also by (5) the accessory dorsolateral setae of the siphon, which are 6 in number and branched near their bases in *Is. lunata* but 7–11 in number and branched beyond their bases in *Is. paranensis*.

Bionomics. *Isostomyia paranensis* is sylvan and associated with areas that flood. The immature stages of *Is. paranensis* studied here were found living in leaf axils of *Androtrichum giganteum* (Kunth) Pfeiffer, 1940 (Cyperaceae); they were associated with larvae of *Wyeomyia (Menolepis) leocostigma* Lutz, 1904. Several immatures (Mean \pm SD: 11.6 \pm 8.47; n = 15) of *Is. paranensis* were observed coexisting in spite of the low water volume (35.6 \pm 28.31 ml) retained by the plants. Third- and fourth-instar larvae of *Is. paranensis* are facultative predators. They usually grab mosquito prey by the mid-abdomen, ingest the internal tissue, and then reject the skin. Marti *et al.* (2007) reported that most *Scirpus giganteus* (= *A. giganteum*) plants they examined harbored only 1 or 2 *Is. paranensis* larvae and that they did not find evidence of predation, the midguts of field-collected larvae containing mainly green algae.

Adults are present from October to May, with maximum abundance in March and April, and are most active at sundown (Maciá 1995).

Distribution. *Isostomyia paranensis* is definitely known at present only from northeastern Argentina. Most published records are from Buenos Aires Province (Brèthes 1910, 1912; Pennington 1919; Shannon and Del Ponte 1928; Edwards 1930; Costa Lima 1931; Prosen *et al.* 1960; García & Casal 1965; Belkin *et al.* 1968; Ronderos *et al.* 1992; Maciá 1997; Marti *et al.* 2007). It is recorded also from Corrientes and Misiones provinces by Duret (1951), Castro *et al.* (1960), and Campos & Maciá (1998). The record of *Is. lunata* from Iguazu, Misiones by Shannon (1931) may refer to *Is. paranensis*.

Material examined. Argentina, Buenos Aires Province, Ensenada, Boca Cerrada Adult males: 7, 7/XI/1995; 4, 4/III/1996; 1, 25/VI/1996, Campos col.; 2, 4/VII/1996; 1, 1/VIII/1996, Maciá col. Adult females: 2, 7/XI/1995; 5, 4/III/1996, Campos col. Larva: 5, 7/XI/1995; 8, 4/III/1996; 3, 13/III/1996. Pupa: 1, 7/XI/1995; 1, 12/XI/1995; 10, 4/III/1996; 1, 13/III/1996; 1, 25/VI/1996, Campos col. (MLP).

Acknowledgments

We thank Dr. A. Maciá (Facultad de Ciencias Naturales y Museo de La Plata, Universidad Nacional de La Plata, Argentina) for help with field work; Professor G. C. Rossi (Centro de Estudios Parasitológicos y de Vectores, UNLP) for providing literature.

This paper is a scientific contribution No. 889 of the Instituto de Limnología “Dr. R. A. Ringuelet.”

References

- Belkin, J.N. (1962) *The mosquitoes of the South Pacific (Diptera, Culicidae)*. Vol. 1. University of California Press, Berkeley. 608 pp.
- Belkin, J.N., Schick, R.X. & Heinemann, S.J. (1968) Mosquito studies (Diptera, Culicidae). XI. Mosquitoes originally described from Argentina, Bolivia, Chile, Paraguay, Perú and Uruguay. *Contributions of the American Entomological Institute*, 4(1), 9–29.
- Bonne-Wepster, J. & Bonne, C. (1921) Notes on South American mosquitoes in the British Museum (Diptera, Culicidae). *Insector Inscitiae Menstruus*, 9, 1–26.
- Bonne-Wepster, J. & Bonne, C. (1922) A new coloration key for the species of the genus *Goeldia* (Diptera, Culicidae). *Insector Inscitiae Menstruus*, 10, 37–38.
- Brèthes, J. (1910) Dípteros nuevos ó poco conocidos de Sud-América. *Anales del Museo Nacional de Buenos Aires*, 20, 469–484.
- Brèthes, J. (1912) Los mosquitos de la Republica Argentina. *Boletín del Instituto Entomológico y de Patología Vegetal*, 1, 5–49.
- Campos, R.E. & Maciá, A. (1998) Culicidae. In: Morrone, J.J. & Coscaron, S. (Eds), *Biodiversidad de Artrópodos Argentinos*. Ediciones SUR, La Plata, Argentina, pp. 291–303.
- Castro, M., García, M. & Bressanello, M.D. (1960) Diptera. Culicidae. Culicinae. *Primeras Jornadas Entomoepidemiológicas de Argentinatina Buenos Aires*, 2, 547–562.
- Costa Lima, A. da (1931) Nota sobre sabethineos do grupo *Joblotia* (Diptera: Culicidae). *Memorias do Instituto Oswaldo Cruz*, 25, 65–71.
- Darsie, R.F., Jr. (1985) Mosquitoes of Argentina. Part 1. Keys for identification of adult females and fourth stage larvae in English and Spanish (Diptera: Culicidae). *Mosquito Systematics*, 17, 153–253.
- Duret, J.P. (1949) Lista de los mosquitos del Gran Buenos Aires. *Revista de Sanidad Militar de Argentina*, 48, 122–124.
- Duret, J.P. (1950) Lista do los mosquitos de la Republica Argentina (Diptera, Culicidae). *Revista de la Sociedad Entomológica Argentina*, 14, 297–318.
- Duret, J.P. (1951) Contribución al conocimiento de la distribución geográfica de los culicidos Argentinos (Diptera-Culicidae). Part IV. *Revista de Sanidad Militar de Argentina*, 50, 372–388.
- Dyar, H.G. (1919a) A note on *Lesticocampa*, and a new species (Diptera, Culicidae). *Insector Inscitiae Menstruus*, 7, 9–11.
- Dyar, H.G. (1919b) A note on Argentine mosquitoes (Diptera, Culicidae). *Insector Inscitiae Menstruus*, 7, 85–89.
- Dyar, H.G. (1921) The mosquitoes of Argentina (Diptera, Culicidae). *Insector Inscitiae Menstruus*, 9, 148–150.
- Dyar, H.G. (1922) Mosquito notes (Diptera, Culicidae). *Insector Inscitiae Menstruus*, 10, 92–99.
- Dyar, H.G. (1923) Notes on *Goeldia* (Diptera, Culicidae). *Insector Inscitiae Menstruus*, 11, 81–88.
- Dyar, H.G. (1928) *The mosquitoes of the Americas*. Carnegie Institution of Washington (Publ. 387), Washington, DC, 616 pp.
- Dyar, H.G. & Knab, F. (1906) The larvae of Culicidae classified as independent organisms. *Journal of New York of Journal of the New York Entomological Society*, 14, 169–230.
- Dyar, H.G. & Shannon, R.C. (1924) The subfamilies, tribes, and genera of American Culicidae. *Journal of the Washington Academy of Science*, 14, 472–486.
- Edwards, F.W. (1930) Mosquito notes.—IX. *Bulletin of Entomological Research*, 21, 287–306.
- Edwards, F.W. (1932) *Diptera. Fam. Culicidae*. In: Wytzman, P. (Ed.), *Genera Insectorum*. Fascicle 194. Desmet-Verteneuil, Brussels, 258 pp.
- García, M. & Casal, O.H. (1965) Culicidae (Diptera) del Delta del Paraná. II – Apuntes Sistemáticos y Biológicos. *Delta Paraná*, 5, 5–16.
- Harbach, R.E. & Peyton, E.L. (1993) Morphology and evolution of the larval maxilla and its importance in the classification of the Sabethini (Diptera: Culicidae). *Mosquito Systematics*, 25, 1–16.
- Knight, K.L. & Stone, A. (1977) A catalog of the mosquitoes of the world (Diptera: Culicidae). Ed. 2. *Thomas Say Foundation*, 6, 1–611.
- Lane, J. (1939) Catalogo dos mosquitos neotropicos. *Boletim de Biologia Série Monografica*, 1, 1–218.
- Lane, J. (1953) *Neotropical Culicidae*. Vol. 2. University Sao Paulo, Sao Paulo, Brasil, pp. 553–1112.
- Lane, J. & Cerqueira, N.L. (1942) Os sabetineos da América (Diptera, Culicidae). *Arquitos de Zoología*, 3, 473–849.
- Maciá, A. (1995) Contribución al conocimiento de la ecología de mosquitos (Diptera: Culicidae) de la zona de La Plata. Doctoral Thesis, Universidad Nacional de La Plata, Argentina.
- Maciá, A. (1997) Age structure of adult mosquito (Diptera: Culicidae) populations from Buenos Aires Province, Argentina. *Memorias do Instituto Oswaldo Cruz*, 92, 143–149.
- Marti, G.A., Micieli, M.V., Maciá, A., Lounibos, L.P. & Garcia, J.J. (2007) Seasonality, abundance and autogeny of the mosquito *Isostomyia paranensis* from phytotelmata in temperate Argentina. *Journal of the American Mosquito*

- Control Association*, 23, 252–258.
- Martínez, A. (1949) Nota sobre un Sabethini encontrado en los alrededores de Buenos Aires. *Misión de Estudios de Patología Regional Argentina*, 76, 43–44.
- Mitchell, C.J. & Darsie, R.F. Jr. (1985) Mosquitoes of Argentina. Part II. Geographic distribution and bibliography (Diptera, Culicidae). *Mosquito Systematics*, 17, 279–360.
- Pennington, M.S. (1919) Sobre "Jantinosoma Arribalzagae" Giles. *Phycis*, 4, 600.
- Petrocchi, J. (1923) Estado actual de la sistemática de los Culicinae (mosquitos) en la Republica Argentina. Enumeración de especies. *Revista del Instituto de Bacteriología Malbran de Buenos Aires*, 3, 83–93.
- Prosen, A.F., Martínez, A. & Carcavallo, R.U. (1960) La familia Culicidae (Diptera) en la ribera fluvial de la Provincia de Buenos Aires. *Anales del Instituto de Medicina Regional (Univ. Noreste)*, 5, 101–113.
- Ronderos, R.A., Schnack, J.A. & Maciá, A. (1992) Composición y variación estacional de una taxocenosis de Culicidae del ecotono subtropical pampásico (Insecta, Diptera). *Graellsia*, 48, 3–8.
- Shannon, R.C. (1931) List of species of Argentine Culicidae. *Sexta Reunión de la Sociedad Argentina de Patología Región Norte, Salta, Argentina*, pp. 494–500.
- Shannon, R.C. & Del Ponte, E. (1928) Los culícidos en la Argentina. *Revista del Instituto de Bacteriología Malbran de Buenos Aires*, 5, 29–140.
- Stone, A. (1944) Notes on the genus *Trichoprosopon* (Diptera, Culicidae). *Revista Entomológica*, 15, 335–341.
- Stone, A. (1967) A synoptic catalog of the mosquitoes of the world, supplement III (Diptera: Culicidae). *Proceedings of the Entomological Society of Washington*, 69, 197–224.
- Stone, A., Knight, K.L. & Starcke, H. (1959) A synoptic catalog of the mosquitoes of the world (Diptera, Culicidae). *Thomas Say Foundation*, 6, 1–358.
- Theobald, F.V. (1901) *A monograph of the Culicidae or mosquitoes. Vol 2*. British Museum (Natural History), London, 391 pp.
- Ward, R.A. (1984) Second supplement to "A catalog of the mosquitoes of the world" (Diptera: Culicidae). *Mosquito Systematics*, 16, 227–270.
- Wood, D.M., Dang, P.T. & Ellis, R.A. (1979) *The mosquitoes of Canada. Diptera: Culicidae*. Agriculture Canada, Hull, Quebec, 390 pp.
- Zavortink, T.J. (1979) Mosquito studies (Diptera, Culicidae). XXXV. The new sabethine genus *Johnbelkinia* and a preliminary reclassification of the composite genus *Trichoprosopon*. *Contributions of the American Entomological Institute*, 17(1), 1– 61.