



Redescription of the subgenus *Securiops* Jacobus, McCafferty & Gattolliat 2006 (Ephemeroptera, Baetidae, *Procloeon* Bengtsson 1915)

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Abstract

The taxon *Securiops* Jacobus, McCafferty & Gattolliat 2006 is treated here as a subgenus of the genus *Procloeon* Bengtsson 1915; it shares all characters of *Procloeon* s. l. and besides them, has peculiar autapomorphies in mouthparts structure. Diagnoses of *Cloeon*/fg1 (or the tribe *Cloeonini sensu* Kluge 2016), *Procloeon*/g1 (or the genus *Procloeon sensu* Kluge 2016) and *Securiops* are given. Larvae of the South African species *Procloeon (Securiops) falcatum* (Crass 1947) **comb. n.** are described for the first time. Based on reared specimens from Zambia, larvae of *Procloeon (Securiops) macafertiorum* Lugo-Ortiz (in Lugo-Ortiz & McCafferty) 1996 are redescribed; subimagines, imagines and eggs of this species are described for the first time. New larval characters of *Procloeon (Securiops) mutadens* (Jacobus *et al.* 2006) **comb. n.** are reported based on a larva from Gambia. Based on reared specimens from Thailand, larvae of *Procloeon (Securiops) primasia* (Kaltenbach *et al.* 2023) **comb. n.** are redescribed; subimagines, imagines and well-developed eggs of this species are described for the first time. Genitalia of *Cheleocloeon excisum* (Barnard 1932) are figured for the first time.

Key words: mayflies, systematics, South Africa, Zambia, Tanzania, Gambia, Thailand

Introduction

The genus-group taxon *Securiops* Jacobus *et al.* 2006 was originally established for the Afrotropical larvae, which formerly were wrongly associated with imagines of *Cloeon dentatum* Kimmins 1956 by Gillies (1988), and because of this, were wrongly placed in the genus *Potamocloeon* Gillies 1990 (whose type species is *Cloeon dentatum*). At present, four Afrotropical species are described based on larval characters under the names *S. macafertiorum* Lugo-Ortiz (in Lugo-Ortiz & McCafferty 1996), *S. mandrare* Jacobus, McCafferty & Gattolliat 2006, *S. megapalpus* Jacobus, McCafferty & Gattolliat 2006 and *S. mutadens* Jacobus, McCafferty & Gattolliat 2006. One Afrotropical species was described based on imaginal characters under the name *Centroptilum falcatum* Crass 1947; it was initially placed in the genus *Centroptilum* Eaton 1869 because at that time the genus *Centroptilum* comprised all baetids with one intercalary in each marginal space of fore wing and hind wings with hooked costal projection; later this species was groundlessly moved to the genera *Afroptilum* Gillies 1990 and *Cheleocloeon* Wuillot & Gillies 1993. A single Oriental species is described based on larval characters under the name *Securiops primasia* Kaltenbach, Phlai-ngam, Suttinun & Gattolliat 2023.

Although some other authors treat *Securiops* as a genus, it is treated here as a subgenus in the genus *Procloeon* based on its larval and imaginal characters (as in Kluge 2020a and elsewhere). Full descriptions of imagines have not been published yet. Kaltenbach *et al.* (2023) stated that «The imaginal stage remains unknown»; however, the key imaginal characters of *Securiops* were reported (Kluge 2020a: Tab. 1), and texture of subimaginal tarsi of *P. (S.) macafertiorum* was described (Kluge 2022a).

Material and methods

Imagines were reared from larvae in cages placed in natural current water and in containers with stagnant water. Most of material will be permanently deposited in the Zoological Institute of the Russian Academy of Sciences (Saint Petersburg, Russia) (ZIN), but is temporarily located in the Department of Entomology of Saint Petersburg State University. Slides were made using Canadian balsam. In order to examine internal parts of the penis and genital muscles of fresh specimens, genitalia were kept in hot water to dissolve non-translucent white inclusions; for this purpose a glass with water and separated genitalia was placed on the cover of a desk-lamp. In the lists of material examined, the following arbitrary signs are used: **L**—larva; **S**—subimago; **I**—imago; **L-S-I♂**—male imago reared from larva, with larval and subimaginal exuviae; **L-S♂**—male subimago reared from larva, with larval exuviae; **L/S♂**—male subimago extracted from mature larva; **S-I♂**—male imago reared from subimago, with subimaginal exuviae.

The term «microlepid» is used according to Kluge (2022a), the terms «gonovectis» and «unistyliger» are used according to Kluge & Novikova (2011); the term «protopteron» is according to Kluge (2005), and other terms are according to Kluge (2004). The noun «blank» is used to describe an unpigmented or pale area.

Systematic position of *Securiops*

(Figs 1–144)

The subgenus *Securiops* Jacobus *et al.* 2006 belongs to the genus *Procloeon* Bengtsson 1915 (corresponding to *Procloeon/g1 sensu* Kluge 2012a and the genus *Procloeon sensu* Kluge 2016b), which belongs to Cloeonini Newman 1853 (corresponding to *Cloeon/fg1 sensu* Kluge 2012 and the tribe Cloeonini *sensu* Kluge 2016b), which belongs to the taxon Anteropatellata Kluge 1997, which belongs to Turbanoculata Kluge 1997 (or family Baetidae s. str.), which belong to Liberevenata Kluge 1997.

Cloeon/fg1, or Cloeonini, besides the taxon *Procloeon/g1*, include *Cloeon* s. str., *Similicloeon* Kluge & Novikova 1992, *Pseudocentropitulum* Bogoescu 1947 and *Waynokiops* Hill *et al.* 2010 (Kluge 2022b).

Procloeon/g1, or *Procloeon* s. l., besides *Securiops*, includes *Pseudocentropitiloides* Jacob 1987, *Oculogaster* Kluge 2016, *Monilistylus* Kluge 2020 and the plesiomorphon *Procloeon* s. str. (Kluge 2020a).

Diagnoses of the taxa Liberevenata, Turbanoculata, Anteropatellata, Cloeon/fg1 and *Procloeon/g1* are given in the previous papers (e.g., Kluge 2016b, 2020a). Here, they are repeated in application to *Securiops*:

Character of Anteropatellata:

Patella-tibial suture. As in most of other Anteropatellata, in *Securiops* the patella-tibial suture is equally developed on all legs in larvae of both sexes and in females of all stages, including their fore legs (Fig. 120–121, 131).

Characters of Cloeonini, or Cloeon/fg1:

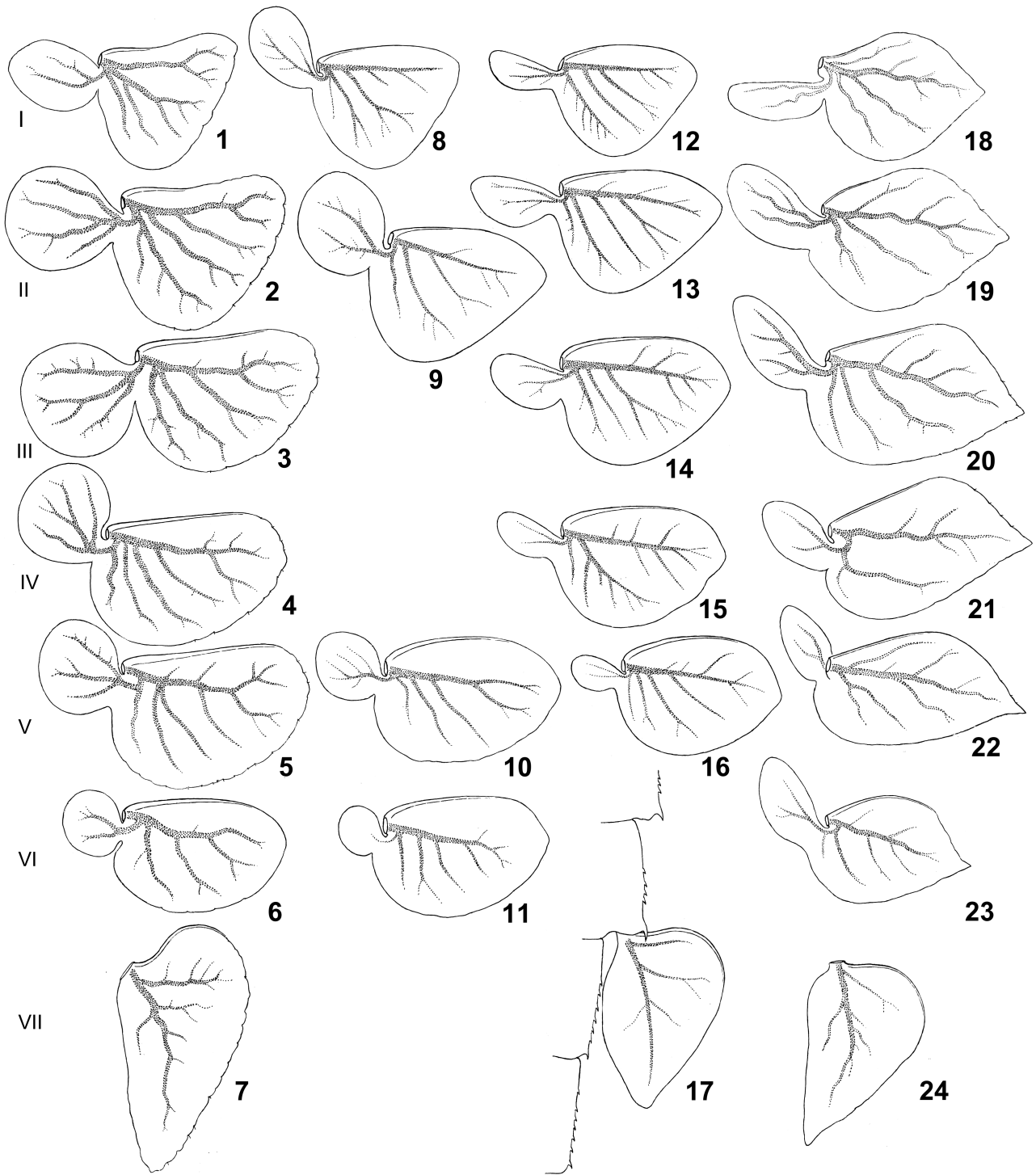
Mandibles. Both larval mandibles have dense setae between prostheca and mola (Figs 34–35, 98–99). The same in some other taxa.

Labial palp. The 3rd segment of labial palp is truncate, and the 2nd segment lacks apical-median projection, so that these two segments form an integral figure widened from base toward apex. At the same time, the border between these segments is retained, and the muscle going from the 2nd segment to the base of the 3rd segment is retained (Fig. 40). An autapomorphy of *Securiops* is the great widening of this triangular formation (see below).

Larval patella-tibial suture. The proximal end of patella-tibial suture is bent distally and connected under acute angle with a row of long thin hairs (autapomorphy of Cloeon/fg1) (Fig. 48).

Larval claw. In all Cloeon/fg1 larval claw is symmetric, slightly curved, either with 2 similar rows of denticles, or without denticles (plesiomorphy within Liberevenata). In all known species of *Securiops* claw is long and lacks denticles (Fig. 50).

Lateral spines on larval abdomen. Lateral margins of abdominal segment IX and some previous segments bear spines (autapomorphy of Cloeon/fg1) (Fig. 17; Kaltenschach *et al.* 2023: fig. 6a).



FIGURES 1–24. Right tergalii of *Securiops* with dorsal lamella turned out. 1–7, *Procloeon (Securiops) falcatum*, tergalii I–VII; 8–17, two individuals of *P. (S.) macafertiorum*: 8–11, tergalii I–II and V–VII; 12–16, tergalii I–V; 17, the same individual, margins of abdominal segments VII–IX with tergalium VII in natural position; 18–24, *P. (S.) primasia*, tergalii I–VII.

Scales on larval abdomen. Abdominal terga and some other body parts of larva bear translucent scales in wide, opened, semicircular sockets. The same in some other baetid taxa, in contrast to angulate and operculated sockets, which are probably initial for Turbanoculata (Kluge 2004). In most species of Cloeon/fg1 such scales densely cover most part of surface of abdominal terga and sterna. Among *Securiops*, such scales are well-developed on abdominal terga III–X and sterna IV–IX in *P. (S.) falcatum* (Figs 55–56); in *P. (S.) mutadens* such scales are sparse (Fig. 103); in *P. (S.) macafertiorum* and *P. (S.) primasia* the scales are completely lost.

Tergalii. Tergalii have the costal rib, but lack the anal rib and can bear a second lobe, which represents an anal-proximal expansion curved dorsally (presence of such lobe is an autapomorphy of *Cloeon/fg1*). In various species of *Cloeon/fg1*, such second lobe is either present on all tergalii I–VII, or is absent on tergalius VII or some other tergalii of posterior pairs, or is absent on all tergalii. Tergalius VII usually lacks the second lobe and often has a peculiar form sharply different from other tergalii: its anal margin (lacking rib) is straight, and the costal margin (armed with the costal rib) is sharply convex (Figs 7, 17, 24); being the last one, this tergalius is directed posteriorly and adjacent by its anal margin to the lateral margins of abdominal segments VIII–IX (Fig. 17). Such shape of tergalius VII is especially characteristic for *Procloeon/g1*, but can be found in some other taxa, sometimes varying individually (e.g., Kluge & Novikova 1992: figs 7.7–8). Because of this difference between tergalius VII and other tergalii, some authors confuse its costal and anal margins and draw it in overturned position (Gillies 1988: fig. 19; Gattolliat 2003: figs 19, 23; Jacobus *et al.* 2006: fig. 19; Kaltenbach *et al.* 2023: fig. 7b).

Mobility of tergalii. Tergalii are able to make intensive rhythmic respiratory movements (plesiomorphy).

Larval caudalii. Cerci and paracercus have dark rings on every 4th joining; segment preceding this joint bears a row of elongate denticles on its posterior margin (Figs 71–72, 124–125).

Subimaginal tarsus. In subimago all tarsomeres on legs of all pairs are covered with pointed microlepidés, without blunt microlepidés (Fig. 70).

Pleuron of subimaginal mesothorax. Posterodorsal process of postsubalar sclerite is diminished, pointed, with concave antero-dorsal margin (Fig. 130);

Fore wing. Fore wing has no more than one marginal intercalary in each space (plesiomorphy within *Liberevenata*) (Fig. 126).

Hind wing. Hind wing, if present, is narrow, with no more than two longitudinal veins, always with prominent, narrow, hooked costal process (Fig. 83); in some species hind wings are completely absent, but no one species has hind wing lacking costal process. Among *Securiops*, hind wings of such structure are present in *P. (S.) falcatum* (Fig. 64) and *P. (S.) macafertiorum* (Fig. 83); in *P. (S.) mutadens*, *P. (S.) primasia* and other species hind wings are absent.

Gonostyli. The 2nd segment of gonostylus is thickened apically, and the 3rd segment is small and petiolate (autapomorphy of *Cloeon/fg1*) (Figs 88, 90, 137). Being developed under larval cuticle, subimaginal gonostyli are bent in the «*Cloeon*-type» pose, that is their 2nd segments are directed laterally, and 3rd segments are directed medially (plesiomorphy within *Turbanoculata*) (Fig. 60).

Penis. In male imago gonovectes are small and incapable for protraction; penial bridge is sclerotized and projected between unistyligers (Figs 91, 137–141).

Character of *Procloeon s. l.*, or *Procloeon/g1*:

Larval cerci. In distal part of larval cercus, each cercomere bears one greatly enlarged spine on lateral side of its posterior margin; these spines form a regular row on lateral side of cercus (autapomorphy of *Procloeon s. l.*) (Figs 72, 105, 125).

Subgenus *Securiops* Jacobus *et al.* 2006

(Figs 1–144)

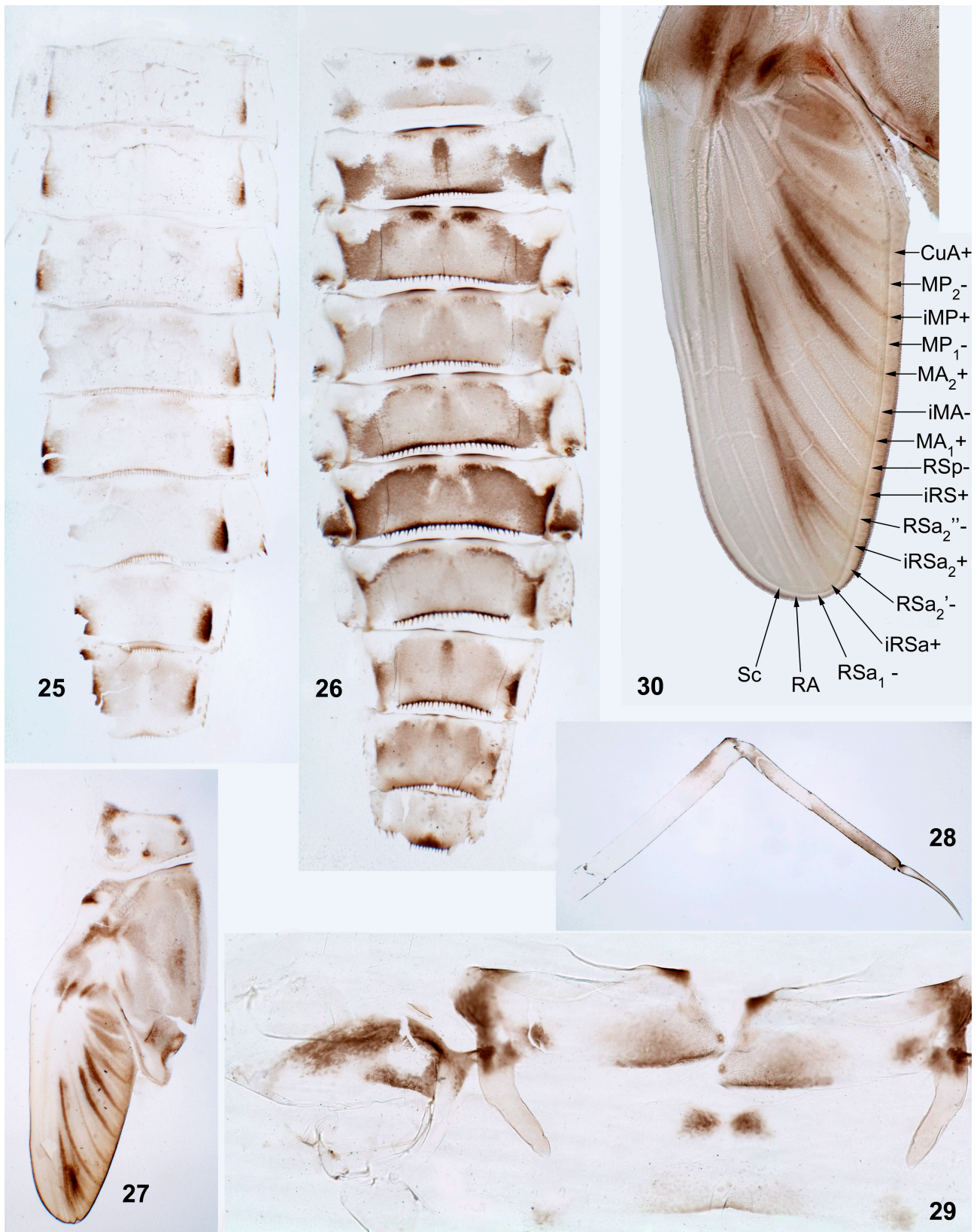
Genus *Securiops* Jacobus, McCafferty & Gattolliat 2006: 133 (larva).

Subgenus *Securiops*: Kluge 2020a: 577 (larva, male imago, egg).

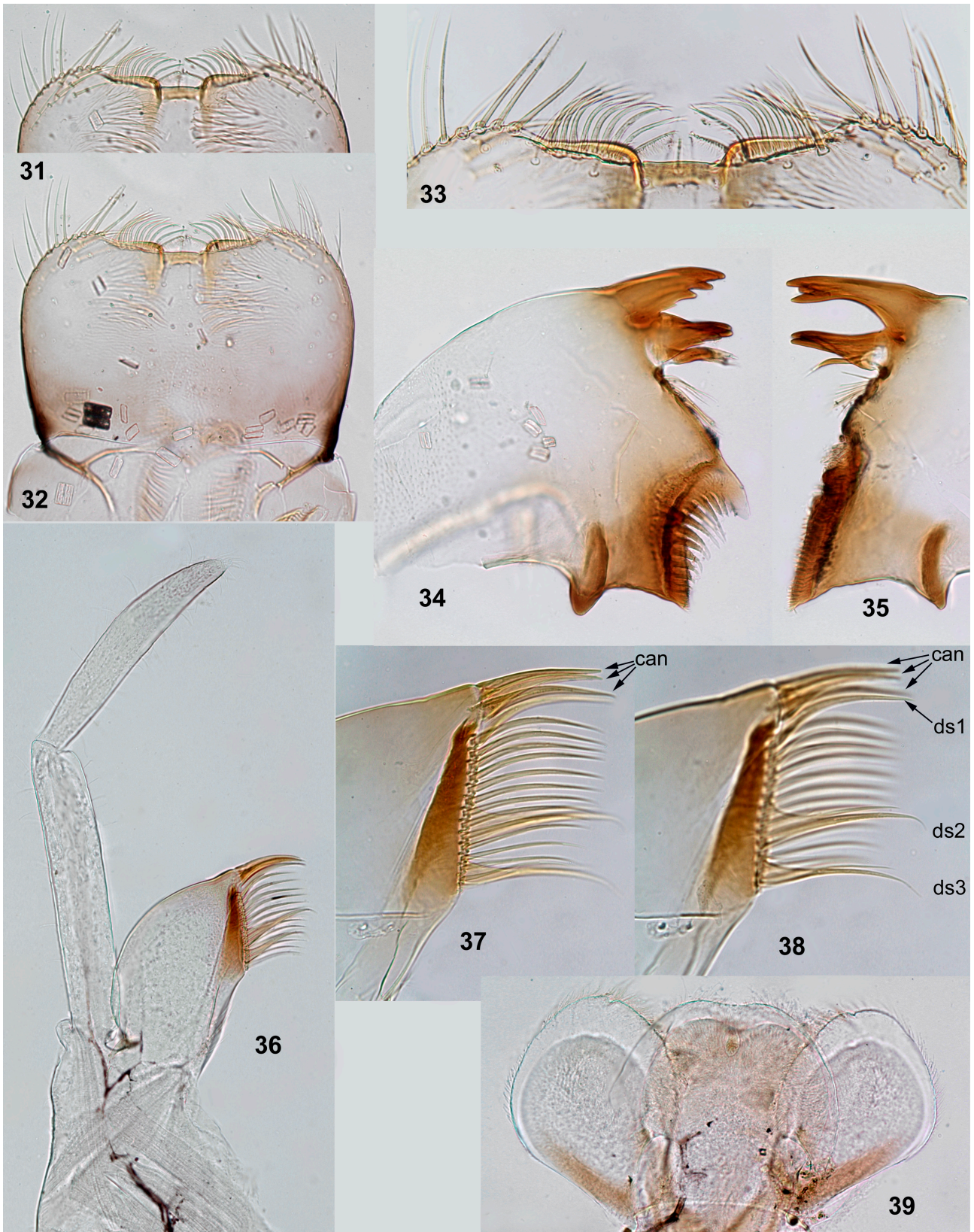
Type species: *Potamocloeon macafertiorum* Lugo-Ortiz (in Lugo-Ortiz & McCafferty) 1996.

Autapomorphies of *Securiops*

Larva is psammophylous, with adaptation for inhabitancy on sandy ground: legs are long and slender, with long claws (Figs 28, 67, 112–114); mouth apparatus is modified, with labium greatly elongated; labium, maxillae and labrum having peculiar shape and setation:



FIGURES 25–30. *Procloeon (Securiops) falcatum*. 25–28, larval exuviae (with same magnification): 25, abdominal sterna; 26, abdominal terga; 27, half of pronotum and mesonotum; 28, fore leg; 29, exuviae of metanotum with hind proptera, left metapleuron and 1st abdominal tergum, enlarged; 30, fore propteron, to show correspondence between cuticular coloration and veins visible inside.



FIGURES 31–39. *Procloeon (Securiops) falcatum*, larval mouthparts. 31, apex of labrum, ventral view; 32, labrum, dorsal view; 33, apex of labrum, enlarged; 34–35, left and right mandibles; 36, maxilla; 37–38, apex of maxilla with focus on ventral and dorsal sides; 39, hypopharynx with superlinguae. Abbreviations: can, maxillary canines; ds1, ds2, ds3, 1st–3rd dentisetae,

Labrum (Figs 31–33, 100). Distal margin is nearly straight (neither sharply concave, nor sharply convex); median incision is wide and shallow; other distal margin is distinctly differentiated into paired submedian and paired lateral portions. The submedian portion has a groove bordered by a more prominent ventral flange and a less prominent dorsal flange; the regular row of marginal setae is attached inside this groove, between these two flanges. The lateral portion has no groove, and the regular row of marginal setae is attached openly on its distal margin. This structure of distal margin is different both from sharply concave in *Pseudocentroptiloides*, and from convex or straight with narrow median incision in other Procloeon/g1 and most other Baetidae (Kluge 2016b: fig. 43; Kluge 2020a: fig. 16; Kluge 2020b: figs 49–50).

Maxillae (Figs 36–38). The 2nd and the 3rd dentisetae are located at a distance from the 1st dentiseteta, nearer to the proximal angle of biting margin; a few small setae are located between the 1st and the 2nd dentiseteta. In other respects, maxilla retains plesiomorphic structure: apex is pointed, with 3 long, slender, arched maxillary canines; the 1st dentiseteta has the same shape as the canines and is pressed to the canines. In other *Procloeon* s. l., the 2nd and the 3rd dentisetetae are located close to the 1st dentiseteta (e.g., Kluge 2016b: fig. 46; Kluge 2020a: fig. 17; Kluge 2020b: fig. 53).

Labium (Figs 40–46, 116–119). Paraglossae are greatly enlarged, three times longer than glossae; glossae and paraglossae are highly modified, with shape and setation different from the initial one (see below); labial palp is greatly widened apically (see below).

Glossa is short, with apex rounded. Ventral side of glossa proximally with a regular transverse row of very long and straight setae; being pressed on slide, these setae can be turned either proximally (Fig. 43), or distally (Fig. 41, 42, 45). Dorsal side of glossa distally with a regular, arched, transverse row of stout, pointed setae directed distally (Fig. 46). Rounded apex of glossa is smooth, without setae. Glossa of *Securiops* differs from the initial one (see Kluge 2016a: 137–138 and figs 4–5; Kluge 2016b: figs 47–48), in that its apex is not pointed and lacks setae, but the marginal setal row is shifted to the dorsal side. Origin of the peculiar transverse ventral-proximal row of straight setae is unclear.

Paraglossae are very large and flattened, either oval (Figs 40–43), or with inner margins angulate and diverging (Fig. 116). Most surface of ventral and dorsal sides is smooth, lacking setae; lateral margin with a regular longitudinal row of long setae; median side with two regular longitudinal rows of larger setae and one longitudinal row of smaller setae dorsad of them. Paraglossa of *Securiops* differs from the initial one (see Kluge 2016a: 137–138 and figs 4–5; Kluge 2016b: figs 47–48), in that its apex is not pointed, and median margin is not evenly concave; possibly, two of the three regular setal rows along the median margin are homologous to the ventro-median and the dorso-median setal rows of the initial structure, and the setae on lateral margin correspond to the latero-apical setae of the initial structure.

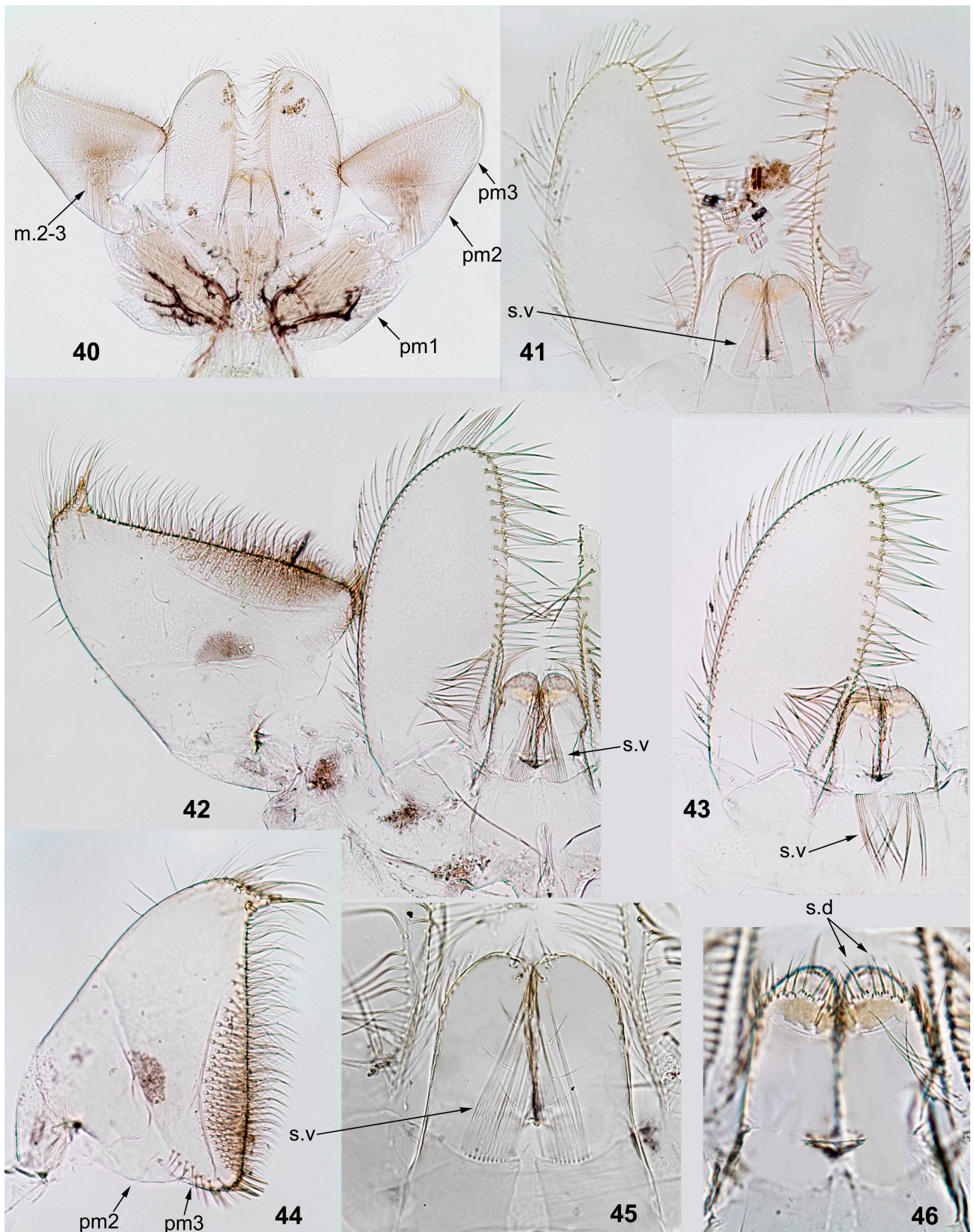
Labial palp (with 3rd segment initially truncate) has 3rd+2nd segments greatly widened, triangular, with straight distal margin of the 3rd segment exceeding median margin of the 3rd+2nd segments; angle formed by lateral and distal margins is bent and stretched forming a small projection (Fig. 44, 116–117). Authors of the previous publications (Gillies 1988, Lugo-Ortiz & McCafferty 1996, Kaltenbach *et al.* 2023) erroneously regarded labial palp of *Securiops* as 2-segmented taking the 2nd and the 3rd segments as one; actually, border between these segments is retained, as well as the muscle going from the 2nd segment to the base of 3rd segment (Figs 40, 44).

Other characters of *Securiops*:

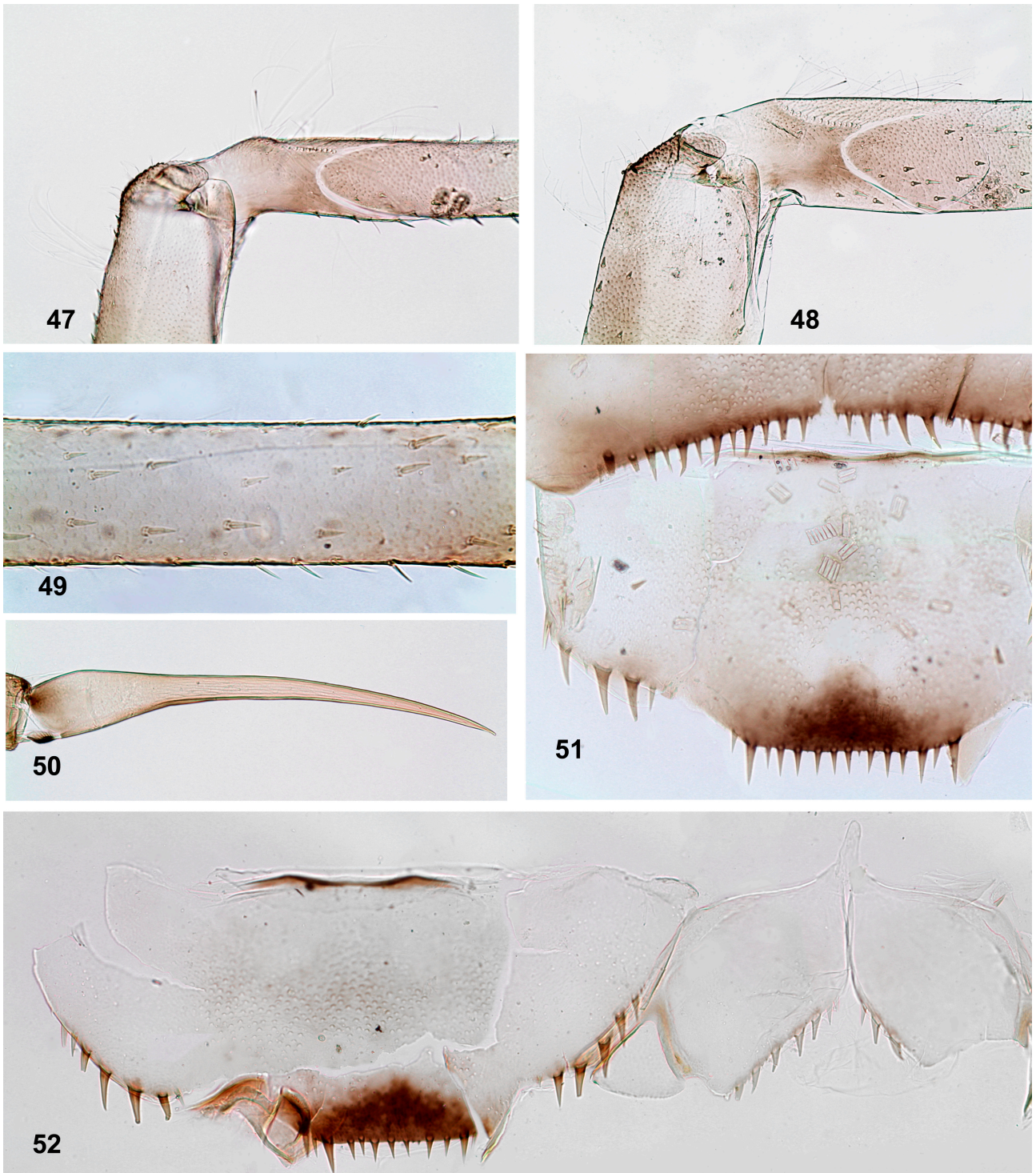
Mandibles (Figs 34–35, 98–99). Mandibles of the «*Centroptilum*-type»: the kinetodontium is deeply separated from the incisor and rotated perpendicular to the plane of the mandible, so that its denticles hide one another in dorsal or ventral view; the left prosthema is bifurcate and rotated in the same manner. Among Procloeon/g1, such «*Centroptilum*-type» of mandibles, besides *Securiops* occurs in *Pseudocentroptiloides* and *Monilistylus* as well; it is also present in some other baetid taxa (Kluge 2020b: figs 18–23; Kluge 2020c: 440 and figs 13–15).

Larval femur setation. In all species of *Securiops*, two subapical setae of femur are absent (in contrast to *Oculogaster* and various taxa not belonging to Cloeon/g1); apical margin of femur lacks stout setae (Fig. 47).

Larval claw. In all species of *Securiops*, claws are long, slender and slightly arched, without denticles and without oblique striation; only faint longitudinal striation is present on narrow distal part (Fig. 50). The same in some other Procloeon/g1 and in some other Baetidae.



FIGURES 40–46. *Procloeon (Securiops) falcatum*, labium. 40, integral labium; 41–46, parts of exuviae: 41, glossae and paraglossae, ventral view; 42, half of labium of another individual (ventral setae of glossae directed distally); 43, the same individual, with ventral setae of glossae directed proximally; 44, distal segments of labial palps; 45–46, enlarged glossae in ventral and dorsal view (ventral setae directed distally). Abbreviations: m2-3, muscle going from 2nd palpomere to base of 3rd palpomere; pm1, pm2, pm3, 1st–3rd palpomeres; s.d, dorsal setae of glossae; s.v, ventral setae of glossa.



FIGURES 47–52. *Procloeon (Securiops) falcatum*, larva. 47, articulation of femur and tibia of fore leg, dorsal view; 48, the same, compressed to show junction of patella-tibial suture with row of fine hairs; 49, fragment of tarsus; 50, claw; 51, abdominal tergum X and margin of tergum IX; 52, abdominal tergum X and paraprocts.

Status of *Securiops*.

Kaltenbach *et al.* (2023) treated *Securiops* as a genus but not as a subgenus, reporting the following its characters as generic ones: «(1) labium with strongly reduced glossae, enlarged paraglossae, and very broad, hatchet-like palps; (2) tergalii I–IV with two lamellae; (3) legs elongate, with relatively few short setae on dorsal and ventral margins; (4) claws very elongate, without denticles; and (5) lateral margins of posterior abdominal segments with sharp

spines». Actually, only the first of these characters constitutes autapomorphy of the subgenus *Securiops*, while the characters (2)–(5) are diagnostic for the taxon *Cloeon*/fg1, to which the subgenus *Securiops* belongs. The regular lateral row of greatly enlarged spines on distal part of cercus (Figs 71–72, 105, 124–125) is the most important diagnostic character of *Procloeon* s. l., to which the subgenus *Securiops* belongs.

Distribution. Paleotropical (Afrotropical and Oriental Regions).

Species composition. Afrotropical species: *Procloeon (Securiops) falcatum* (Crass 1947) **comb. n.**; *P. (S.) macafertiorum* (Lugo-Ortiz in Lugo-Ortiz & McCafferty 1996); *P. (S.) mandrare* (Jacobus, McCafferty & Gattolliat 2006) **comb. n.**; *P. (S.) megapalpus* (Jacobus, McCafferty & Gattolliat 2006) **comb. n.**; *P. (S.) mutadens* (Jacobus, McCafferty & Gattolliat 2006) **comb. n.**. Oriental species: *Procloeon (Securiops) primasia* (Kaltenbach *et al.* 2023) **comb. n.**

Key to larvae (the number in parentheses refers to the antithesis)

- 1(4) Hind protoptera present (Figs 29, 67) (can be poorly visible, since cuticle of hind protopteron is colorless). 2
- 2(3) Abdominal terga IV–X with numerous scales (Figs 55–56); terga IV and VII without medial longitudinal stripe (Fig. 26) *P. (S.) falcatum*
- 3(2) All abdominal terga without scales, with numerous denticles (Fig. 74); terga IV–V and VII–IX with contrasting medial longitudinal stripe on light background (Figs 66, 69) *P. (S.) macafertiorum*
- 4(1) Hind protoptera absent (Fig. 108, 111) or represented by short vestiges (Fig. 102).
- 5(6) Spines on lateral side of cercus sharply differentiated: in proximal portion of cercus all spines stout, conic and not longer than next cercomere; in distal portion of cercus all spines delicate, widened from base, as long as 2–3 next cercomeres (Figs 124–125). Tergalii with apex stretched and pointed, resembling linden leaf (Figs 18–24) *P. (S.) primasia*
- 6(5) Spines on lateral side of cercus gradually change from shorter in proximal part of cercus to longer in its distal part (Fig. 105). Tergalii with apex rounded (Gillies 1988: figs 14–19). *P. (S.) mutadens*; possibly, also (*S. mandrare* and *P. (S.) megapalpus*).

Procloeon (Securiops) falcatum (Crass 1947) **comb. n.**

(Figs 1–7, 25–65)

Centroptilum falcatum Crass 1947: 80 (♂ & ♀ imago).

Afroptilum (Afroptilum) falcatum: Gillies 1990: 99.

Cheleocloeon falcatum: Lugo-Ortiz & McCafferty 1998: 379.

Potamocloeon macafertiorum: Jacobus & McCafferty 2005: 474 (larva, partim).

Material examined. SOUTH AFRICA, Western Cape Province: Cape Winelands District, Jonkershoek Valley, Eerste River upstream Stellenbosch, Swiss Club (5 km SE Stellenbosch), 33°57'30"S, 18°55'E, 18–22.I and 8–12.II.2019, coll. N. Kluge & L. Sheyko: 1 L-S♂, 1 L/S♂, 2 larvae; the same locality and collectors, 8–11.II.2019: 2 larvae.

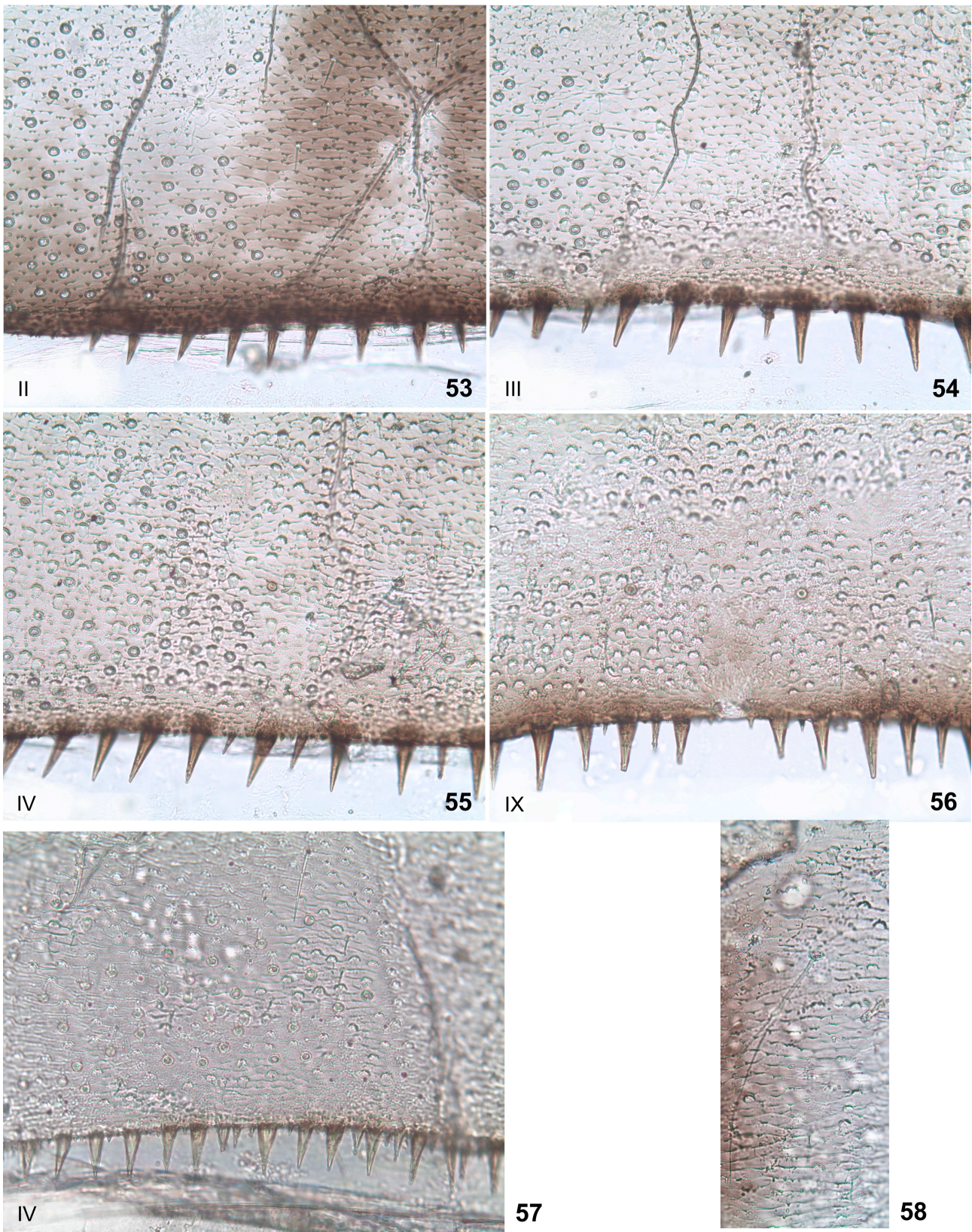
Descriptions

Larva. CUTICULAR COLORATION. Cuticle of anterior part of head nearly colorless, occipit light brownish. Pronotum, mesonotum and metanotum with composite pattern of colorless, light brown and dark brown areas (Fig. 27). Fore protopteron with colorless base and dark brown striation on convex veins iRSa, iRSa₂, iRS and on distal portions of convex veins MA₂ and iMP (Fig. 30). Hind protopteron brown basally, colorless at most part (Fig. 29). Mesothoracic and metathoracic pleura brown (Fig. 29), prothoracic pleura and all thoracic sterna colorless. Legs mostly colorless, with brownish darkening in distal part of femur, proximal part of tibia and distal part of tarsus (Fig. 28). Abdominal terga with composite pattern of colorless, light brown and dark brown areas, with brown coloration most expressed on tergum VI (Fig. 26); terga IV and VII without medial longitudinal stripe (in contrast to *P. (S.) macafertiorum*). Abdominal sterna either nearly entirely colorless, or with contrasting brown longitudinal sublateral stripes (Fig. 25). Caudalii nearly colorless, with brown bands on each 4th segment (as in Fig. 66).

HYPODERMAL COLORATION. Not expressed; shortly before molt to subimago, subimagonal coloration becomes visible through larval cuticle (as in Figs 59–63).

SHAPE AND SETATION. Mouthparts characteristic for *Securiops* (see above) (Figs 31–46). Paraglossae nearly oval, with inner margin either evenly convex (Figs 42–43), or slightly concave in distal half (left side on Fig. 41).

On dorsal side of glossae, cuticle with transverse light brown sclerite just proximad of transverse setal row (Fig. 46); remainder cuticle of labium colorless. Distal segment of labial palp without row of stout setae, with several stout setae near outer-distal and inner-distal corners (Fig. 44).

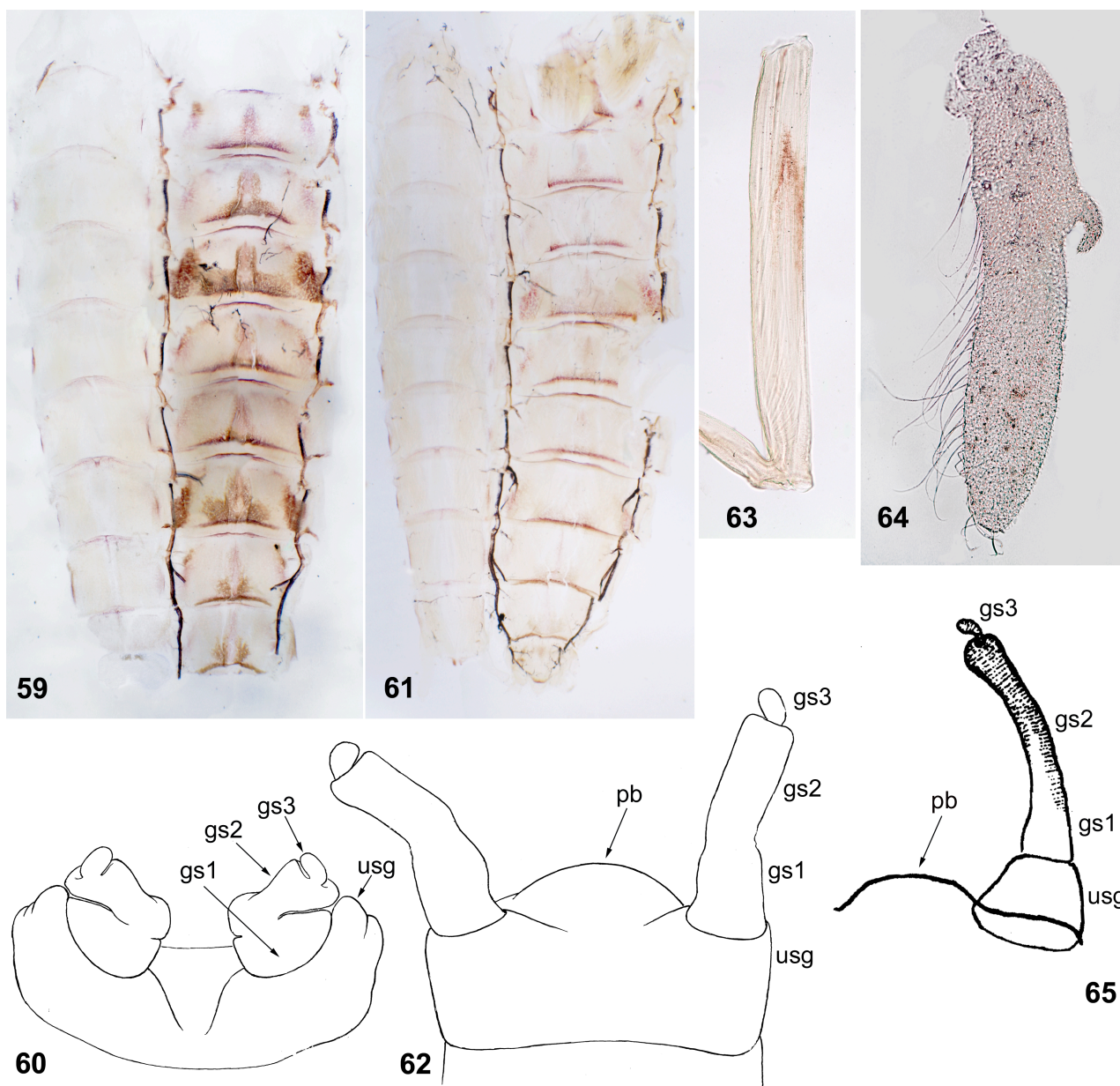


FIGURES 53–58. *Procloeon (Securiops) falcatum*, exuviae of larval abdomen. 53–56, terga II, III, IV and IX; 57, sternum IV; 58, constant bifurcate seta on sublateral part of sternum VIII.

Legs (Figs 47–50): Femur, tibia and tarsus with rather small, stout, pointed, spine-like setae. On femur, all these spine-like setae equally small, located mostly on outer and inner sides not forming regular rows (Fig. 47). On tibia and tarsus, these spine-like setae irregularly dispersed on all sides (Fig. 49); only in distal part of tarsus forming rather regular longitudinal row. Claws characteristic for *Securiops* (see above) (Fig. 50).

Lateral spines present on abdominal segments IV–IX, varying from 2 to 8 spines on one side (Figs 25–26). Small posterolateral spines present on segments II–VII.

Posterior margin of abdominal tergum I smooth, without denticles; posterior margins of terga II–X with heavily sclerotized, conic, sharply pointed, spine-like denticles separated by spaces wider than denticle width (Figs 51–56); on tergum IX row of denticles interrupted medially, behind pair of submedian setae (Figs 51, 56); projected portion of tergum X row with pair of larger denticles by sides and straight row of smaller denticles between them (Figs 51–52).



FIGURES 59–65. *Procloeon (Securiops) falcatum*. 59–60, parts of male subimago extracted from larva: 59, abdomen; 60, genitalia; 61–64, young male subimago: 61, abdomen; 62, genitalia; 63, fore femur; 64, hind wing (partly crumpled); 65, genitalia of male imago (after Crass 1947). Abbreviations: gs1, gs2, gs3, 1st–3rd segments of gonostylus; pb, median projection of penial bridge; usg, unistyliger.

Posterior margins of abdominal sterna I–III smooth, without denticles; posterior margins of sterna IV–IX with spine-like pointed denticles, smaller and denser than denticles on terga (Fig. 57). Paraproct with spine-like denticles larger than denticles on sterna (Fig. 52).

Abdominal terga, sterna and paraprocts with oval scales in wide semilunar non-opercula-bearing sockets. Terga I–II without scales, with numerous small, pointed denticles (Fig. 53); tergum III with few scales and many denticles (Fig. 54); terga IV–X with numerous scales and less prominent denticles or with blunt transverse ridges instead of denticles (Figs 55–56). Sterna I–III without scales; sternum IV with few scales; sterna V–IX with numerous scales (Fig. 57).

Besides scales, abdominal terga and sterna with ring-like sensilla and fine setae. Fine setae vary from simple to bifid, from small to long, located sparsely and irregularly, not forming regular rows; each tergum VII–IX and sternum II–VIII with pair of long, bifurcate setae (Fig. 58).

Tergalii without denticles on costal ribs; dorsal lamella roundish, present on tergalii I–VI and absent on tergalium VII. Tergalium I shorter than others, widened, with anal margin sharply convex and costal margin concave (Fig. 1). Tergalii II–VI gradually changing from this shape to oval shape of tergalium VI (Figs 2–6). Tergalium VII with costal margin sharply convex (Fig. 7).

Caudalii characteristic for *Procloeon/g1* and *Cloeon/fg1* (see above). Spines on lateral side of cercus gradually change from shorter in proximal part of cercus to longer in its distal part; in distal part of cercus, spine on lateral side of each segment twice longer than next segment (as in Figs 71–72).

Subimago. CUTICULAR COLORATION. Cuticle of thorax mostly colorless, only selected areas of mesonotum and thoracic pleura contrastingly dark brown (as in Figs 84–85).

TEXTURE. On legs of all pairs, all tarsal segments covered with pointed microlepidies (as in Figs 71–72).

Imago, male. Not examined; described by Crass (1947). Judging by hypodermal coloration of the male subimago reared from larva, and by subimaginal tissues in the mature male larva, fore femur has brown spot at proximal part (Fig. 63) and abdominal terga have variable brown markings, most extensive either on tergum IV (Fig. 61), or on terga IV and VII (Fig. 59). Hind wing with hooked costal process and with two veins (Fig. 64), wider than in *P. (S.) macafertiorum*. Middle and hind legs with tarsus longer than tibia, with two apical spines on initial 2nd and 3rd tarsomeres (actual 1st and 2nd tarsomeres) (as in Fig. 87). Judging by subimaginal genitalia, penial bridge forms wide, semicircular projection (Fig. 62).

Imago, female. Undescribed; reported by Crass (1947).

Egg. Unknown.

Dimension. Specimen examined with fore wing length 5.5 mm; according to Crass (1947), fore wing length 6–8.5 mm.

Notes. Originally (Crass 1947), the species under the name *Centroptilum falcatum* was described based on imagines collected in South Africa. Lugo-Ortiz & McCafferty (1998) placed *falcatum* [*Centroptilum*] in the genus *Cheleocloeon* Wuillot & Gillies 1993, because they regarded its imago to be similar to another South-African species, which was originally described under the name *Centroptilum excisum* Barnard 1932 and currently placed in the genus *Cheleocloeon*. They wrote: «The only difference between the two species is the presence of hind wings in female adults of *C. falcatum*». Actually, male imagines of these species well differ one from another by genital structure. Till now, genitalia of *Cheleocloeon excisum* have not been described, but our material (imagines reared from larvae in South Africa) reveals that they have a structure typical for *Cheleocloeon*, with hook-like movable gonovectes and non-sclerotized penial bridge (Kluge 2016a) (Fig. 145). In contrast to this, genitalia of *falcatum* [*Centroptilum*] were originally figured as having prominent semicircular penial bridge (Fig. 65; Crass 1947: fig. 20b), which is characteristic for *Cloeon/g1*, but not for *Cheleocloeon*. Judging by this figure, genitalia of *falcatum* [*Centroptilum*] are similar to *P. (S.) macafertiorum*: both have unistyligers widely separated and gradually narrowing distally (Fig. 90), while in *Cheleocloeon excisum* unistyligers are brought together, and articulation of the gonostylus with the unistyliger has composite structure (Fig. 145).

***Procloeon (Securiops) macafertiorum* Lugo-Ortiz (in Lugo-Ortiz & McCafferty) 1996**

(Figs 8–17, 66–97)

Potamocloeon macafertiorum Lugo-Ortiz: Lugo-Ortiz & McCafferty 1996: 178 (larva); Jacobus & McCafferty 2005: 474 (larva, partim—see *falcatum*).

Securiops macafertiorum: Jacobus, McCafferty & Gattoliat 2006: 133 (larva).

Procloeon (Securiops) macafertiorum: Kluge 2022a: 161 (subimago).

Material examined. ZAMBIA: Luangwa river near Luangwa Bridge, 15°00'S, 30°13'E, 2–8.VIII.2014, coll. N. Kluge & L. Sheyko: 1 L-S-I♂, 2 L/S♂, 4 L/S♀, 1 S-I♂, 1 I♂, 1 I♀; Solwezi District, Mutanda Falls, 10–12.VIII.2014, coll. N. Kluge & L. Sheyko: 1 L♀. TANZANIA: border of Mbeya Region and Njombe Region, Great Ruaha river upstream Mfumbi (8 km E Chimala), 8°52'S, 34°05'E, 26.VII–3.VIII.2016, coll. N. Kluge & L. Sheyko: 1 L♂.

Descriptions

Larva. Briefly described by Lugo-Ortiz & McCafferty (1996).

CUTICULAR COLORATION. Cuticle of anterior part of head mostly colorless. Pronotum, mesonotum and metanotum with composite pattern of colorless, light brown and dark brown areas (Fig. 68). Fore protopteron with colorless base and dark brown striation on convex veins iRS₁, iRS₂, iRS and on distal portions of convex veins MA₂ and iMP (Fig. 68; as in Fig. 30). Hind protopteron brown basally, colorless at most part (Fig. 67; as in Fig. 29). Metathoracic pleura brown, prothoracic pleura and all thoracic sterna colorless (Fig. 67). Legs colorless (Fig. 67). Abdominal terga with composite pattern of colorless, light brown and dark brown areas, with brown coloration most expressed on tergum VI; terga IV–V and VII–IX mostly light, with contrasting medial longitudinal stripe on anterior part (Fig. 66). Abdominal sterna either nearly entirely colorless, or with contrasting brown longitudinal sublateral stripes (Fig. 66). Caudalii nearly colorless, with brown bands on each 4th segment (Fig. 66).

HYPODERMAL COLORATION. Not expressed; shortly before molt to subimago, subimaginal coloration becomes visible through larval cuticle (as in Figs 77–82, 86).

SHAPE AND SETATION. Mouthparts characteristic for *Securiops* (see above) (as in Figs 31–46). Paraglossae nearly oval, with inner margin evenly convex (as in Figs 42–43). Cuticle of glossae entirely colorless, as well as remainder cuticle of labium [in contrast to *P. (S.) falcatum*]. Distal segment of labial palp without row of stout setae, with several stout setae near outer-distal and inner-distal corners (as in Fig. 44).

Legs: Femur and tibia with few, occasional, small spine-like setae. Tarsus with slender, spine-like setae on inner side (Fig. 73). Claws characteristic for *Securiops* (see above) (Fig. 67; as in Fig. 50).

Lateral spines present on abdominal segments V–IX, varying from 2 to 8 spines on one side (Figs 17, 66). Small posterolateral spines present on segments II–VII.

Posterior margin of abdominal tergum I smooth, without denticles; posterior margins of terga II–X with heavily sclerotized, brown, conic, sharply pointed, spine-like denticles separated by spaces wider than denticle width (Figs 74); on tergum IX row of denticles interrupted medially, behind pair of submedian setae (Fig. 76); projected portion of tergum X row with few larger denticles by sides, either without denticles between them, or with few smaller denticles between them (Fig. 76).

Posterior margins of abdominal sterna I–IV smooth, without denticles; posterior margins of sterna VI–IX with colorless, conic, sharply pointed, spine-like denticles, smaller and denser than denticles on terga (Fig. 75). Paraproct with spine-like denticles larger than denticles on sterna (Fig. 76).

Scales entirely absent; all abdominal terga with numerous small, pointed, brown denticles (Fig. 74); all abdominal sterna with numerous smaller, colorless denticles (Fig. 75).

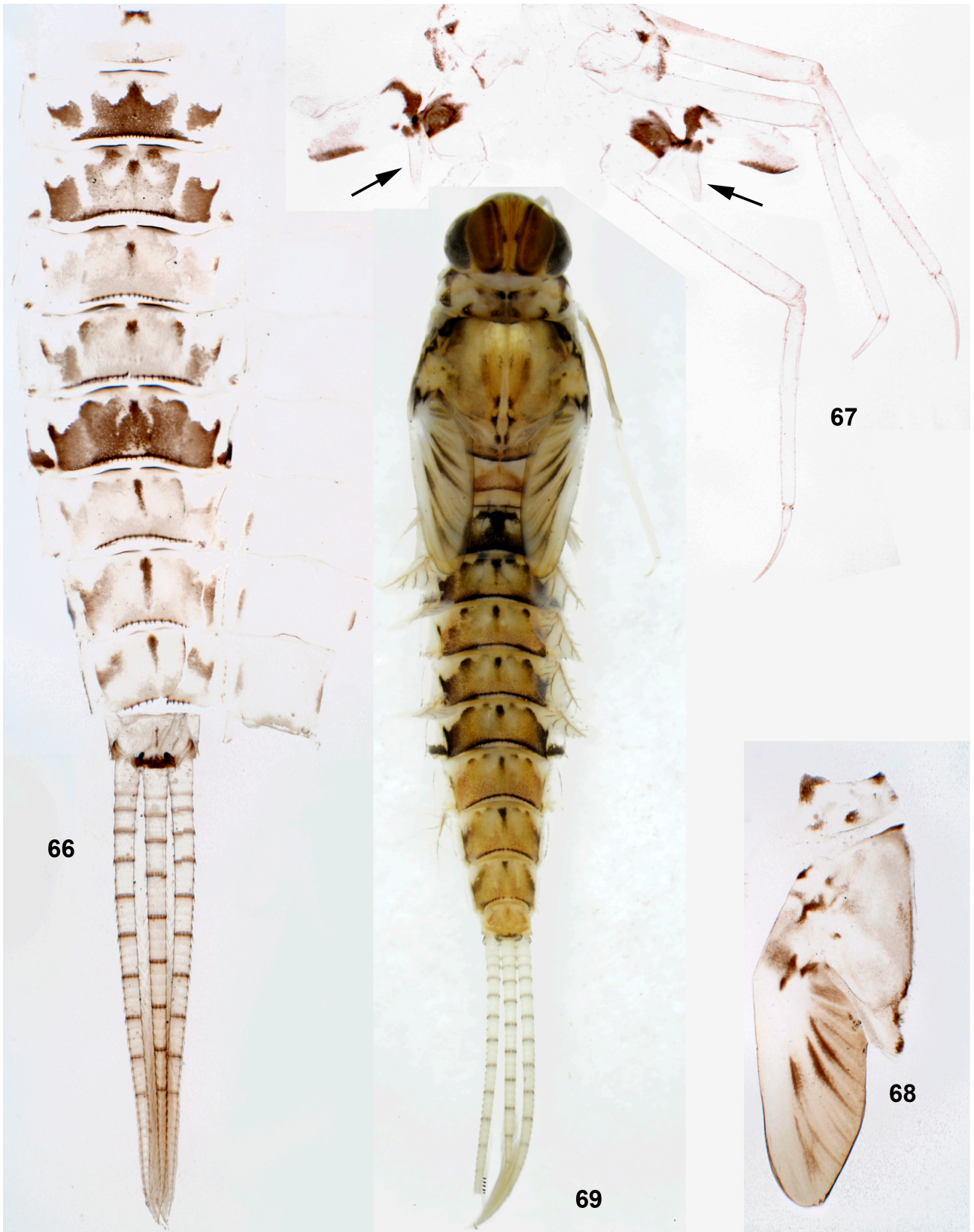
Besides denticles, abdominal terga and sterna with ring-like sensilla and fine setae. Fine setae vary from simple to bifid, from small to long, located sparsely and irregularly, not forming regular rows or constant pairs.

Tergalii without denticles on costal ribs; dorsal lamella present on tergalii I–VI and absent on tergalii VII, either roundish (Figs 8–11), or elongate (Figs 12–16). Tergalii I–VI with costal margin slightly convex, tergalii VII with costal margin sharply convex (Fig. 17).

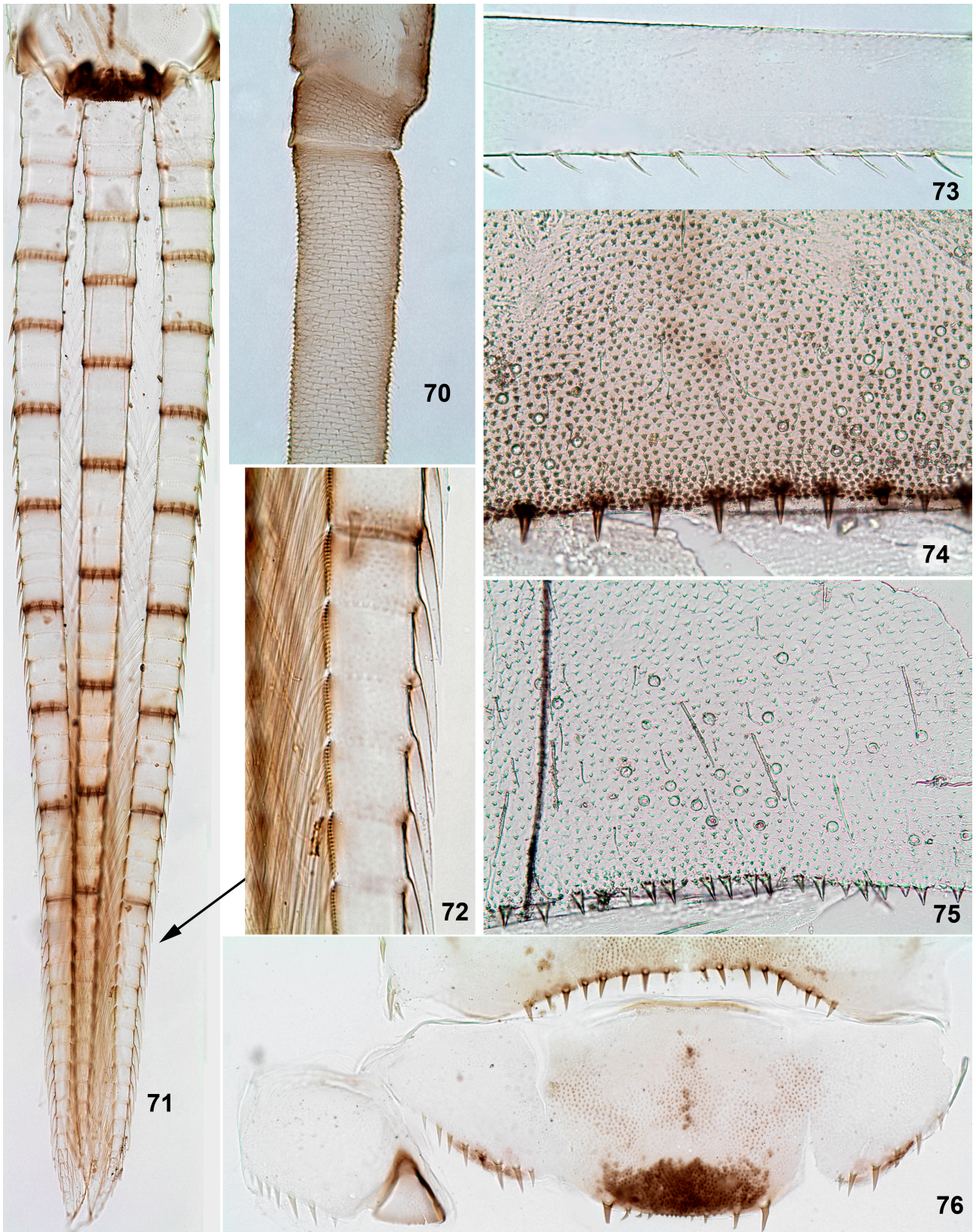
Caudalii characteristic for *Procloeon/g1* and *Cloeon/fg1* (see above). Spines on lateral side of cercus gradually change from shorter in proximal part of cercus to longer in its distal part (Fig. 71); in distal part of cercus, spine on lateral side of each segment twice longer than next segment (Fig. 72).

Subimago. **CUTICULAR COLORATION.** Head nearly colorless, antennal flagellum brownish on median side. Pronotum light ochre. Mesonotum mostly colorless, with contrasting brown grooves bordering anterolateral scutal costa, contrasting brown spot on prealar bridge and contrasting brown lateral sclerite of parascutellum (Fig. 85). Thoracic pleura and sterna mostly colorless, with contrasting brown postsubalar sclerite with lateropostnotal crest and contrasting brown pleural suture; pleura of metathorax entirely colorless (Fig. 84). Wing cuticle colorless, microtrichia ochre. Legs: femur nearly colorless, tibia and tarsus tinged with ochre. Abdominal terga medially light ochre, laterally colorless; sterna colorless. Gonostyli light ochre (Fig. 89). Cerci light ochre.

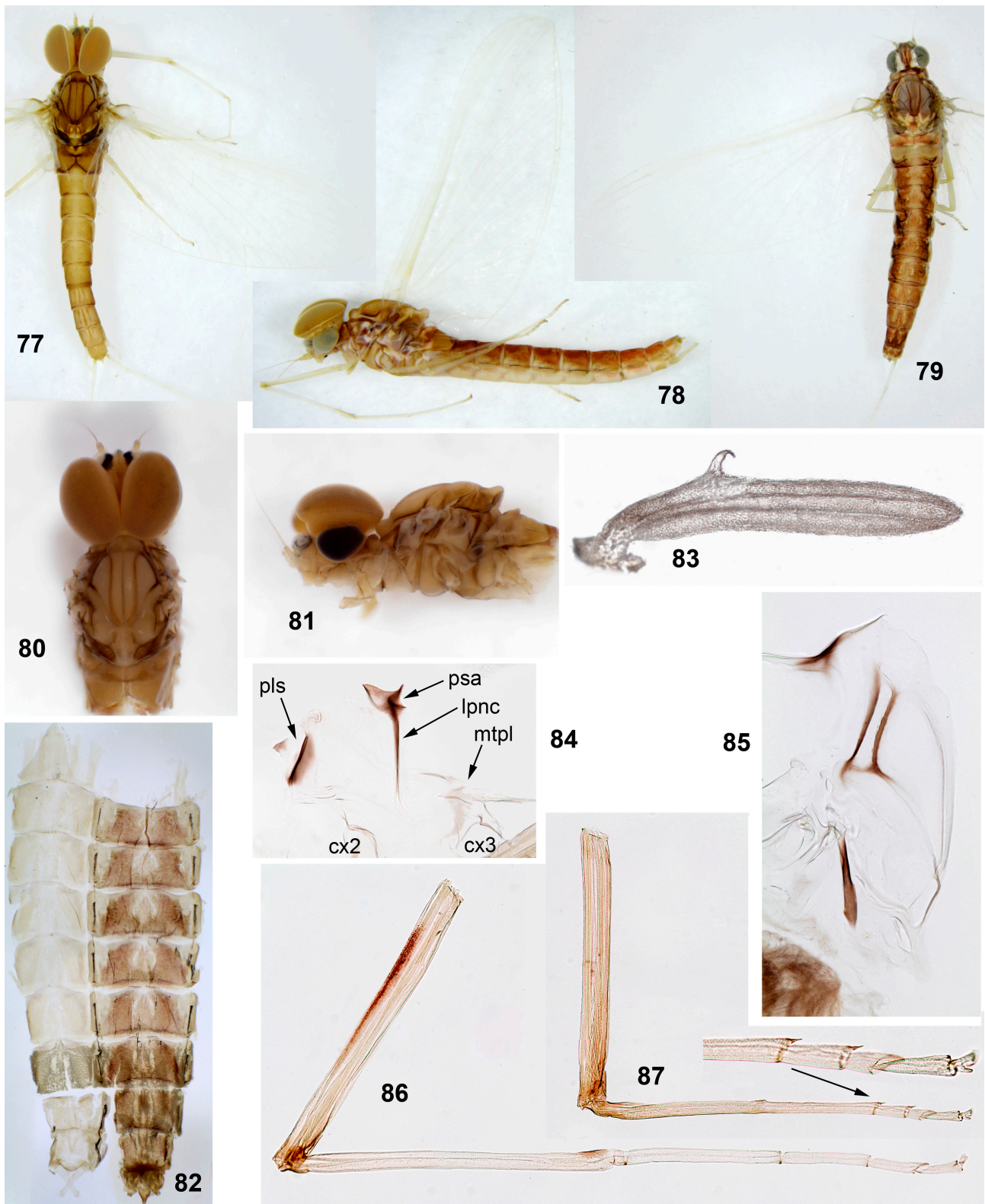
TEXTURE. On legs of all pairs, all tarsal segments covered with pointed microlepidies (Fig. 70).



FIGURES 66–69. Larvae of *Procloeon* (*Securiops*) *macafertiorum*. 66–68, larval exuviae (with same magnification): 66, abdominal terga and sterna; 67, thoracic sternum, pleura, halves of metanotum with hind protoptera and right legs (arrows show hind protoptera); 68, half of pronotum and mesonotum; 69, last instar male larva.



FIGURES 70–76. *Procloeon (Securiops) macafertiorum*. 70, subimaginal exuviae: apex of tibia and base of tarsus of fore leg of male; 71–76, larval exuviae: 71, caudalii; 72, fragment of cercus; 73, fragment of fore tarsus; 74, abdominal tergum IV; 75, abdominal sternum V; 76, abdominal tergum X, paraproct and margin of tergum IX.



FIGURES 77–87. *Procloeon (Securiops) macafertiorum*. 77, 78, male imagines; 79, female imago; 80–87, parts of male imago and subimago reared from larva: 80–81, head and thorax; 82, abdomen; 83, hind wing; 84, subimaginal exuviae of thoracic pleura; 85, subimaginal exuviae of half of mesonotum; 86–87, fore and hind legs. Abbreviations: cx2, cx3, coxae of middle and hind legs; lpnc, lateropostnotal crest; mtpl, pleurite of metathorax; pls, pleural suture; psa, postsubalar sclerite.

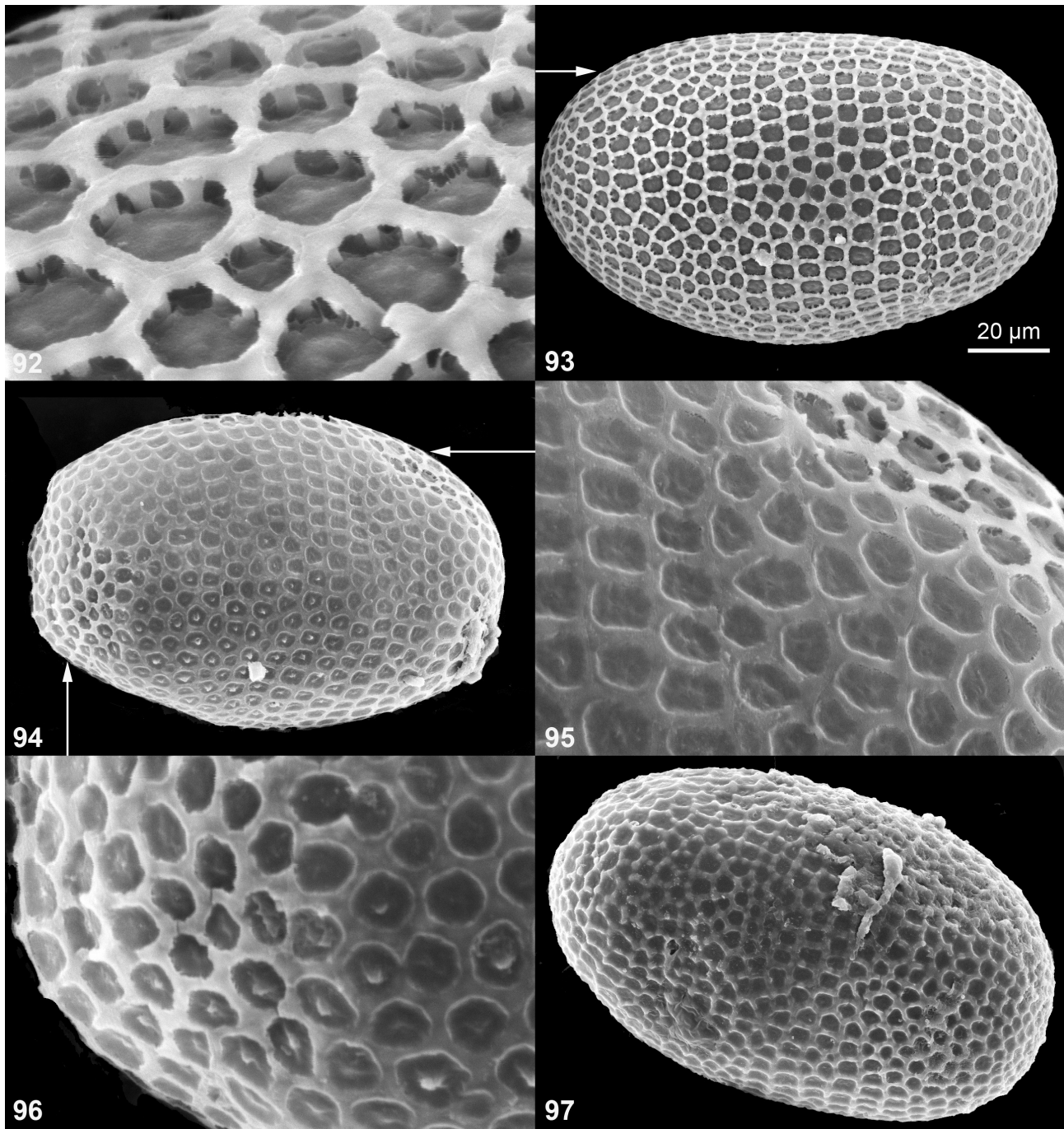
Imago, male (Figs 77–78, 80–82). Head ochre. Turbinate eyes orange or yellowish. Thorax ochre with brown. Wings colorless. Pterostigma of fore wing with 5–10 complete, non-branched, oblique crossveins (as in Fig. 126). Hind wing narrow, with two longitudinal veins and hooked costal process (Fig. 83). Legs light ochre; either all legs without maculae (Figs 77–78), or fore femur with diffusive macula on outer side near base (Fig. 86). Middle and hind legs with tarsus longer than tibia, with two apical spines, on initial 2nd and 3rd tarsomeres (actual 1st and 2nd tarsomeres) (Fig. 87). Abdominal terga ochre with diffusive brown maculae, sterna ochre. Cerci ochre. Gonostyli and penis ochre. Penial bridge forming semicircular projection (Figs 88, 90–91).



FIGURES 88–91. *Procloeon (Securiops) macafertiorum*. 88, genitalia of male imago reared from larva; 89, its subimaginal exuviae; 90, genitalia of another specimen, ventral view; 91, the same, with focus on penis.

Imago, female (Fig. 79). Head and thorax ochre with brown and gray. Fore tarsus 5-segmented, with two apical spines, on 2nd and 3rd tarsomeres; middle and hind tarsi 4-segmented, with two apical spines, on initial 2nd and 3rd tarsomeres (actual 1st and 2nd tarsomeres) (as in Fig. 87). Coloration of wings, legs, abdomen and cerci as in male.

Egg. Oval; chorion with even convex relief in form of net with isohedric cells (Figs 92–97).



FIGURES 92–97. *Procloeon (Securiops) macafertiorum*, eggs extracted from mature larva.

Dimension. Fore wing length 5 mm.

Notes. Larva of *P. (S.) macafertiorum* is similar to the larva determined here as *P. (S.) falcatum*, but well differs from it by absence of scales on all abdominal terga and sterna (Figs 74–75). It can be also recognized by some difference in cuticular coloration of abdominal terga. According to the original description of *macafertiorum* [*Potamocloeon*], its «terga 4, 5, and 7–9 pale yellow-brown, with median brown speck anteriorly» (Lugo-Ortiz &

McCafferty 1996: 178); this feature of cuticular coloration (Figs 66, 69) allows to distinguish this species from *P. (S.) falcatum*, in which at least terga IV and VII have no such median brown speck (Figs. 26).

Original description of *P. (S.) macafertiorum* was based on a single larva. The holotype is deposited in Purdue Entomological Research Collection, West Lafayette, Indiana. Luke Jacobus kindly examined the holotype and revealed that all its abdominal terga lack scales and are densely covered with small denticles (as in Fig. 74).

In the original description (which was based on a single larva) Lugo-Ortiz & McCafferty (1996) wrote that «Maxillae (Fig. 6) with four to five elongate sharp denticles on galealaciniae». Actually, maxilla of this species invariably bears 3 apical canines and 3 dentisetae, as other representatives of *Securiops* (as in Figs 36–38).

Procloeon (Securiops) mutadens (Jacobus et al. 2006) comb. n.
(Figs 98–105)

Cloeon dentatum: Gillies 1988: 53 (larva; non imago, nec Kimmins 1956).

Potamocloeon dentatum: Gillies 1990a: 208 (larva, non imago, nec Kimmins 1956); Jacobus & McCafferty 2005: 474 (larva).

Securiops mutadens Jacobus, McCafferty & Gattolliat 2006: 137 (larva).

Material examined. GAMBIA, Fatoto, R. Gambia, 19.II.1993, coll. M.T. Gillies, Y127-8: 1 L♀.

Additions and corrections to larval description

Maxillary palp. Length of 2nd (last) segment of maxillary palp was accepted as a key character separating species of *Securiops*: in *S. mutadens* it was said to be 0.55 of 1st segment length, in contrast to 0.85 in *S. macafertiorum* and *S. mandradae* (Jacobus & McCafferty 2005; Jacobus et al. 2006). This proportion (0.55) corresponds to the figure in the description (Gillies 1988: fig. 30), but in another larva from the same locality in Gambia, the 2nd segment is longer, and its ratio to the 1st segment is about 0.7 (Fig. 101).

Labial palp. Gillies (1988) described the labial palp as having «two segments», taking the 2nd and 3rd segments fore one; however, the border separating these segments and the muscle going from the 2nd segment to the 3rd one are retained, as in other *Securiops* (as in Fig. 40). Distal segment of labial palp without row of stout setae, with several stout setae near outer-distal and inner-distal corners (as in Fig. 44).

Abdominal terga and sterna. Lateral spines are present on abdominal segments IV–IX, varying from 2 to 8 spines on one side; their number is not as constant as reported by Gillies (1988). Posterolateral spines are present on segments II–VII.

Posterior margin of abdominal tergum I is smooth, without denticles; posterior margins of terga II–X have heavily sclerotized, brown, conic, sharply pointed, spine-like denticles separated by spaces wider than denticle width (Fig. 103); on tergum IX row of denticles is interrupted medially, behind pair of submedian setae (as in Fig. 51); projected portion of tergum X row with few larger denticles by sides, with few smaller denticles between them (as in Figs 51–52).

Posterior margins of abdominal sterna I–IV are smooth, without denticles; posterior margins of sterna VI–IX have colorless, conic, sharply pointed, spine-like denticles, denser than denticles on terga (Fig. 104). Paraproct with spine-like denticles larger than denticles on sterna (as in Fig. 52).

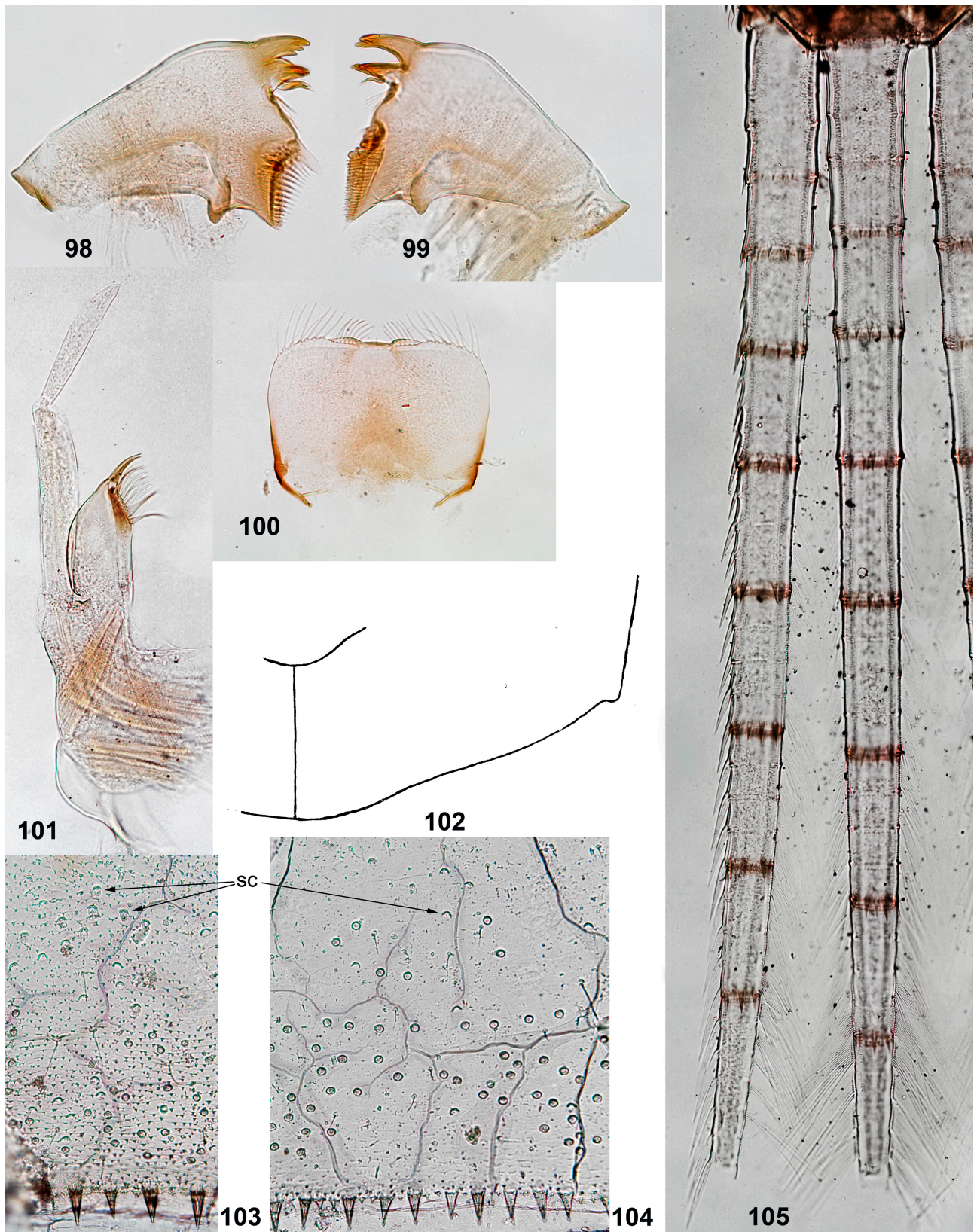
Abdominal terga with sparse, small protuberances; terga III–X also with few, sparsely situated, oval scales in wide semilunar non-opercula-bearing sockets (Fig. 103). Sterna VI–VIII also with such scales (Fig. 104). Besides this, abdominal terga and sterna with ring-like sensilla and irregularly situated fine setae.

Tergalii. Tergalii I–IV with dorsal lamella, tergalii V–VII without dorsal lamella; tergalium VII enlarged (Gillies 1988: figs 14–19). Tergalium VII was figured with its anal margin directed up, like costal margins of other tergalii (Gillies 1988: fig. 19); probably, the author confused the anal margin with the costal one. Actually, tergalium VII has costal margin sharply convex, and anal margin straight, that is typical for *Procloeon* s. l. (as in Fig. 17).

Caudalii. On most part of cercus, lateral side of each segment with one long spine on posterior margin; these spines are gradually changed from stout and moderately long (about as long as segment lengths) in proximal part of cercus to delicate and very long (up to 3 times exceeding segment length) in middle and distal part of cercus (Fig. 105). Posterior margin of each 4th segment of cercus and paracercus, followed by bark brown ring, with several pointed spines both on dorsal and ventral sides.

Winged stages. Unknown.

Egg. Unknown.



FIGURES 98–105. *Procloeon (Securiops) mutadens*. 98–99, left and right mandibles; 100, labrum; 101, maxilla; 102, larval cuticle of metanotum with vestige of hind protopteron; 103, abdominal tergum V; 104, abdominal sternum V; 105, caudalii. Abbreviation: sc, scales and scale sockets.

***Procloeon (Securiops) primasia* (Kaltenbach *et al.* 2023) comb. n.**

(Figs 18–24, 106–144)

Securiops primasia Kaltenbach, Phlai-ngam, Suttinun & Gattolliat 2023: 129 (larva).

Material examined. THAILAND: Kanchanaburi province, river Taphoen near falling into river Kwai-Yai, Lad-Ya (= Lat Ya), resort «Island Resort River Kwai», 30.I–1.II.2015, coll. N. Kluge & L. Sheyko: 5 L-S-I♂, 1 L-S♂, 1 S-I♂, 3 L-S-I♀, 1 L-S♀; Erawan Falls, 1–4.II.2015, coll. N. Kluge & L. Sheyko: 2 L/S♀, 1 L♀; Mae-Hong-Son Province, river Pai upstream of Pai, 9.II.2015, coll. N. Kluge & L. Sheyko: 1 L-S-I♂.

Additions and corrections to larval and egg descriptions

Cuticular coloration. Larvae of the both sexes have two sharply different forms of cuticular coloration, in one of which abdominal terga have very contrasting dark brown median part and light lateral parts (Fig. 106), while another form has abdominal terga mostly light, with small brown markings (Fig. 115). Kaltenbach *et al.* (2023) wrongly assumed that the first form is the normal one, and the second form has «colour not yet fully developed» (Kaltenbach *et al.* 2023: fig. 1). Actually, cuticle of the both forms is finally developed, that is testified by shed exuviae shown on the Figs 106–115.

Glossa. As well as in other species of *Securiops*, glossa has an arched, subapical, transverse row of setae located on its dorsal side [erroneously reported as «ventroapically» and in «ventral view» (Kaltenbach *et al.* 2023: fig. 4d)] and a row of long, straight setae near base on its ventral side (not reported in the original description) (Figs 116, 118–119).

Paraglossa. In contrast to other species, inner margins of paraglossae are sharply angulate, in apical part concave and diverging (Figs 116; Kaltenbach *et al.* 2023: figs 4a, e).

Labial palp. Setal field located on apical-dorsal side, proximally is bordered by sparse, regular row of especially large setae in high sockets (in contrast to the African species) (Fig. 117). Kaltenbach *et al.* (2023) described the labial palp as «2-segmented», taking the 2nd and 3rd segments fore one; however, the border separating these segments and the muscle going from the 2nd segment to the 3rd one are retained, as in other *Securiops* (Kaltenbach *et al.* 2023: figs 4a–b).

Tibiae. The proximal end of patella-tibial suture is bent distally and connected under acute angle with row of long thin hairs (as in other *Cloeon*/fg1, see above) (Fig. 120). In the original description, the bent portion of patella-tibial suture is not shown on the drawing (Kaltenbach *et al.* 2023: fig. 5j).

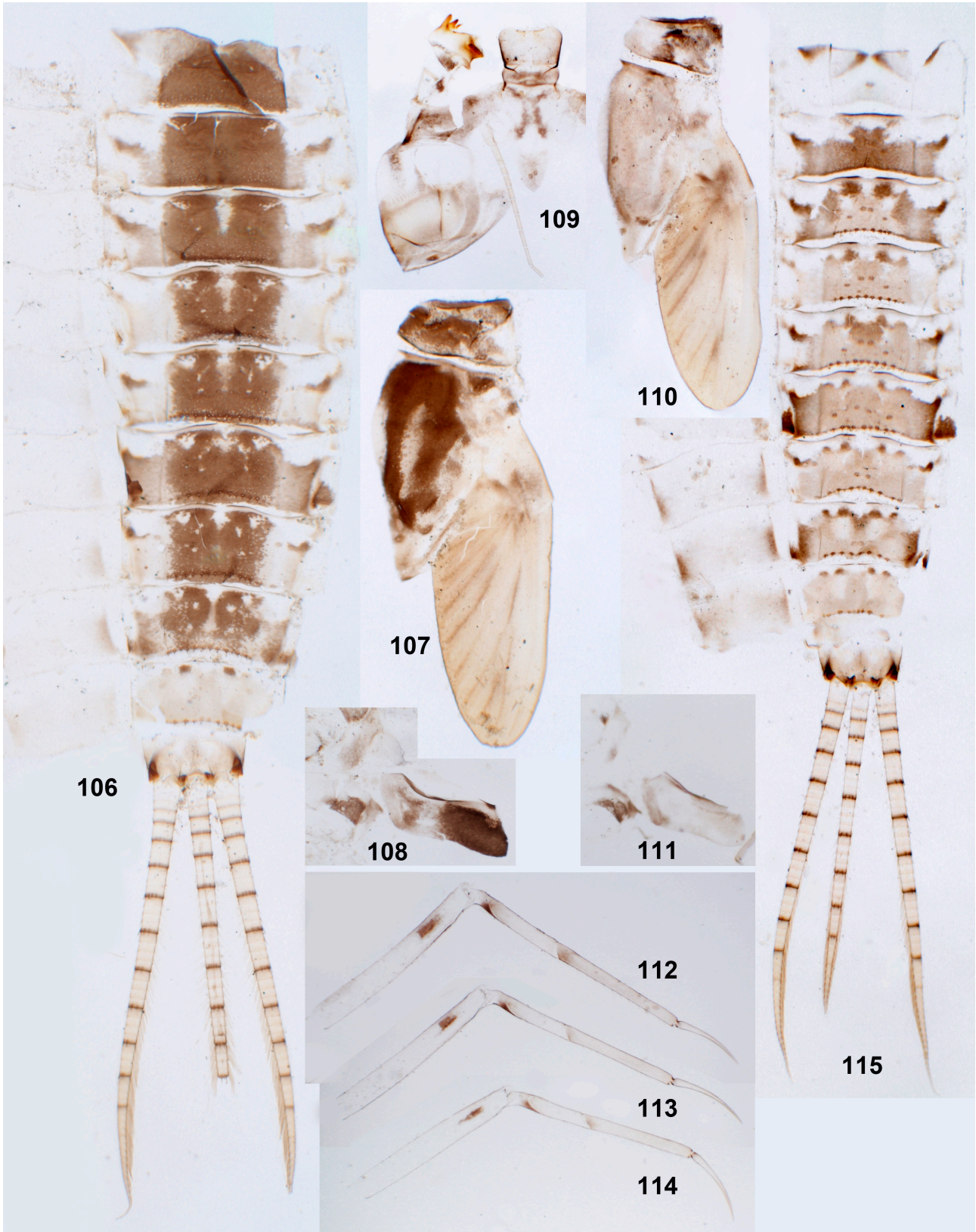
Lateral spines on abdomen. Lateral spines are located on abdominal segments VIII–IX, varying from 2 to 10 larger or smaller spines on one side (not constantly seven and five spines which are reported in the original description); previous segments normally lack lateral spines; small posterolateral spines are present on abdominal segments III–VII (Kaltenbach *et al.* 2023: fig. 6a).

Abdominal terga and sterna. Scales are entirely absent; all abdominal terga with numerous small, pointed, brown protuberances; all abdominal sterna with numerous colorless protuberances; besides this, abdominal terga and sterna with ring-like sensilla and fine setae, which are located sparsely and irregularly, not forming regular rows or constant pairs (Figs 122–123).

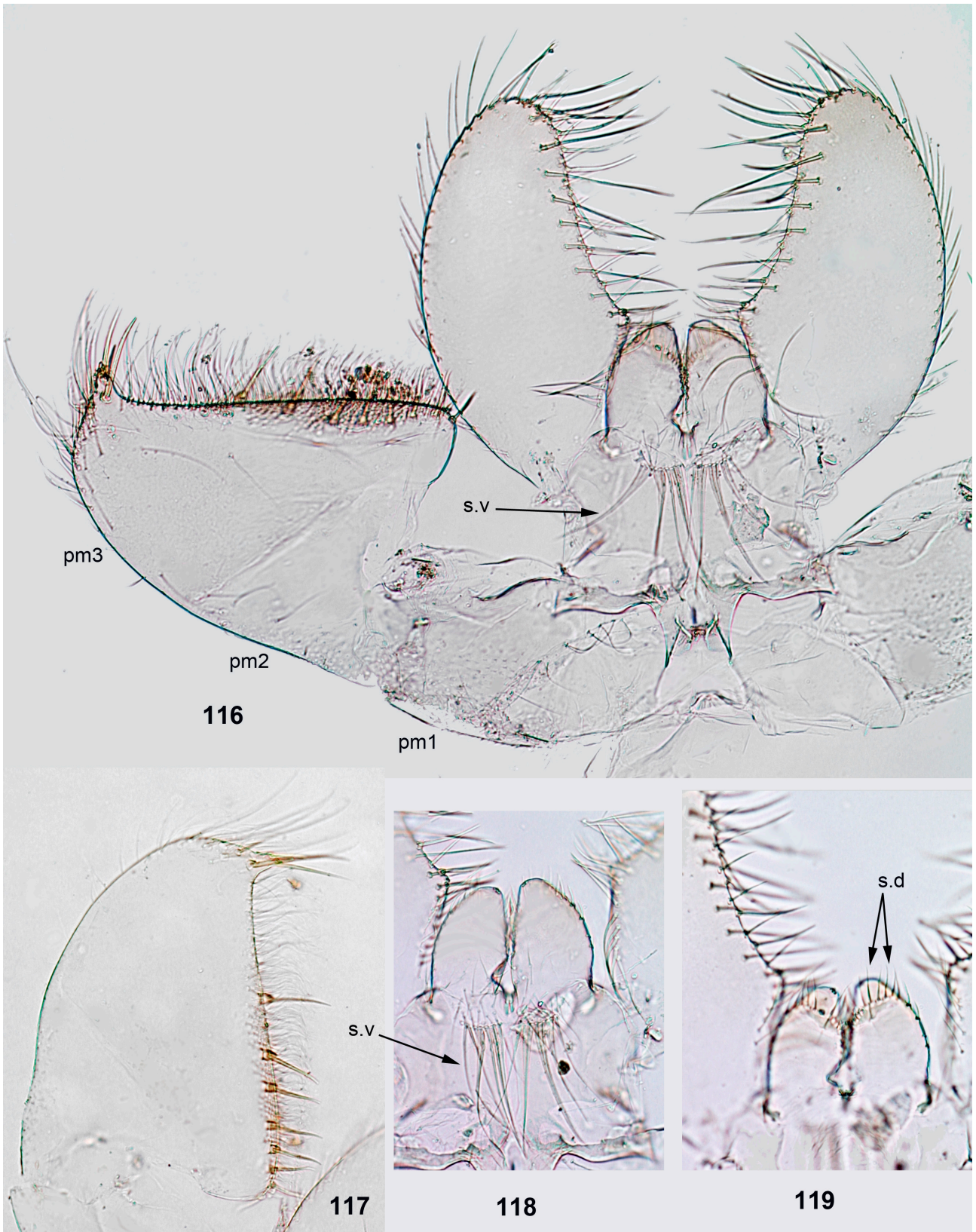
Tergalii. Second lamella (see characteristics of *Cloeon*/fg1 above) is present on tergalii of I–VI pairs and absent on tergalii of the VII pair (Figs 18–24). In the original description, the second lamella was erroneously reported on tergalii VII (Kaltenbach *et al.* 2023: 136) because on the drawing (Kaltenbach *et al.* 2023: fig. 7b) the tergalii VII was overturned, its sharply convex costal margin was taken for the anal margin, and an occasional fold along costal margin was taken for a gap separating two lamellae. Actually, the costal margin is bordered with the costal rib and cannot be expanded into second lamella; the second lamella, characteristic for *Cloeon*/fg1, if present, represents an outgrowth of the anal margin, which is not bordered by a rib.

Tergalii of *P. (S.) primasia* have characteristic species-specific shape resembling linden leaf: with apex stretched and pointed, and with costal margin more convex than in other species (Figs 18–24).

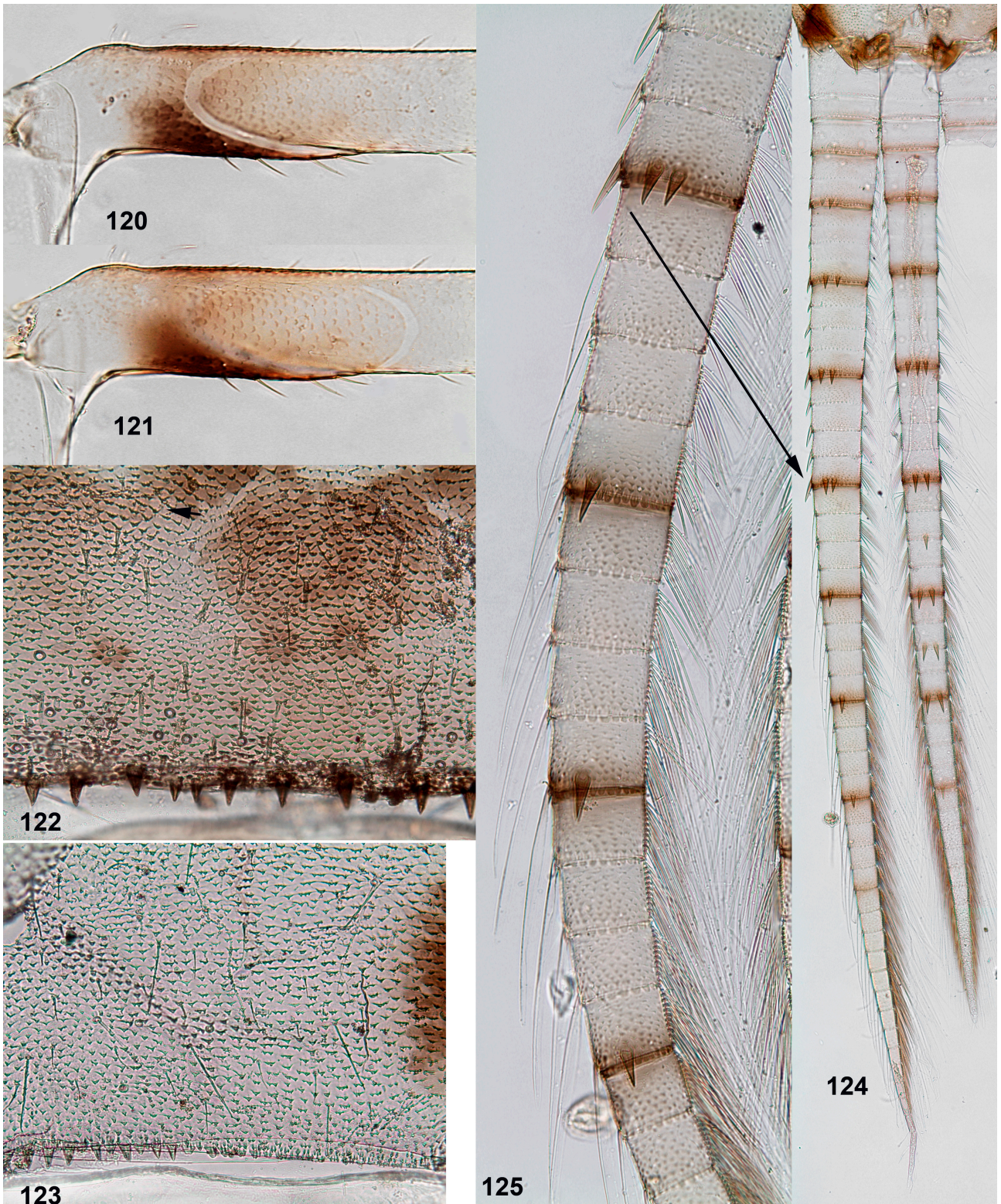
Cerci. Cerci of *P. (S.) primasia* have unique structure: the enlarged spines on lateral side of cercus (characteristic for *Procloeon*/g1) are sharply differentiated: in proximal portion of the cercus all spines are stout, conic and not longer than next cercomere; in distal portion of the cercus all spines are delicate, widened from base and greatly enlarged, being as long as 2–3 next cercomeres (Fig. 124–125). Original description was based on larvae with broken cerci (Kaltenbach *et al.* 2023: fig. 1), and this important character was not reported.



FIGURES 106–115. *Procloeon (Securiops) primasia*, larval exuviae. 106–108, dark individual (female); 109–115, light individual (male); 106, 115, abdominal terga and sterna; 107, 110, half of pronotum and mesonotum; 108, 111, left thoracic pleura and half of metanotum; 109, part of head; 112–114, fore, middle and hind legs.



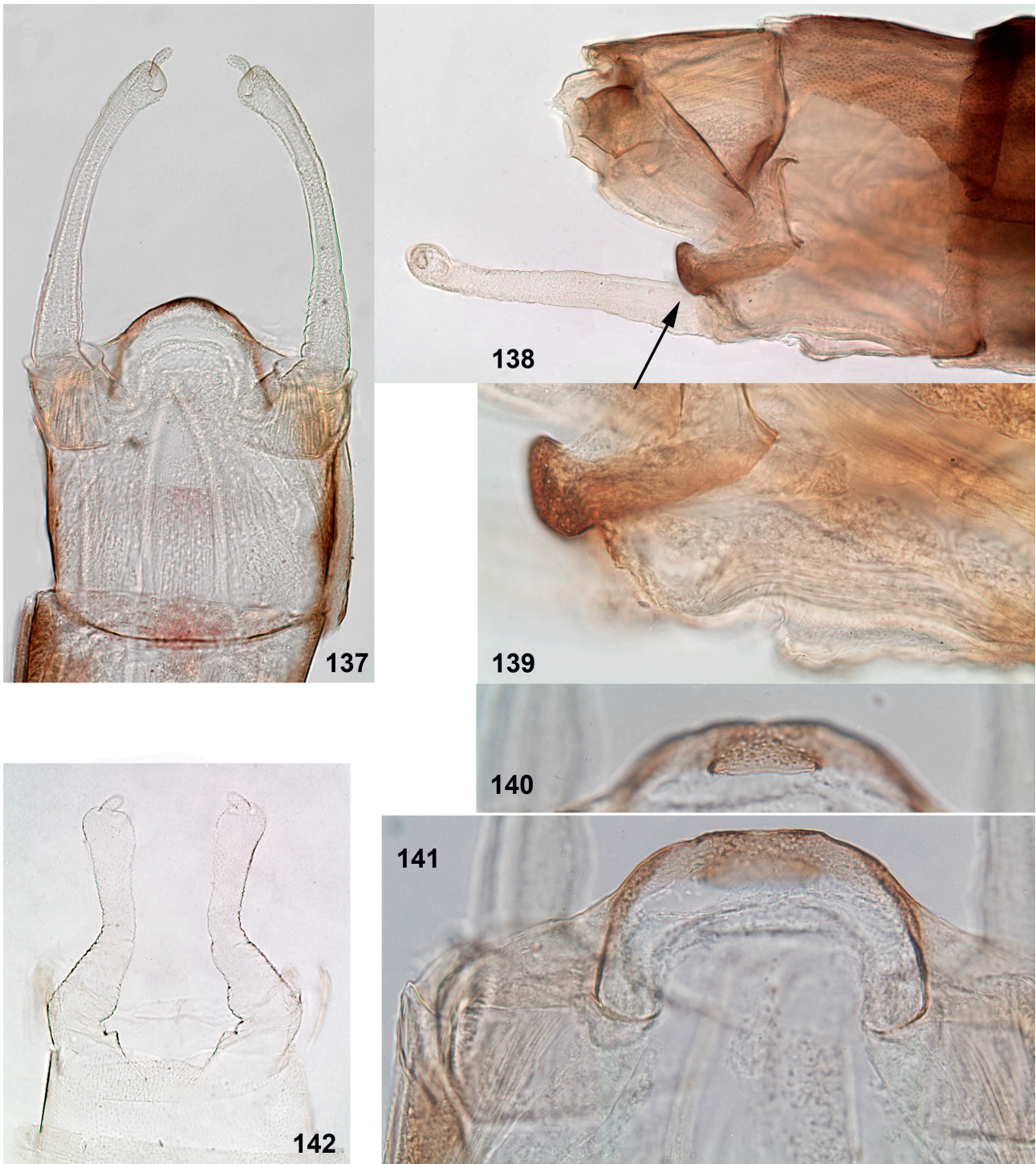
FIGURES 116–119. *Procloeon (Securiops) primasia*, exuviae of labium. 116, labium (ventral setae of glossae directed proximally); 117, 2nd and 3rd segments of labial palp; 118–119, glossae in ventral and dorsal views (ventral setae directed proximally). Abbreviations: pm1, pm2, pm3, 1st–3rd palpomeres; s.d, dorsal setae of glossae; s.v, ventral setae of glossa.



FIGURES 120–125. *Procloeon (Securiops) primasia*, larval exuviae. 120, base of tibia of fore leg, with focus on dorsal side; 121, the same with focus on ventral side; 122, abdominal tergum V; 123, abdominal sternum VIII; 124, cercus and paracercus; 125, portion of cercus.

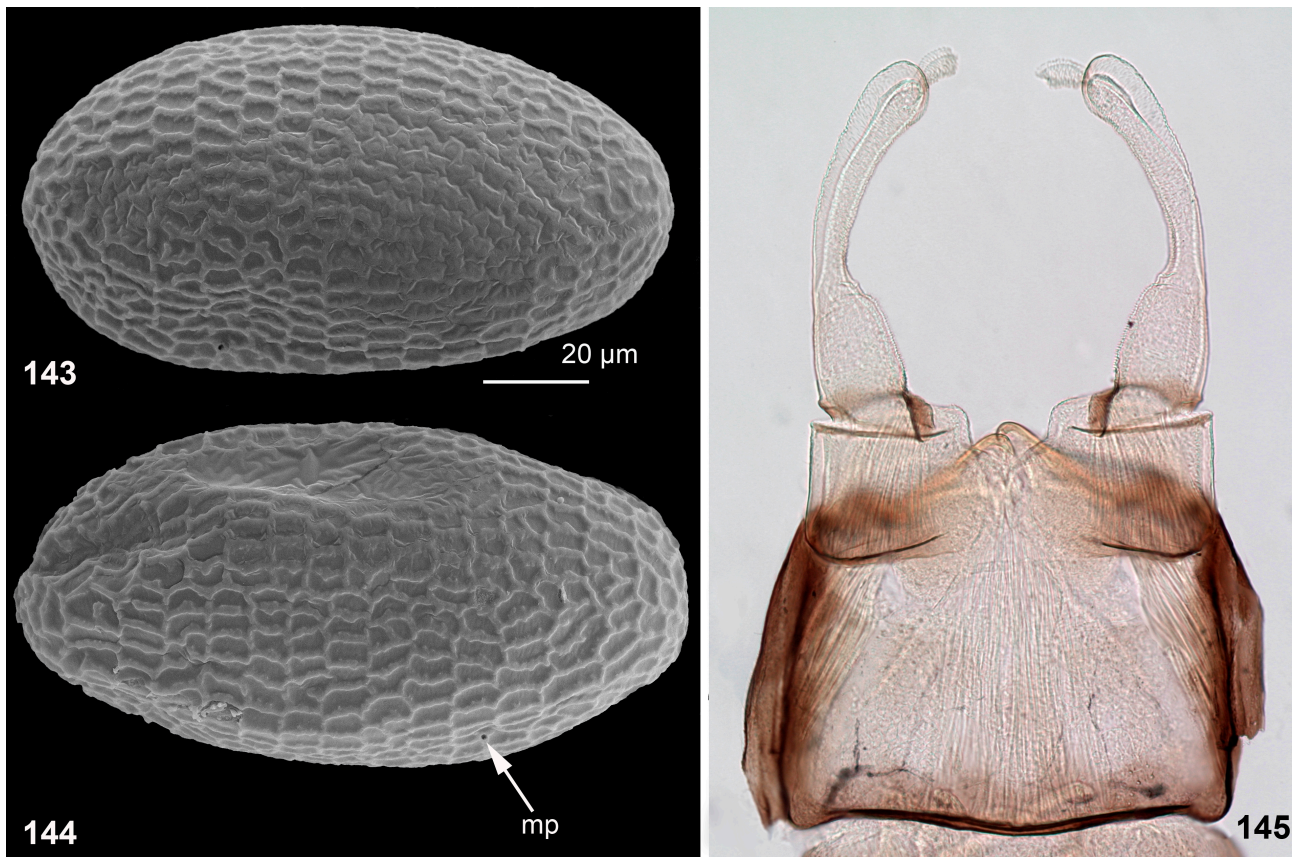


FIGURES 126–136. *Procloeon (Securiops) primasia*. 126–127, male imagines; 128, female imago; 129, subimaginal exuviae of half of mesonotum; 130, subimaginal exuviae of thoracic pleura; 131–133, fore leg of female imago; 134–136, its middle leg. Abbreviations: cx2, cx3, coxae of fore, middle and hind legs; lpnc, lateropostnotal crest; mtpl, pleurite of metathorax; pls, pleural suture; psa, postsubalar sclerite.



FIGURES 137–142. *Procloeon (Securiops) primasia*. 137–141, genitalia of male imagines: 137, ventral view; 138, lateral view, right gonostylus and styliger removed; 139, lateral view of penis; 140, apex of penis with focus on its dorsal margin; 141, the same penis with focus on ventral side; 142, subimaginal exuviae of genitalia.

Egg. Elongate-oval; chorion with even convex relief in a form of net with cells elongated along egg axis; micropyle is very small, round (Figs 143–144). Kaltenbach *et al.* (2023) erroneously described eggs of this species as having «four longitudinal rows of wide, sub-rectangular structural elements» (Kaltenbach *et al.* 2023: 136, figs 7c–d). Eggs described by them, were not developed; their «sub-rectangular structural elements» are tissues of ovarium, but not elements of the egg chorion. The same egg structure is visible on scanning electron photographs in all cases when non-developed eggs are examined (e.g., see Kopelke & Müller-Liebenau 1982: fig. 6: egg of *Baetis alpinus*).



FIGURES 143–145. 143–144, eggs of *Procloeon* (*Securiops*) *primasia*. 145, male imaginal genitalia of *Cheleocloeon excisum* (Barnard 1932), reared from larva in Eerste river 9.II.2019 by N. Kluge and L. Sheyko [the same locality as for *P. (S.) falcatum*]. Abbreviation: mp, micropyle.

Descriptions of winged stages

Subimago. CUTICULAR COLORATION. Head nearly colorless, antennal flagellum brownish. Pronotum colorless. Mesonotum mostly colorless, with contrasting brown grooves bordering anterolateral scutal costa, contrasting brown prealar bridge and contrasting brown lateral sclerite of parascutellum (Fig. 129). Thoracic pleura and sterna mostly colorless, with contrasting brown area of pleural suture, contrasting brown postsubalar sclerite with lateropostnotal crest and brown pleura of metathorax (Fig. 130). Wing cuticle colorless, microtrichia ochre. Legs colorless. Abdominal terga and sterna colorless. Gonostyli colorless (Fig. 142). Cerci colorless.

TEXTURE. On legs of all pairs, all tarsal segments covered with pointed microlepidies (as in Fig. 70).

Imago, male (Figs 126–127). Head brown. Turbinate eyes dark brown. Thorax brown with membranes ochre. Wings colorless, with veins ochre. Pterostigma with several complete, non-branched, oblique crossveins. Legs ochre; either all legs without maculae, or fore femur with diffusive macula on outer side near base (as in Fig. 132). Middle and hind legs with tarsus longer than tibia, with one apical spine on initial 3rd tarsomere (actual 2nd tarsomere) (as in Figs 135–136). Abdomen mostly ochre; terga with diffusive brownish markings; posterior part of tergum VII and terga VIII–IX brownish. Cerci uniformly ochre. Gonostyli ochre, long and slender (Fig. 137). Penial bridge forming projection semicircular in ventral view (Fig. 137), apically with projection bent dorsally under right angle (Figs 138–141).

Imago, female (Fig. 128). Head, thorax and abdomen ochre with brown markings. Fore tarsus 5-segmented, with small apical spine on 3rd segment (Fig. 132–133); middle and hind tarsi 4-segmented, with apical spine on initial 3rd segment (actual 2nd segment) (Fig. 135–136). Coloration of wings, legs, and cerci as in male.

Dimension. Fore wing length of male and female 4–5 mm.

Acknowledgements

The author thanks Luke M. Jacobus (Indiana University Purdue University Columbus, Indiana, USA) for the important information about the holotype of *P. (S.) macafertiorum*. The author thanks Cape Nature for collecting permit CN44-59-6588. Scanning electron microscopy was performed at the Center for Molecular and Cell Technologies of St. Petersburg State University (project 109-262).

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