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The larvae of some species of *Callibaetis* Eaton (Ephemeroptera: Baetidae)

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The larvae of some species of *Callibaetis* Eaton (Ephemeroptera: Baetidae)

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The larvae of three known species of *Callibaetis* are described here for the first time: *C. gonzalezi* (Navás), *C. pollens* Needham & Murphy and *C. sellacki* (Weyenbergh). The larva of *C. willineri* Navás is redescribed and the larva of *C. guttatus* Navás is revised and discussed. The diagnoses of the adults are also provided.

Keywords: South America; Ephemeroptera; Baetidae; *Callibaetis*; nymphs

Introduction

Eaton (1881) described the genus *Callibaetis* for the first time. He included one species *Callibaetis pictus* (Eaton) originally placed in *Baetis*. Since then many authors such as Banks (1900), Eaton (1871, 1885), Gillies (1990), and McCafferty and Provonsha (1993) have described new species in this genus.

Callibaetis is characterised in the imago by: (1) body with small reddish spots; (2) male wings hyaline or with spots, female wings always pigmented with a characteristic colour pattern; (3) forewings with marginal intercalary veins paired or single; (4) hind wings with three longitudinal veins and several cross veins; (5) genitalia with forceps three segmented. The larvae are characterised by: (1) long antennae, 5–6 times head length; (2) labrum with a row of flattened spine-like setae along anterior margin; (3) mandibles with incisors deeply cleft; (4) maxillae with a row of long setae on apex of galea-lacinia; (5) labium with glossae wider than paraglossae, segment 2 of palps without projection and with a row of spine-like setae, segment 3 elongate and with a medial concavity; (6) tarsal claws with two rows of very long cylindrical denticles; (7) gills present on abdominal segments I–VII with two lamellae narrowly connected to each other (Domínguez, Molineri, Pescador, Hubbard and Nieto 2006).

The genus has a widespread Pan-American distribution from the USA to the Rio Negro province in the south of Argentina. Most of the species of *Callibaetis* are each also widely distributed (Domínguez et al. 2006). In most cases, the species are known only from adults, especially from female imagines. That is because the female imaginal wings present different colour patterns. However, this character is variable even between sexes of the same species.

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Although the species are very conspicuous, sometimes they are difficult to identify. In South America there are 14 valid species known from adults, with only three of them also known from larvae: *C. guttatus*, *C. radiatus* and *C. willineri* (Traver 1944; Da-Silva 1991; Salles, Da-Silva and Lugo-Ortiz 2003).

Herein imagines of three species are associated with their larval stages: *C. gonzalezi* (Navás 1934), *C. sellacki* (Weyenbergh 1883) and *C. pollens* Needham and Murphy (1924). The species *C. willineri* Navás (1932a) and *C. guttatus* Navás (1915a) are also revised.

Materials and methods

The examined material is housed in the following institutions: Fundación-Instituto Miguel Lillo, Tucumán, Argentina (IFML) and Universidad Mayor de San Andrés, La Paz, Bolivia (UMSA).

Taxonomy

Callibaetis gonzalezi (Navás) (Figures 1–15)

Cloeon gonzalezi Navás, 1934, p. 27.

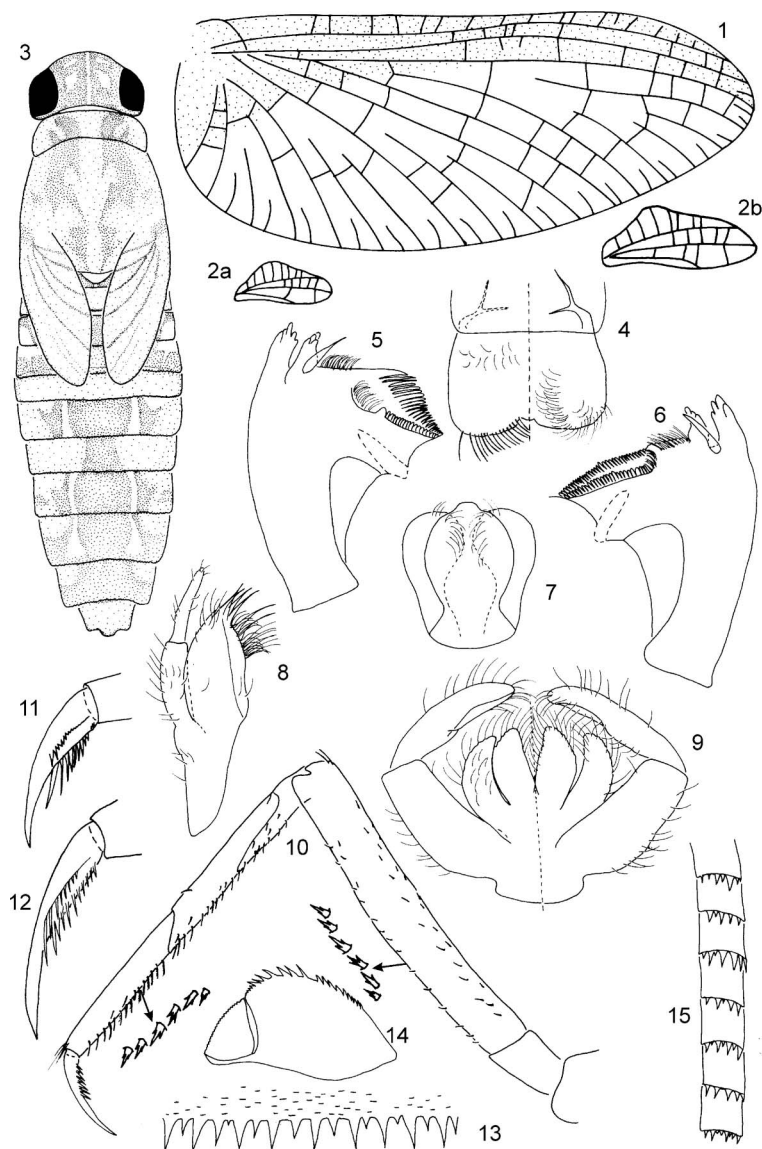
Callibaetis gonzalezi; Gillies, 1990, p. 24; Domínguez et al. 2006, p. 113.

Material examined. 5 larvae and 2♀ imagines: ARGENTINA: Formosa, A° Torhue, 10 km S de Formosa, 8/ 12/ 1986, Domínguez col.; 1♀ imago: Misiones, P.N. Iguazú, Río Iguazú, Puerto Canoas, 26/ 11/ 1998, Domínguez, Molineri & Nieto cols.; 9♀ imagines and 2 subimagines: Salta, Depto. San Martín, A° madrejones, Ruta Tartagal, Pocitos, 19/ 4/ 1983, Domínguez col. 17♀ imagines and 2 Larvae (dissected): BOLIVIA: Laguna Granja, 10-11/ 3/ 2003, Molina & Gibon cols.; 11 larvae (1 dissected) same locality, 16/ 9/ 2003, Molina et al. col.; 35 larvae: Depto Tarija, Río Grande de Tarija, S 22°43'52", W 64°16'15.3", 374 m, 4/ 3/ 2006, Domínguez & Nieto cols. 10♀ imagines and 5 larvae from Bolivia, Laguna Granja housed in UMSA other material housed in IFML. Study of some larvae collected at two localities permits the association with the imagines on the basis of colour patterns.

Female imago (Figures 1–2a,b) characterised by Navás (1934). Gillies (1990) with new material added some useful characters.

Larva (Figure 3). Length: body 5–6 mm; cerci 3.2 mm (partially broken); terminal filament 2.8 mm antennae 4.2 mm (partially broken). Head yellowish brown. Antennae pale yellow, at least four times as long as head capsule. Mouthparts (Figures 4–9): labrum (Figure 4) wider than long, anterior margin with an emargination and with a row of 15–17 long flattened spine-like setae. Mandibles (Figures 5 and 6) with incisors cleft in two sets, inner set at oblique angle with outer set, setae between prosthecae and mola, prosthecae formed of stout, spine-like setae. Hypopharynx (Figure 7) with lingua scarcely longer than superlinguae. Maxillae (Figure 8) with long canines and with a row of long setae on apex, palps subequal in length to galea-lacinia, segment 1 subequal to segment 2. Labium (Figure 9) with glossae subequal in length but wider than paraglossae, glossae and paraglossae with a row of long spine-like setae, segment 2 of palps with a row of short spines on inner margin, segment 3 with a medial concavity.

Thorax yellowish brown with pale spots as in Figure 3. Pleurae yellowish brown, sterna pale yellow. Legs yellow. Femora apically with a transverse yellowish brown band. Leg I (Figure 10): ventral margin of femur and tarsus with a row of three-pointed spines (Figure 10); tarsal claw (Figure 11) 0.4 times the length of tarsus and with two rows of long



Figures 1–15. *Callibaetis gonzalezi*. Figures 1–2. Female imago. (1) forewing; (2a) hind wing; (2b) hind wing, detail. Figures 3–15. Larva. (3) General view. Mouthparts (Figures 4–9): (4) labrum, left half in dorsal view (d.v.), right half in ventral view (v.v.); (5) left mandible v.v.; (6) right mandible v.v.; (7) hypopharynx; (8) maxilla v.v.; (9) labium, left d.v., right v.v. (10) leg I; (11) tarsal claw I; (12) tarsal claw III. (13) Posterior margin of tergum IV. (14) Paraproct. (15) Cercus.

denticles. Legs II–III with tibiae and tarsi with pectinate spines (Figure 10), ventral margin of tarsi with a row of three-pointed spines; tarsal claws (Figure 12) at least half the length of tarsi and with two rows of denticles.

Abdomen yellowish brown. Colour pattern with segments V, VII and VIII with two parallel pale bands as in Figure 3. Posterior margin of terga with spines as in Figure 13.

Sterna pale yellow. Gills with trachea pigmented. Paraproct with 20–21 spines (Figure 14). Caudal filaments pale yellow and with a whorl of spines on each segment (Figure 15).

Diagnosis. *Callibaetis gonzalezi* can be distinguished from other species of the genus by following combination of characters. In the female imagines, (1) vitta without clear windows around cross-veins, pigment extending broadly across base of wings to anal margin (Figure 1); (2) marginal intercalary veins of forewings single; (3) hind wings (Figure 2a,b) with 13–17 cross-veins, and with a broadly rounded costal process; (4) legs without spots; (5) abdominal sterna with anterolateral dark spots. In the larvae, (1) general colour pattern as in Figure 3 with abdominal segments V, VII and VIII with two parallel pale bands; (2) anterior margin of labrum (Figure 4) with an emargination and with a row of 15–17 long, flattened, spine-like setae; (3) prosthecae of mandibles (Figures 5 and 6) a stout spine-like setae; (4) maxillae (Figure 8) with palps scarcely longer than galea-lacinia.

Distribution. Argentina, Bolivia and Paraguay.

Callibaetis guttatus Navás (Figures 16–36)

Callibaetis guttatus Navás, 1915a: 120; Gillies, 1990: 25; Da-Silva, 1991: 346; Domínguez et al., 2006, p. 113.

Callibaetis apicatus Navás, 1917, p. 189.

Callibaetis bruchius Navás, 1920a, p. 55.

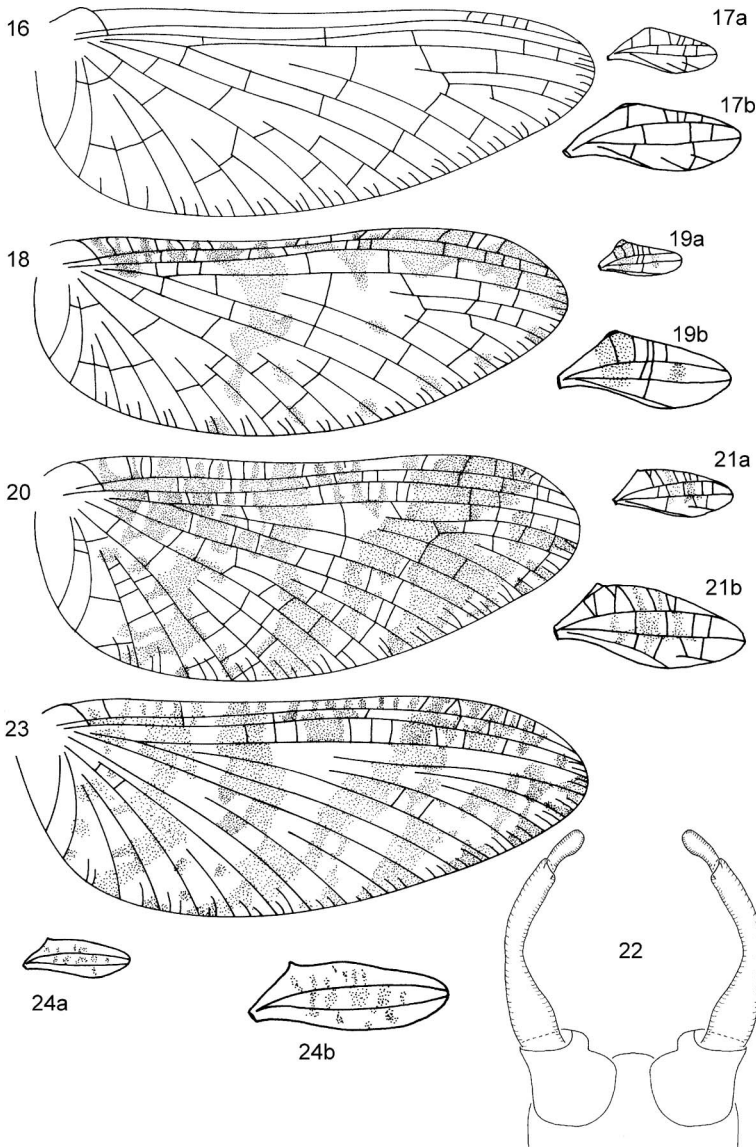
Callibaetis zonatus Navás, 1929, p. 224.

Material examined. 17 larvae, 2♀ and 2♂ imagines (reared), 1♀ and 1♂ imagines: ARGENTINA: Tucumán, Depto. Tafí Viejo, Raco (km 19), A° Palangana, S 26°40'00", W 65°24'50", 24/ 11/ 2001, Molineri col.; 5♂ and 3♀ imagines, 2♂ subimagines: Misiones, Pque. Prov. Urugua-i, A° Uruzú, S 25° 51'29", W 54°10'10", 322 m, 7-11/ 12/ 1999, C Molineri; 13♀ imagines: same locality, 26/ 11/ 2001, Domínguez, Orce & Nieto col. Material housed in IFML.

Adults (Figures 16–24) characterised by Navás (1915a). Gillies (1990) noted that this species is highly variable with regard to the extent of pigmentation in the wings. Some specimens of both sexes have forewings with extensive spotting over the wing field, occasionally reduced to a series of spots along the posterior margin. However, Da-Silva (1991) described the forewings in females with seven transverse bands and hyaline in males.

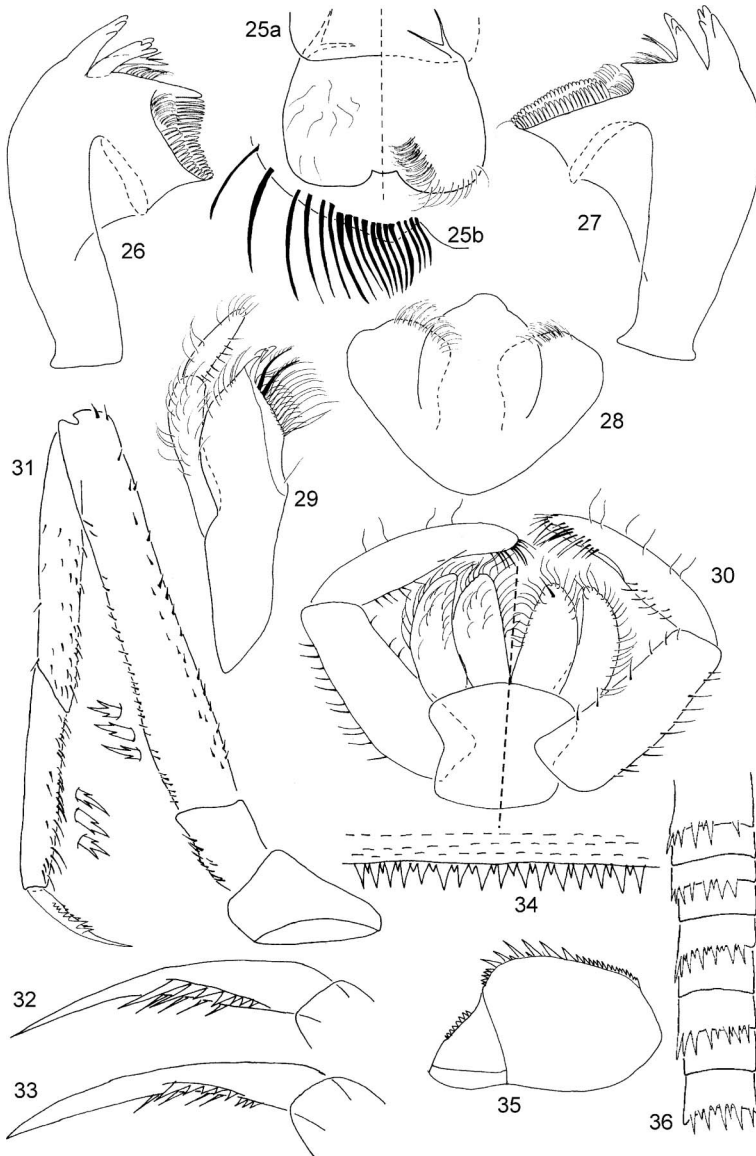
New material collected and reared is not in agreement with the pigmentation of the wings described above. Two different groups assignable to this species were distinguished. The first group represents female imagines with forewings with reduced spotting as in Figure 18 and males with hyaline forewings (Figure 16). The second group, however, represents forewings in both sexes (Figures 20 and 23) with extensive spotting over general wing field.

Larva. Characterised by Da-Silva (1991). Based on the new material presented herein, the following characteristics are included that are not in agreement with or omitted from the original description: (1) labrum (Figures 25a,b) with anterior margin with a row of 17–19 long flattened setae; (2) mandibles (Figures 26 and 27) with inner set of incisors at oblique angle with outer set and with setae between prosthecae and mola present, right prostheca bifid; (3) hypopharynx (Figure 28) with lingua longer than superlinguae; (4) maxillae (Figure 29) with four long canines, palps two-segmented longer than galea-lacinia, segment 1 1.5 times longer than segment 2; (5) labium (Figure 30) with glossae with a



Figures 16–24. *Callibaetis guttatus*. Male imago: (16) forewing; (17a) hind wing; (17b) hind wing, detail. Female imago: (18) forewing; (19a) hind wing; (19b) hind wing, detail. Male imago: (20) forewing; (21a) hind wing; (21b) hind wing, detail. (22) Genitalia v.v. Female imago: (23) forewing; (24a) hind wing; (24b) hind wing, detail.

strong seta ventrally; (6) leg I: femur (Figure 31) and tarsus with ventral margin with a row of three-pointed spines, tarsus also with pectinate spines, tarsal claw (Figure 32) 0.4 times the length of tarsus and with two rows of long denticles; (7) legs II–III: femora, tibiae and tarsi with pectinate spines, tarsal claws (Figure 33) at least half the length of tarsi; (8) posterior margin of abdominal terga with spines as in Figure 34; (9) paraprocts with 25–27 spines (Figure 35); (10) caudal filaments (Figure 36) with a whorl of spines every two segments.



Figures 25–36. *Callibaetis guttatus*. Larva. Mouthparts (Figures 25–30): (25a) labrum, left half in d.v., right half in v.v.; (25b) labrum, apical setae; (26) left mandible v.v.; (27) right mandible v.v.; (28) hypopharynx; (29) maxilla v.v.; (30) labium, left d.v., right v.v. (31) leg I; (32) tarsal claw I; (33) tarsal claw III. (34) Posterior margin of tergum IV. (35) Paraproct. (36) Cercus.

Diagnosis. *Callibaetis guttatus* can be distinguished from the other species of the genus by the following combination of characters. In the imagines, (1) forewings at least in female (Figures 18, 20, 23) with spots along posterior margin, sometimes extending forming bands; (2) forewings (Figures 16, 18, 20, 23) with paired marginal intercalary veins; (3) hind wings (Figures 17a,b, 19a,b, 21a,b, 24a,b) with 0–15 cross-veins and with a pointed costal process; (4) tibiae I and II with two spots basally; (5) abdominal sterna with

anterolateral dark spots; (6) genitalia with bases of forceps approximated and with a concavity on internal margins (Figure 22). In the larvae, (1) labrum (Figures 25a,b) with anterior margin with a row of 17–19 long flattened setae; (2) prosthema of right mandible bifid (Figure 27); (3) glossae of labium with a strong seta ventrally (Figure 30); (4) femur (Figure 31) and tarsus I with ventral margin with a row of three-pointed spines; (5) caudal filaments (Figure 36) with a whorl of spines every two segments.

Distribution. Argentina and Brazil.

Biology. This species was collected in streams with rocky substrate and low currents.

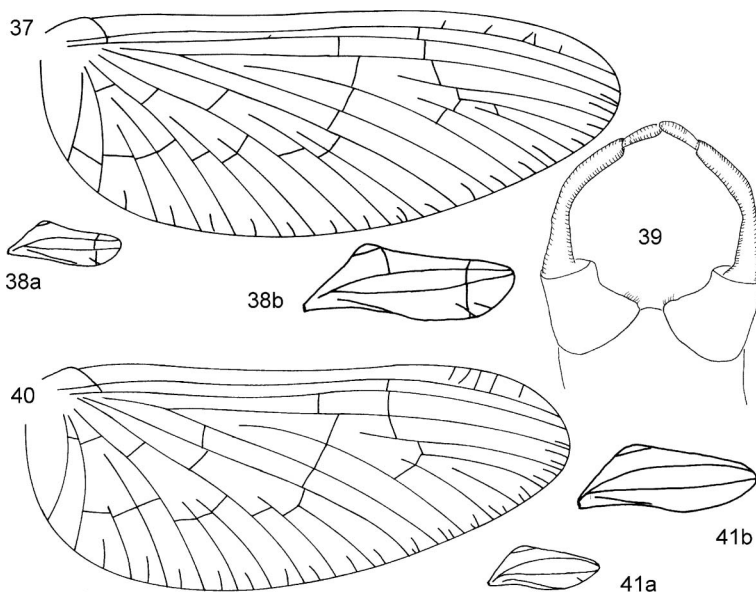
***Callibaetis pollens* Needham & Murphy (Figures 37–54)**

Callibaetis pollens Needham & Murphy, 1924: 51; Domínguez et al. 2006: 116.

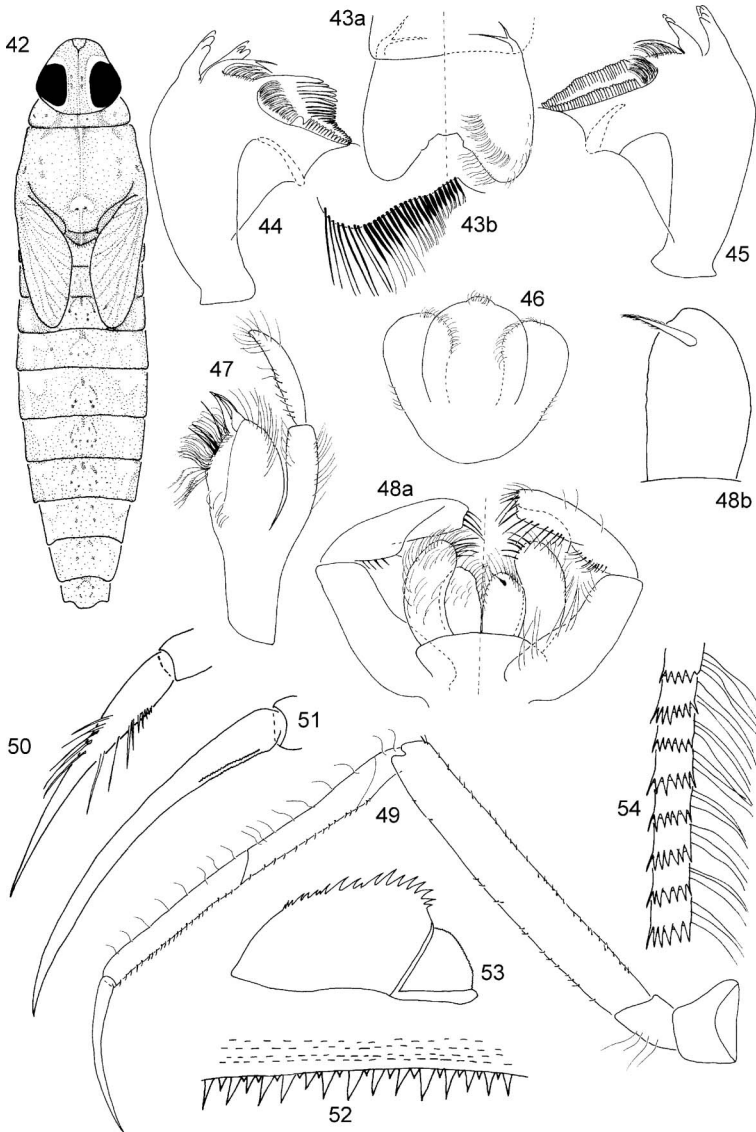
Material examined. 16 larvae: ARGENTINA: Tucumán, Acheral, río Aranillas cruce RP 38; S27°06'59.9", W 65°27'43.9", 28/ 7/ 2006, Molineri, Nieto, Giordano & Rueda cols.; 1♀ imago (reared) same locality, 5/ 8/ 2006, Molineri & Nieto cols.; 23 larvae and 32♀ imagines same locality and collectors, 13/ 9/ 2007. Material housed at IFML.

Adults (Figures 37–41). Male imago and female subimago characterised by Needham and Murphy (1924). Based on the material collected herein it was observed that the female imagines do not have a body with small reddish spots. Male imagines were not collected.

Larva (Figure 42). Length: body 7.0–7.4 mm; cerci 3.2–3.4 mm; terminal filament 2.8–3.1 mm, antennae (partially broken) 4.0 mm. Head yellowish brown, compound eyes in male larvae orange brown. Antennae pale yellow, at least three times as long as head capsule.



Figures 37–41. *Callibaetis pollens*. Male imago: (37) forewing; (38a) hind wing; (38b) hind wing, detail. (39) Genitalia. Female imago: (40) forewing; (41a) hind wing; (41b) hind wing, detail.



Figures 42–54. *Callibaetis pollens*. Larva. (42) General view. Mouthparts (Figures 43–48): (43a) labrum, left half in d.v., right half in v.v.; (43b) labrum, apical setae; (44) left mandible v.v.; (45) right mandible v.v.; (46) hypopharynx; (47) maxilla v.v.; (48a) labium, left d.v., right v.v. (48b) glossa v.v. (49) leg I; (50) tarsal claw I; (51) tarsal claw III. (52) Posterior margin of tergum IV. (53) Paraproct. (54) Cercus.

Mouthparts: labrum (Figure 43a) wider than long, anterior margin with a deep, u-shaped emargination and with a row of 28–30 long flattened spine-like setae, spine-like setae near to midline apically bifid (Figure 43b). Mandibles (Figures 44 and 45) with incisors cleft in two sets, inner set at oblique angle with outer set, setae between prostheca and mola present. Prostheca of left mandible bifid (Figure 44), right prostheca formed as spine-like seta (Figure 45). Hypopharynx (Figure 46) with lingua longer than superlinguae. Maxillae

(Figure 47) with long canines and with a row of long setae on apex, palps 1.5 times the length of galea-lacinia, segment 1 subequal to segment 2. Labium (Figures 48a,b) with glossae wider and shorter than paraglossae and with a strong, spine-like seta ventrally; glossae and paraglossae with a row of long spine-like setae, segment 2 of palps with a row of short spines on inner margin, segment 3 with a medial concavity and apically truncate.

Thorax yellowish brown, mesonotum with a pale spot as in Figure 42. Pleurae yellowish brown, sterna pale yellow. Legs pale yellow. Femora with brown spots basally and a transverse brown band apically. Leg I (Figure 49): tarsus with a row of three-pointed spines and pectinate spines, tarsal claw (Figure 50) 0.7 times the length of tarsus and with two rows of long spines. Tarsal claws II–III (Figure 51) 0.8 times the length of tarsi and with two rows of minute denticles.

Abdomen yellowish brown with a colour pattern as in Figure 42. Posterior margin of terga with spines as in Figure 52. Sterna pale yellow. Gills with pigmented trachea. Paraprocts with 18–20 spines (Figure 53). Caudal filaments yellow, posterior margin of each segments yellowish brown and with a whorl of spines (Figure 54).

Diagnosis. *Callibaetis pollens* can be distinguished from other species of the genus by the following combination of characters. In the imago, (1) forewings without pigmentation in both sexes (Figures 37 and 40); (2) marginal intercalary veins of forewings single (Figures 37 and 40); (3) hind wings (Figures 38a,b and 41a,b) with 1–6 cross-veins, and with a broadly rounded costal process; (4) abdominal sterna with anterolateral dark spots; (5) genitalia with bases of forceps close together and with setae on internal margin (Figure 39); (6) body without small spots at least in female imagines. In the larvae, (1) general colour pattern as in Figure 42; (2) labrum (Figure 43a), anterior margin with a deep, u-shaped emargination and with a row of 28–30 long flattened spine-like setae, spine-like setae near to lateral margin bifid apically (Figure 43b); (3) left mandible (Figure 44) with prostheca bifid, right prostheca formed as spine-like seta (Figure 45); (4) maxillae (Figure 47) with palps 1.5 times the length of galea-lacinia; (5) labium (Figure 48a) with glossae shorter than paraglossae and with a strong spine-like setae ventrally (Figure 48b), segment 3 of palps truncate apically; (6) tarsal claws long, at least 0.7 times the length of tarsi, claws II and III with two rows of minute denticles (Figure 51).

Distribution. Argentina and Brazil.

Biology. This species was collected in a river with sandy substrate and low current.

***Callibaetis sellacki* (Weyenbergh) (Figures 55–72)**

Cloe sellacki Weyenbergh, 1883, p. 164.

Cloe Lorentzii Weyenbergh, 1883, p. 167.

Callibaetis sellacki Eaton, 1885, p. 198; Gillies, 1990, p. 27.

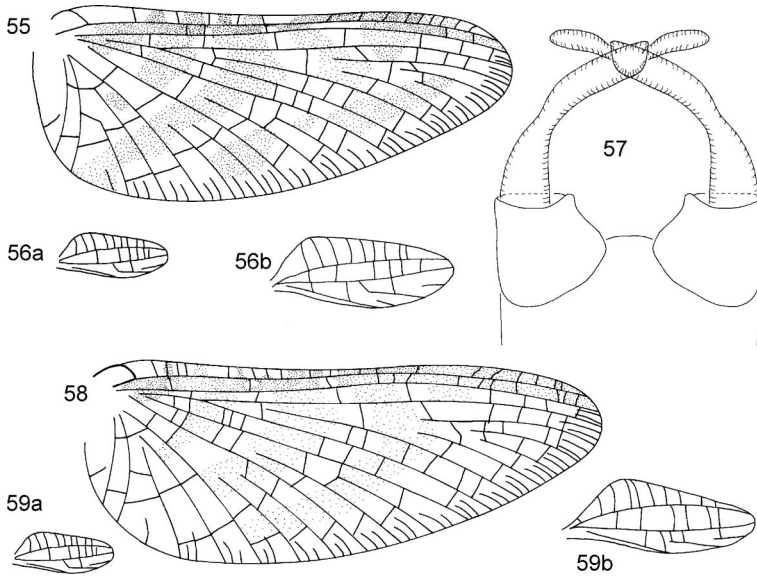
Callibaetis trifasciatus (partim) Navás, 1915a, p. 120.

Callibaetis fasciatus Ulmer, 1921, p. 246.

Callibaetis lineatus Navás, 1932b, p. 82.

Material examined. 5 larvae, 40♂ and 9♀ imagines: ARGENTINA, Buenos Aires, Tandil, A° Quequén Chico, 6/ I/ 1983, Domínguez col. Material housed in IFML.

Adults (Figures 55–59) characterised by Weyenbergh (1883). Later Gillies (1990) proposed four new synonymies and improved the diagnostic characteristics of this species.



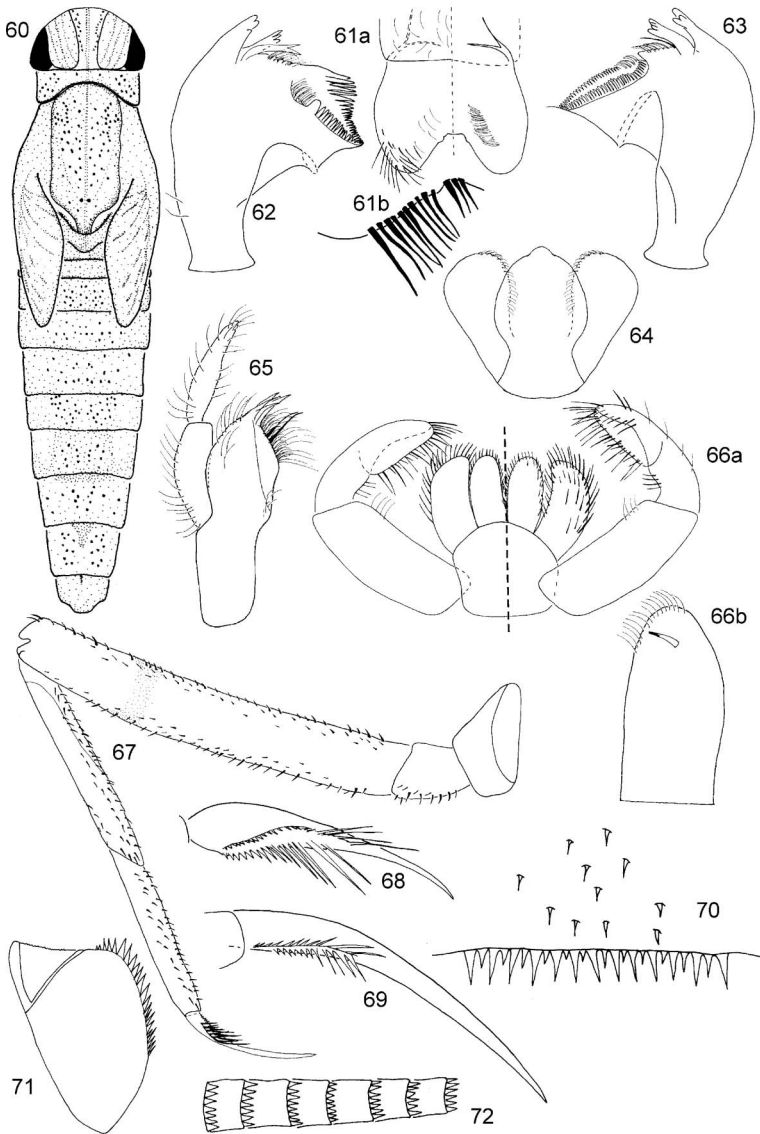
Figures 55–59. *Callibaetis sellacki*. Male imago: (55) forewing; (56a) hind wing; (56b) hind wing, detail. (57) Genitalia. Female imago: (58) forewing; (59a) hind wing; (59b) hind wing, detail.

Larva (Figure 60). Length: body 8.7–8.8 mm; cerci 4.3–4.4 mm; terminal filament 4.0 mm. Antennae broken. Head brown, male compound eyes orange brown. Antennae yellow. Mouthparts (Figures 61–66): labrum (Figure 61a,b) wider than long, anterior margin with a deep, u-shaped emargination and with a row of 12–13 long flattened spine-like setae. Mandibles (Figures 62 and 63) with incisors cleft in two sets, inner set at oblique angle with outer set, setae between prostheca and mola present. Prostheca of left mandible bifid (Figure 62), right prostheca formed as spine-like seta (Figure 63). Hypopharynx (Figure 64) with lingua subequal in length to superlinguae. Maxillae (Figure 65) with long canines and with a row of long setae on apex, palps 1.5 times the length of galea-lacinia, segment 1 subequal to segment 2. Labium (Figure 66a) with glossae subequal in length but narrower than paraglossae and with a strong spine-like seta ventrally (Figure 66b), glossae and paraglossae with a row of spine-like setae, segment 3 of palps rounded.

Thorax (Figure 60) yellowish brown, forewing pads with a transverse dark line. Pleurae yellowish brown, sterna pale yellow. Legs yellow. Femora with a transverse dark band apically. Leg I (Figure 67): ventral margin of femur with a row of three-pointed spines, tarsus with pectinate spines, tarsal claw (Figure 68) 0.6 times the length of tibia and with two rows of long denticles. Legs II–III: tarsi with pectinate spines, tarsal claws (Figure 69) 0.75 times the length of tibiae and with two rows of denticles.

Abdomen yellowish brown, with small dark spots over all segments as in Figure 60. Posterior margin of terga with spines as in Figure 70. Sterna yellow. Gills with trachea pigmented. Paraprocts with 20–22 spines (Figure 71). Caudal filaments yellowish brown and with a whorl of spines on each segment (Figure 72).

Diagnosis. *Callibaetis sellacki* can be distinguished from the other species of the genus by the following combination of characters. In the imago, (1) forewings (Figures 55 and 58) in both sexes with two main pigmented bands, the outer band parallel to posterior



Figures 60–72. *Callibaetis sellacki*. Larva. (60) General view. Mouthparts (Figures 61–66): (61a) labrum, left half in d.v., right half in v.v.; (61b) labrum, apical setae; (62) left mandible v.v.; (63) right mandible v.v.; (64) hypopharynx; (65) maxilla v.v.; (66a) labium, left d.v., right v.v. (66b) glossa v.v. (67) leg I; (68) tarsal claw I; (69) tarsal claw III. (70) Posterior margin of tergum IV. (71) Paraproct. (72) Cercus.

margin of wings; (2) with marginal intercalary veins of forewings paired (Figures 55 and 58); (3) hind wings with 25–30 cross-veins (Figures 56a,b and 59a,b); (4) genitalia (Figure 57) with bases of forceps close together, segment 3 elongate. In the larva, (1) labrum with a deep, u-shaped emargination and with row of 12–13 long flattened spine-like setae (Figures 61a,b); (2) left mandible (Figure 62) with bifid prostheca, right prostheca formed as spine-like seta (Figure 63); (3) maxillary (Figure 65) palps 1.5 times

the length of galea-lacinia; (4) general colour pattern with small dark spots over all body dorsally as in Figure 60.

Distribution. Argentina and Chile.

***Callibaetis willineri* Navás (Figures 73–87)**

Callibaetis willineri Navás, 1932a, p. 115; Gillies, 1990, p. 30; Domínguez et al. 2006, p. 117.

Callibaetis alegre Traver, 1944, p. 46.

Material examined. 25 larvae, 2♀ and 2♂ subimagines (reared): URUGUAY, Flores, Ruta 14, km 253, Gruta del Palacio, 16/ V/ 2000, Morelli & Molineri cols. The material is housed half in Facultad de Ciencias de la República del Uruguay and half in IFML.

Adults (Figures 73–74). Characterised by Navás (1932a). Later Gillies (1990) improved the diagnostic characteristics.

Larva. Characterised by Traver (1944) as *C. alegre*. New material assignable to this species was collected, so herein a redescription of the previously insufficiently described larva is proposed.

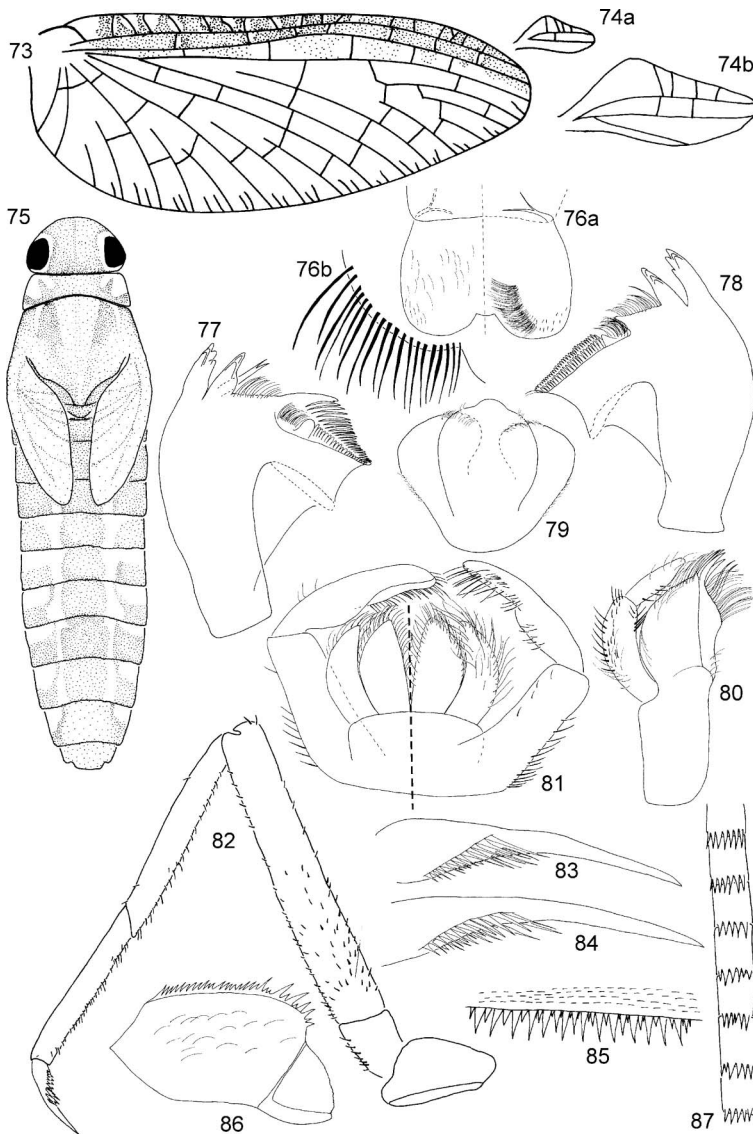
Length: body 8.8–8.9 mm; cerci 7.7–7.8 mm; terminal filament 7.4–7.5 mm, antennae 6.9–7.0 mm. General view as in Figure 75. Head yellowish brown, compound eyes of the male yellow. Antennae pale yellow, 5.5 times the length of head capsule. Mouthparts (Figures 76–81): labrum (Figures 76a,b) wider than long, anterior margin with an emargination and with a row of 18–20 long flattened spine-like setae. Mandibles (Figures 77 and 78) with incisors cleft in two sets, inner set at oblique angle with outer set, setae between prosthecae and mola present. Prostheca of left mandible bifid (Figure 77), right prostheca is formed as spine-like seta (Figure 78). Hypopharynx (Figure 79) with lingua longer than superlinguae. Maxillae (Figure 80) with long canines and with a row of long setae on apex, palps subequal in length to galea-lacinia, segment 1 1.5 times longer than segment 2. Labium (Figure 81) with glossae subequal in length but wider than paraglossae, glossae and paraglossae with a row of long spine-like setae, palp segment 3 apically rounded.

Thorax yellowish brown (Figure 75). Pleurae yellowish brown, sterna pale yellow. Legs yellow. Femora with a yellowish brown transverse band. Leg I (Figure 82): ventral margin of femur with a row of three-pointed spines, tarsus with pectinate spines, tarsal claw (Figure 83) 0.5 times the length of tibia and with two rows of long denticles. Leg II–III: femora, tibiae and tarsi with pectinate spines, tarsal claws (Figure 84) 0.5 times the length of tibiae and with two rows of denticles.

Abdomen (Figure 75) yellowish brown, posterior margin of each segment brown, segments II–VIII with two parallel pale bands. Posterior margin of terga with spines as in Figure 85. Sterna pale yellow. Gills with trachea pigmented. Paraprocts with 28–30 spines (Figure 86). Caudal filaments yellowish brown, with brown setae and with a whorl of spines on each segment (Figure 87).

Variability. Some larvae have the transverse band of the femora and the abdomen yellow.

Diagnosis. *Callibaetis willineri* can be distinguished from the other species of the genus by the following combination of characters. In the imago, (1) marginal intercalary veins of forewings paired (Figure 73); (2) forewings in female with basal half of vitta overlapping



Figures 73–87. *Callibaetis willineri*. Figures 73–74. Female imago. (73) Forewing; (74a) hind wing; (74b) hind wing, detail. Figures 75–87. Larva. (75) General view. Mouthparts (Figures 76–81): (76a) labrum, left half in d.v., right half in v.v.; (76b) labrum, apical setae; (77) left mandible v.v.; (78) right mandible v.v.; (79) hypopharynx; (80) maxilla v.v.; (81) labium, left d.v., right v.v. (82) leg I; (83) tarsal claw I; (84) tarsal claw III. (85) Posterior margin of tergum IV. (86) Paraproct. (87) Cercus.

vein R_1 to as far as R_2 in the $\frac{1}{2}$ or more of its length (Figure 73), male forewings hyaline; (3) hind wings hyaline with 6–10 cross-veins and with a broadly rounded costal process (Figures 74a,b); (4) abdominal sterna with anterolateral dark spots. In the larvae, (1) labrum (Figures 76a,b) with an emargination and with a row of 18–20 long flattened spine-like setae; (2) prosthema of left mandible bifid (Figure 77), right prosthema a spine-like seta (Figure 78); (3) lingua (Figure 79) longer than superlinguae; (4) maxillae (Figure 80) with

palps subequal in length to galea-lacinia; (5) abdominal colour pattern with segments II–VIII having two parallel pale bands (Figure 75).

Distribution. Argentina, Brazil and Uruguay.

Discussion

There are 14 valid species of *Callibaetis* known from adults in South America: *C. camposi* Navás (1930a), *C. dominguezi* Gillies (1990), *C. fasciatus* (Pictet 1843), *C. gonzalezi* (Navás 1934), *C. gregarius* Navás (1930b), *C. guttatus* Navás (1915a), *C. jocosus* Navás (1912), *C. nigrivenosus* Banks (1918), *C. pollens* Needham and Murphy (1924), *C. radiatus* Navás (1920b), *C. sellacki* (Weyenbergh 1883), *C. viviparus* Needham and Murphy (1924), *C. willineri* Navás (1932a), *C. zonalis* Navás (1915b). Only *C. guttatus*, *C. radiatus* and *C. willineri* are also known from larvae (Traver 1944; Da-Silva 1991; Salles et al. 2003). The species only known from larvae are discussed here.

Callibaetis pollens and *C. sellacki* larvae share a labrum with anterior margin with a deep u-shaped emargination. These species can be differentiated from each other by the denticles of the tarsal claws II and III which are minute in *C. pollens* and long in *C. sellacki*. Each of them also has a distinctive abdominal colour pattern. *C. willineri* and *C. gonzalezi* share maxillary palps subequal in length to galea-lacinia and a similar abdominal colour pattern but differ in that the prosthema of the left mandible of *C. willineri* is bifid while that of *C. gonzalezi* is formed as spine-like seta. *C. guttatus* and *C. radiatus* can be differentiated from each other by the prothema of the right mandible which is bifid in *C. guttatus* and formed as a spine-like seta in *C. radiatus*.

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