

# *Labiobaetis* Novikova & Kluge (Ephemeroptera: Baetidae) from the Afrotropical Region

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*Labiobaetis* Novikova & Kluge is recorded from the Afrotropical Region for the first time. Six new species are described: *Labiobaetis aquacidus* (South Africa and Kenya), *L. fabulosus* (Madagascar), *L. masai* (Kenya), *L. nadineae* (South Africa), *L. piscis* (South Africa) and *L. plumbago* (Madagascar). Eight species previously assigned to the genera *Baetis* Leach, *Cymulabaetis* McCafferty & Waltz or *Pseudocloeon* Klapálek are transferred to *Labiobaetis*: *L. balcanicus* (Müller-Liebenau & Soldán), *L. boussoulii* (Gillies), *L. cleopatrae* (Thomas & Soldán), *L. elouardi* (Gillies), *L. insolitus* (Kopelke), *L. kalengoensis* (Kopelke), *L. mtonis* (Gillies), and *L. vinosus* (Barnard). The last species is redescribed from many additional specimens from South Africa. The wider range of morphological variation and gradation now apparent from the study of Afrotropical species of *Labiobaetis* indicates that *Cymulabaetis* is no longer sustainable as a separate genus and is placed as a junior synonym of *Labiobaetis*. *Labiobaetis* is distinguished within the *Baetis* complex of genera by the presence of a distomedial constriction or concavity on maxillary palp segment 2 in the larvae. Most species also possess a distolateral notch on the antennal scapes.

**Key words:** Ephemeroptera, Baetidae, *Labiobaetis*, Africa, Madagascar, new species, new combinations, *Cymulabaetis*, new synonym.

## INTRODUCTION

Novikova & Kluge (1987) originally described *Labiobaetis* as a subgenus of *Baetis* Leach (Ephemeroptera: Baetidae). As such, it included those Holarctic and Oriental species variously placed in the *Baetis atrebatinus*, *B. molawinensis* and *B. propinquus* species groups by Müller-Liebenau (1969, 1973, 1981, 1982, 1984a,b), Morihara & McCafferty (1979a,b) and Müller-Liebenau & Hubbard (1985). McCafferty & Waltz (1995) raised *Labiobaetis* to generic status, and they also described *Cymulabaetis* for *C. balcanicus* (Müller-Liebenau & Soldán), from Bulgaria and Greece and *C. cleopatrae* (Thomas & Soldán) from Egypt, two problematic species previously assigned to the *B. atrebatinus* group (Müller-Liebenau & Soldán 1981; Thomas & Soldán 1989). McCafferty & Waltz (1995) showed that *Labiobaetis* and *Cymulabaetis* belong to the monophyletic *Baetis* complex of genera, that also includes *Acentrella* Bengtsson, *Baetiella* Uéno, *Baetis*, *Barbaetis* Waltz & McCafferty, *Demoreptus* Lugo-Ortiz & McCafferty, *Gratia* Thomas, *Heterocloeon* McDunnough, *Liebiella* Waltz & McCafferty,

*Platybaetis* Müller-Liebenau and *Pseudocloeon* Klapálek. Waltz & McCafferty (1987) and McCafferty & Waltz (1990) defined this complex of genera by the autapomorphic presence of the femoral villopore in the larvae (Waltz & McCafferty 1987: Figs 1, 4, 5, 12, 17).

McCafferty & Waltz (1995) delimited *Labiobaetis* by the presence of a distomedial concavity on segment 2 of the maxillary palps and a distolateral notch on the antennal scapes in the larvae. They distinguished *Cymulabaetis* by the combination of the labrum with an anterior submarginal row of branched setae, maxillary palps without a distomedial concavity and scapes without a distolateral notch in the larvae. Adults were not consistently distinguishable in the two genera. The original rationale for establishing *Cymulabaetis* as a separate genus was that *C. balcanicus* and *C. cleopatrae* represented species that apparently did not manifest the synapomorphies distinguishing *Labiobaetis*, as they were described at the time. McCafferty & Waltz (1995) cautioned, however, that those species could revert to *Labiobaetis* if intermediate species were discovered.

As part of our comprehensive survey and

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systematic analysis of the baetid fauna of the Afrotropical Region (Lugo-Ortiz & McCafferty 1996a,b,c, 1997a,b), we have discovered the genus *Labiobaetis* in sub-Saharan Africa and Madagascar. Diverse Afrotropical *Labiobaetis* species revealed that the morphology of the distolateral margin of the scapes and distomedial margin of segment 2 of the maxillary palps vary considerably among species. The distolateral margin of the scapes grades from having a notch to being slightly chamfered to being unmodified, and the distomedial margin of segment 2 of the maxillary palps grades from having a slight constriction to a pronounced concavity. It was also found that the degree of development of the villopore varies significantly: in most species it is well developed, in others it appears rudimentary, and in some it may be secondarily absent. Other characters that vary widely include the presence and absence of hind wing pads and the presence and absence of the first pair of abdominal gills in the larvae.

The clinal morphology of the scapes and segment 2 of the maxillary palps and different degrees of development of the villopore shown by the Afrotropical species of *Labiobaetis* required the modification of the McCafferty & Waltz (1995) concept of that genus. In particular, it became evident that the observed species variability and gradation of characters would incorporate *C. balcanicus* and *C. cleopatrae* in *Labiobaetis*, thus rendering *Cymulabaetis* untenable as a separate taxon. We therefore place *Cymulabaetis* as a junior synonym of *Labiobaetis* and transfer *C. balcanicus* and *C. cleopatrae* to *Labiobaetis*.

The concept of *Labiobaetis* must be expanded to include species with or without a distolateral notch on the antennal scapes, with the distomedial modification of segment 2 of the maxillary palps ranging from a constriction to a pronounced concavity, with or without a villopore, with gills present or absent on abdominal segment 1, and with or without hind wings (and hind wing pads). The apomorphic distolateral notch on the scapes has been secondarily lost in some species of *Labiobaetis*. The apomorphic distomedial modification of segment 2 of the maxillary palps, although variable, continues to be diagnostic for all species of the genus. *Indobaetis* Müller-Liebenau & Morihara shows convergent maxillary palp morphology (Müller-Liebenau & Morihara 1982: Figs 1d, 2d), but Waltz *et al.* (1994) showed that *Indobaetis* belongs to another complex of genera, the *Indobaetis*

complex, comprising *Alainites* Waltz & McCafferty, *Dipheter* Waltz & McCafferty, *Nigrobaetis* Novikova & Kluge and *Takobia* Novikova & Kluge.

Twenty nine species of *Labiobaetis*, including *L. balcanicus* and *L. cleopatrae*, are known from the Holarctic and Oriental Regions (McCafferty & Waltz 1995). The discovery of Afrotropical species significantly adds to this number and extends the known geographic range. *Labiobaetis* fits the Arctogeian distributional pattern, *i.e.*, Afrotropical + Holarctic + Oriental Regions (realms of Schmidt (1954)). This pattern suggests that the genus primarily evolved during the Tertiary, since the breakup of Gondwanaland. Twelve Afrotropical species, six representing new species, are reported alphabetically below. Two new species are recorded from Madagascar; all other reports are from sub-Saharan Africa. Material examined is in the following institutions: Albany Museum, Grahamstown (AMGS); the Purdue Entomological Research Collection, West Lafayette, Indiana (PERC); and the United States National Museum, Washington, D.C. (USNM).

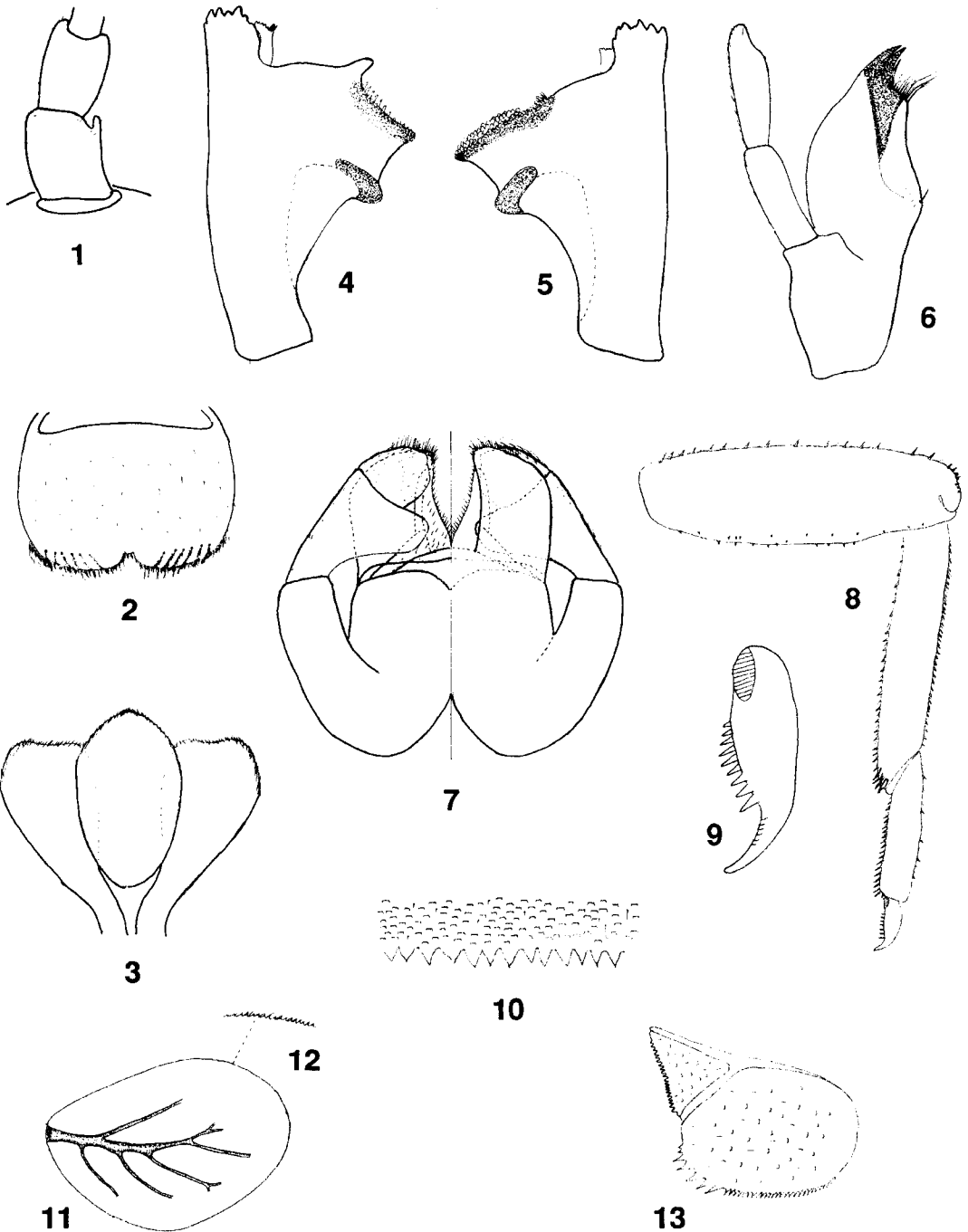
## THE AFROTROPICAL SPECIES OF *LABIOBAETIS*

### *Labiobaetis aquacidus* sp. n., Figs 1–13

#### *Description*

*Larva.* Lengths. Body: 5.5–6.1 mm; caudal filaments: 2.8–3.0 mm.

*Head.* Coloration yellow-brown, with no distinct pattern. Antennae 2.0–2.2 times length of head capsule; scapes (Fig. 1) with notch at distolateral margin and short, fine, simple setae scattered over surface. Labrum (Fig. 2) broadly rounded anteriorly, dorsally with 5–7 branched setae submarginally on each side of midline (similar to Fig. 15); dorsal submedial pair of setae absent. Hypopharynx as in Fig. 3. Left mandible (Fig. 4) incisors with 3 + 4 denticles; prosthema robust, apically denticulate; triangular process at base of mola elongate. Right mandible (Fig. 5) incisors with 3 + 4 denticles; prosthema slender, apically denticulate; small tuft of short, fine, simple setae at base of mola. Maxillae (Fig. 6) with four denticles on apex of galealaciniae and 4–5 short, fine, simple setae submarginally near medial hump; medial hump with short, stout, simple seta; palp segments 1 and 2 subequal, extending slightly beyond galealaciniae; palp segment 2 with pronounced



**Figs 1–13.** *Labiobaetis aquacidus*, larva. 1, scapes; 2, labrum; 3, hypopharynx; 4, left mandible; 5, right mandible; 6, right maxilla; 7, labium (left = ventral; right = dorsal); 8, left foreleg; 9, tarsal claw; 10, tergum 4 (detail); 11, gill 4; 12, gill margin (detail); 13, paraproct.

distomedial concavity. Labium (Fig. 7) with many long, robust, simple setae medially on glossae and three rows of pectinate setae apically on paraglossae; palp segment 1 slender, subequal to segments 2 and 3 combined; palp segment 2 with broad, blunt distomedial process and 4–5 short, fine, simple setae dorsally; palp segment 3 somewhat elongate and apically pointed, with numerous short, fine, simple setae scattered over surface.

*Thorax.* Coloration yellow-brown, with no distinct pattern. Hind wing pads present. Legs (Fig. 8) yellow-brown; femora with rudimentary villopore, 14–16 apically pointed, simple setae dorsally, and scattered short, stout, simple setae ventrally; tibiae with numerous short, stout and short, fine, simple setae dorsally and ventrally; tarsi with 5–6 short, stout, simple setae and scattered short, fine, simple setae dorsally and 18–20 apically pointed simple setae of increasing length ventrally; tarsal claws (Fig. 9) with seven or eight sharp denticles, increasing slightly in length distally.

*Abdomen.* Coloration yellow-brown, with no distinct pattern. Tergal surfaces (Fig. 10) with abundant scale bases and scattered, short, fine, simple setae; posterior margins with somewhat irregular triangular spination. Sterna pale-yellow to cream. Gills (Fig. 11) on segments 1–7, well tracheated, with small serrations and short, fine, simple setae marginally (Fig. 12); middle gills 1.25–1.50 times length of corresponding segments. Paraprocts (Fig. 13) with numerous marginal spines increasing in length distally, with scattered scale bases and short, fine, simple setae on surface. Caudal filaments pale-yellow to cream, with broad pale-brown medial band; terminal filament nearly 0.90 times length of cerci.

*Adult.* Unknown.

*Etymology.* The specific epithet is an arbitrary combination of the Latin words *aqua* (water) and *acidus* (sour). It is in reference to the type locality, the Mlazi River (formerly Umlaas River), which derives its name from the Zulu word *laza* (sour water).

*Distribution.* Kenya, South Africa.

*Remarks.* Larvae of *L. aquacidus* are distinguished by the presence of a distolateral notch on the antennal scapes (Fig. 1); lack of submedial pair of setae and presence of a short, submarginal row of branched setae dorsally on each half of the labrum (Fig. 2); presence of a pronounced distomedial concavity on maxillary palp segment 2 (Fig. 6);

pronounced distomedial process of labial palp segment 2 with a short, straight medial margin (Fig. 7); and numerous marginal spines and scattered short, fine, simple setae on the paraprocts (Fig. 13).

*Type material examined.* Holotype: larva, SOUTH AFRICA: KwaZulu-Natal, Umlaas R., between Camperdown and Eston, 21.5 °C, 3.x.1971, G.F. & C.H. Edmunds (PERC). Paratypes: 6 larvae, same data as holotype (2 larvae in AMGS, 4 larvae in PERC); larva, Umkomaas R., Lundy's Hill, ca 50 km W of Pietermaritzburg, road to Bulwer, 10.0 °C, 29.44S 29.54E, 1.x.1971, G.F. & C.H. Edmunds (PERC) (mouthparts and forelegs mounted on slide (medium: Euparal)).

*Additional material examined.* KENYA: 5 larvae, Turasha R., 8100 ft, 00.36S 36.34E, 8.i.1991, R.W. Griffiths (PERC). SOUTH AFRICA: 28 larvae, same data and deposition as holotype; *Eastern Cape Province*, 19 larvae, Great Fish R., just N of Karoo Sulphur Springs, nr Cradock, 32.07S 25.37E, 10.xi.1990, W.P. & N. McCafferty; *KwaZulu-Natal*, larva, Sani Pass road at police post, 16.4 °C, 1950 m, 29.36S 29.21E, 1.x.1971, G.F. & C.H. Edmunds (PERC); 6 larvae, Howick Falls, Umgeni R., 29.28S 30.14E, 2.x.1971, G.F. & C.H. Edmunds (PERC); larva, Albert Falls, Umgeni R., 29.26S 30.26E, no date, G.F. Edmunds & F.M. Chutter (PERC); 15 larvae, Umlaas R., at Durban waterworks filtration plant, nr Pinetown, 22.3 °C, 4.x.1971, G.F. & C.H. Edmunds (PERC); 5 larvae, Mooi R., below Mooi R. Township, 1350 m, 29.13S 29.59E, 20.ix.1990, W.P. & N. McCafferty (PERC).

### ***Labiobaetis boussoulius* (Gillies) comb. n.**

*Baetis boussoulius* Gillies, 1993: 214.

*Distribution.* Guinea.

*Remarks.* Gillies (1993) described *L. boussoulius* from larvae and male subimagos and adults. Larvae are distinguished by a relatively shallow distomedial concavity on segment 2 of the maxillary palps (Gillies 1993: Fig. 5), broadly rounded distomedial process on labial palp segment 2 (Gillies 1993: Fig. 8), presence of hind wing pads and conspicuous villopore (Gillies 1993: Fig. 10) and untracheated gills (Gillies 1993: Fig. 12). Male adults are distinguished by relatively long and narrow hind wings (Gillies 1993: Figs 1, 2) and a small subbasal conical projection on segment 2 of the genital forceps (Gillies 1993: Fig. 3).

***Labiobaetis elouardi* (Gillies) comb. n.***Baetis elouardi* Gillies, 1993: 216.*Distribution.* Guinea.

*Remarks.* Gillies (1993) described *L. elouardi* from larvae and male and female adults. Larvae are distinguished by the presence of a lateral notch on the antennal scapes (Gillies 1993: Fig. 22); somewhat cleft mandibular incisors (Gillies 1993: Figs 18, 19); a shallow distomedial concavity on segment 2 of the maxillary palps (Gillies 1993: Fig. 20); small, round distomedial process on labial palp segment 2 (Gillies 1993: Fig. 21); absence of hind wing pads and villopore; well-tracheated gills (Gillies 1993: Fig. 24) and paraprocts with three relatively small irregular distomedial spines (Gillies 1993: Fig. 26). Male adults are distinguished by the absence of hind wings and subbasal slightly bulbous segment 2 of the genital forceps (Gillies 1993: Fig. 15).

***Labiobaetis fabulosus* sp. n., Figs 14–26***Baetis* sp. Demoulin 1968: 1.**Description**

*Larva. Lengths.* Body: 7.4–8.7 mm; caudal filaments: 5.8–6.2 mm.

*Head.* Coloration yellow-brown, with no distinct pattern. Antennae 2.5–3.0 times length of head capsule; scapes with lateral notch at distolateral margin (similar to Fig. 1). Labrum (Fig. 14) broadly rounded anteriorly, with numerous short, fine, simple setae dorsally and 15–17 branched setae (Fig. 15) submarginally on each side of midline; dorsal submedial pair of setae absent. Hypopharynx (Fig. 16) with lingua with anteromedial tuft of long, robust, simple setae coalesced into a long, apically-pointed projection. Left mandible (Fig. 17) incisors with eight fused denticles, somewhat fanlike; prosthema robust, apically denticulate; triangular process at base of mola short; lateral margin with scattered, fine, simple setae. Right mandible (Fig. 18) incisors with eight fused denticles, somewhat fanlike; prosthema slender, apically denticulate; small tuft of short, fine, simple setae at base of mola. Maxillae (Fig. 19) with four sharp denticles on apex of galealaciniae and 4–5 simple setae submarginally near medial hump; medial hump with short, stout, simple seta; palp segments 1 and 2 subequal, extending well beyond galealaciniae; palp segment 2 with pronounced distomedial concavity. Labium

(Fig. 20) with reduced glossae and enlarged paraglossae; glossae nearly 0.33 times length of paraglossae, slender ventrally, with conical protuberance dorsally and long, robust, simple setae apically; paraglossae broadly rounded anteriorly, with three rows of distally pectinate setae apically; palp segment 1 slender, somewhat longer than segments 2 and 3 combined; segment 2 slightly convex laterally, broad, subrectangular, and cleaver-shaped medially as in Fig. 20, with scattered, short, fine, simple setae over surface; segment 3 nearly 2.0 times as long as wide, apically pointed, with numerous short, fine, simple setae scattered over surface.

*Thorax.* Coloration yellow-brown, with no distinct pattern. Hind wing pads present. Legs (Fig. 21) pale-yellow-brown; femora without villopore and with 14–16 sharp simple setae dorsally and scattered, short, apically pointed, simple setae ventrally; tibiae with numerous short, apically pointed, simple setae ventrally and short, stout, simple setae dorsally; tarsi with numerous short, apically pointed, simple setae ventrally, increasing in length distally and short, stout, simple setae dorsally; tarsal claws (Fig. 22) with 8–10 sharp denticles.

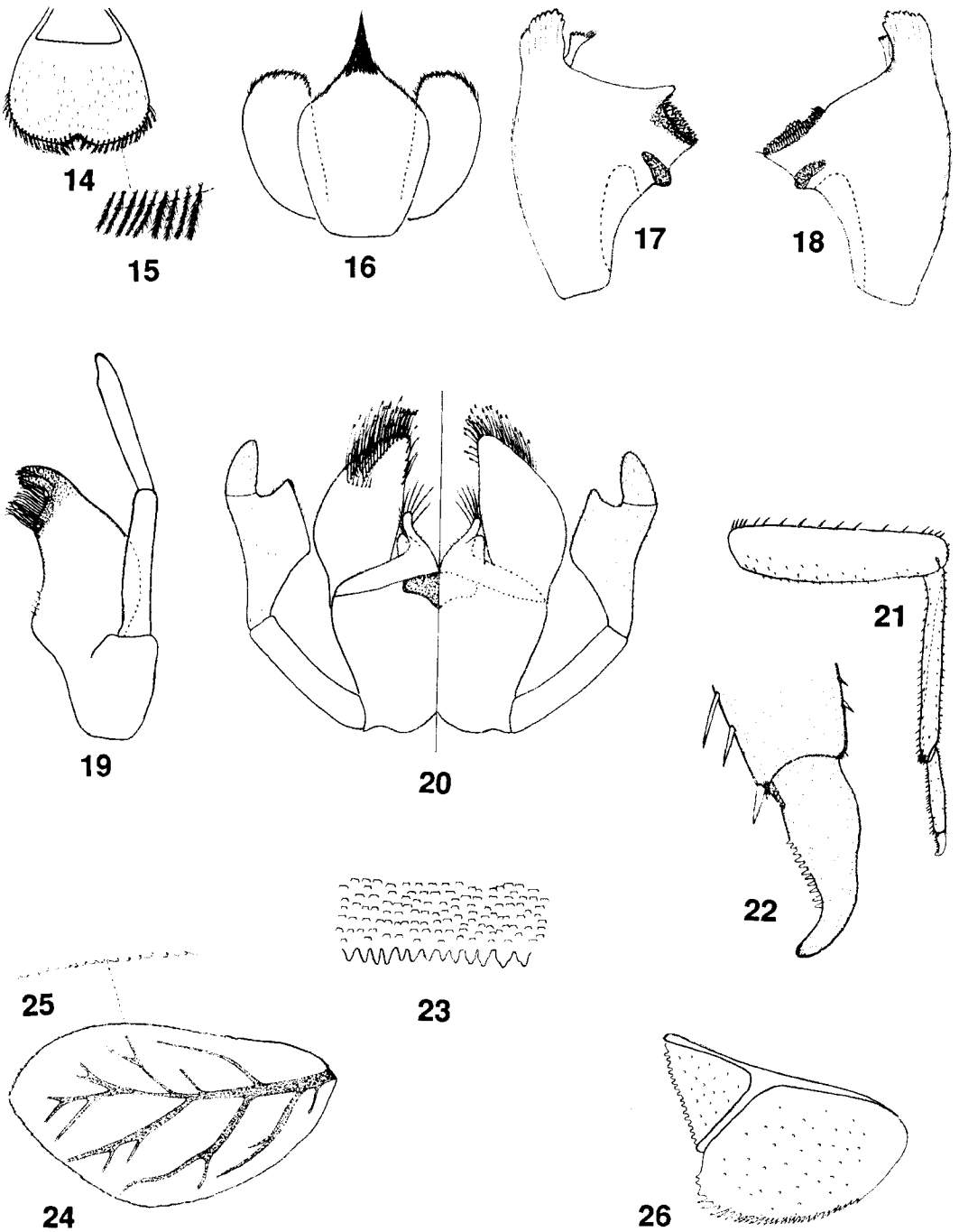
*Abdomen.* Coloration pale to medium-yellow-brown, with no consistent pattern. Terga 1, 4, 7, and 10 usually pale-yellow-brown, with no distinct pattern; others usually medium-yellow-brown, with two small cream submedial oblique dashes anteriorly and two small cream submedial dots in midregion. Length 2.0–2.3 times length of head and thorax combined. Tergal surfaces (Fig. 23) with abundant small scale bases; posterior margins with somewhat irregular spination. Sterna pale-yellow-brown. Gills (Fig. 24) on segments 1–7, well tracheated, with small serrations and short, fine, simple setae marginally (Fig. 25); middle gills 1.25–1.50 times length of corresponding segments. Paraprocts (Fig. 26) with numerous marginal spines increasing in length distally, and with scale bases scattered over surface. Caudal filaments pale-yellow to cream, with broad pale-brown median band; terminal filament nearly 0.5 times length of cerci.

*Adult.* Unknown.

*Etymology.* The specific epithet from Latin, is a reference to the extraordinary morphology.

*Distribution.* Madagascar.

*Remarks.* *Labiobaetis fabulosus* is distinguished by the presence of a distolateral notch on the antennal



**Figs 14–26.** *Labiobaetis fabulosus*, larva. 14, labrum; 15, labral setae; 16, hypopharynx; 17, left mandible; 18, right mandible; 19, left maxilla; 20, labium (left = ventral; right = dorsal); 21, left foreleg; 22, tarsal claw; 23, tergum 4 (detail); 24, gill 4; 25, gill margin (detail); 26, paraproct.

scapes (similar to Fig. 1); lack of dorsal submedial pair of setae and presence of a long submarginal row of branched setae on both sides of the labrum dorsally (Fig. 14); a hypopharynx with an antero-medial tuft of long, robust, simple setae coalesced into a long projection (Fig. 16); somewhat fanlike mandibular incisors (Figs 17, 18); shortened glossae with a dorsal hump, broad paraglossae and a cleaver-shaped labial palp segment 2 (Fig. 20); presence of hind wing pads and absence of villopore; relatively long abdomen; and numerous marginal spines on the paraprocts (Fig. 26).

Demoulin (1968) described this species as *Baetis* sp. based on three immature larvae collected from the Manatanana River in Fianarantsoa Province, Madagascar. The immature specimens we examined match Demoulin's (1968) description and figures, and we assign his material to *L. fabulosus*.

*Type material examined.* Holotype: larva, MADAGASCAR: *Antananarivo* (= *Tananarive*) Province, Amboromptsy R., nr Sambaina, 3.xi.1971, G.F., C.H. Edmunds & F. Emmanuel (PERC). Paratypes (all Madagascar): 2 larvae, same data and deposition as holotype; *Fianarantsoa* Province, 2 larvae, Namarona R., at Ranomafana, 22 °C, 5.xi.1971, G.F., C.H. Edmunds & F. Emmanuel; *Toamasina* (= *Tamatave*) Province, 3 larvae, Anekova R., 15 km E of Perinet (= Andasibe), 16 °C, 11.x.1971, G.F., C.H. Edmunds & F. Emmanuel (PERC) (antenna, mouthparts, forelegs, tergum 4, and paraproct of one larva mounted on slide (medium: Euparal)); 5 larvae, Perinet (= Andasibe), 18 °C, 12.x.1971, G.F., C.H. Edmunds & F. Emmanuel (2 larvae in PERC, 3 larvae in USNM); 4 larvae, Ifasina R., at Bedary R. N. 2, 46 km W of Brickaville, 15.x.1971, G.F., C.H. Edmunds & F. Emmanuel (PERC).

*Additional material examined.* MADAGASCAR: *Antananarivo* (= *Tananarive*) Province, 5 larvae, stream at Mandraka, 18.6 °C, 19.x.1971, G.F., C.H. Edmunds & F. Emmanuel (PERC); 4 larvae, Amboromptsy R., nr Sambaina, 3.xi.1971, G.F., C.H. Edmunds & F. Emmanuel (PERC); *Fianarantsoa* Province, 15 larvae, Namarona R., at Ranomafana, 22 °C, 5.xi.1971, G. F., C. H. Edmunds & F. Emmanuel (PERC); 5 larvae, Tsaratango R., 23 °C, 9 km E of Ranomafana, 6.xi.1971, G.F., C.H. Edmunds & F. Emmanuel (PERC); 3 larvae, Nosy Bé, Djabalar R., 11 km NW of Hell-Ville, 25.x.1971, G.F., C.H. Edmunds & F. Emmanuel (PERC); *Toamasina* (= *Tamatave*) Province, 13 larvae, Anekova R., 15 km E of Perinet (= Andasibe), 16 °C, 11.x.1971, G.F., C.H. Edmunds & F. Emmanuel

(PERC); 5 larvae, Perinet (= Andasibe), 18 °C, 12.x.1971, G.F., C.H. Edmunds & F. Emmanuel (PERC); 15 larvae, Amboasary R., Perinet (= Andasibe), 18 °C, 12.x.1971, G.F., C.H. Edmunds & F. Emmanuel (PERC) (antenna, mouthparts, forelegs, and paraproct of one larva mounted on slide (medium: Euparal)); 8 larvae, Ifasina R., at Bedary R. N. 2, 46 km W of Brickaville, 15.x.1971, G.F., C.H. Edmunds & F. Emmanuel (PERC); 5 larvae, stream at Gri-Gri, 23 °C, R. N. 2, 17.x.1971, G.F., C.H. Edmunds & F. Emmanuel (PERC).

***Labioaetis gambiae* (Gillies) comb. n.**

*Baetis gambiae* Gillies, 1993: 218.

*Distribution.* Gambia.

*Remarks.* Gillies (1993) described this species from larvae and male and females adults. Larvae are distinguished by the labium having a small, thumblike process on segment 2 and an enlarged segment 3 (Gillies 1993: Fig. 34), absence of hind wing pads, and relatively poorly-tracheated gills (Gillies 1993: Fig. 36). Male adults are distinguished by the absence of hind wings and a relatively long and slender segment 2 of the genital forceps (Gillies 1993: Fig. 29).

***Labioaetis insolitus* (Kopelke) comb. n.**

*Baetis insolitus* Kopelke, 1980: 107.

*Distribution.* Democratic Republic of the Congo.

*Remarks.* Kopelke (1980) described *L. insolitus* from male and female adults. The species is most similar to *L. boussoutilius*, but differs in the relatively broad and short hind wings (Kopelke 1980: Fig. 11b) and genital forceps with segment 2 subbasally bulbous and segment 3 somewhat more ovoid (Kopelke 1980: Fig. 10).

***Labioaetis kalengoensis* (Kopelke) comb. n.**

*Baetis kalengoensis* Kopelke, 1980: 101.

*Distribution.* Democratic Republic of the Congo.

*Remarks.* Kopelke (1980) described *L. kalengoensis* from male and female adults. Male adults are most similar to those of *L. mtonis* (Gillies) but differ in segment 3 of the genital forceps being well demarcated (Kopelke 1980: Fig. 1). Gillies (1994) indicated that male adults of *L. kalengoensis* lacked a subapical ventral spur on the paraprocts, but our analysis of Kopelke's figure of the genital area (Kopelke 1980: Fig. 1) revealed that it has the

paraproctal spur, and that it is somewhat larger than that of *L. mtonis*. The differences between the male adults of this species and *L. mtonis* appear to be minor, and *L. mtonis* eventually may prove to be a junior synonym of *L. kalengoensis* once the larval stage of the latter is known.

### ***Labiobaetis masai* sp. n., Figs 27–38**

#### **Description**

*Larva.* Lengths. Body: 6.7 mm; caudal filaments: 3.7 mm.

*Head.* Coloration generally medium-brown to pale-yellow-brown, with cream areas on frons and surrounding compound eyes. Antennae nearly 2.5 times length of head capsule; scapes not modified at distolateral margin. Labrum (Fig. 27) broadly rounded anteriorly, dorsally with 8–10 branched setae submarginally on each side of midline; dorsal submedial pair of setae absent. Hypopharynx as in Fig. 28. Left mandible (Fig. 29) with 3 + 3 denticles; prosthema robust, apically denticulate; triangular process at base of mola elongate. Right mandible (Fig. 30) with 3 + 3 denticles; prosthema robust, apically denticulate; small tuft of short, fine, simple setae at base of mola. Maxillae (Fig. 31) with four denticles on apex of galealaciniae and 3–4 simple setae submarginally near medial hump; medial hump without short, stout, simple seta; palp segment 1 somewhat longer than segment 2; palp segment 2 with pronounced distomedial concavity. Labium (Fig. 32) with many long, simple setae medially on glossae and three rows of distally pectinate setae apically on paraglossae; palp segment 1 slender, subequal to segments 2 and 3 combined; segment 2 with thumblike medial process, abundant short, fine, simple setae scattered over surface, and 3–4 long, fine, simple setae dorsally; palp segment 3 somewhat elongate and apically pointed, with numerous short, fine, simple setae scattered over surface.

*Thorax.* Coloration pale-yellow-brown, with pair of submedial crescent-like medium-brown markings on pronotum and various markings on meso- and metanota. Hind wing pads present. Legs (Fig. 33) yellow-brown; femora with conspicuous villopore, 16–18 long, apically-pointed, simple setae dorsally and scattered, short, stout, simple setae ventrally; tibiae with abundant short, stout, simple setae dorsally and scattered, short, stout, simple setae ventrally; tarsi with scattered, short, stout, simple setae dorsally and

scattered, short, stout, simple setae and three or four robust, subapical setae of increasing length ventrally; tarsal claws (Fig. 34) with 11–12 sharp denticles, increasing in length distally.

*Abdomen.* Coloration pale-yellow-brown to cream. Tergum 1 pale-yellow-brown; terga 2–5 pale-yellow-brown, with anterior irregular cream markings and submedial pair of cream dots in middle region; terga 6–7 cream, medially and laterally medium-brown; tergum 8 medium-brown, with pair of large sublateral posterior cream markings; tergum 9 cream, anteriorly medium-brown; tergum 10 cream, posteriorly medium-brown. Tergal surfaces (Fig. 35) with abundant scale bases; posterior margins with irregular triangular spination and randomly distributed short, fine, simple setae. Sterna pale-yellow-brown to cream. Gills (Fig. 36) on segments 1–7, relatively poorly tracheated, with small serrations and short, fine, simple setae marginally (Fig. 37); middle gills 1.25–1.50 times length of corresponding segments. Paraprocts (Fig. 38) with 8–10 marginal spines, increasing slightly in length distally, and with scattered, short, fine, simple setae over surface. Caudal filaments pale-yellow to cream, unbanded; terminal filament nearly 0.68 times length of cerci.

*Adult.* Unknown.

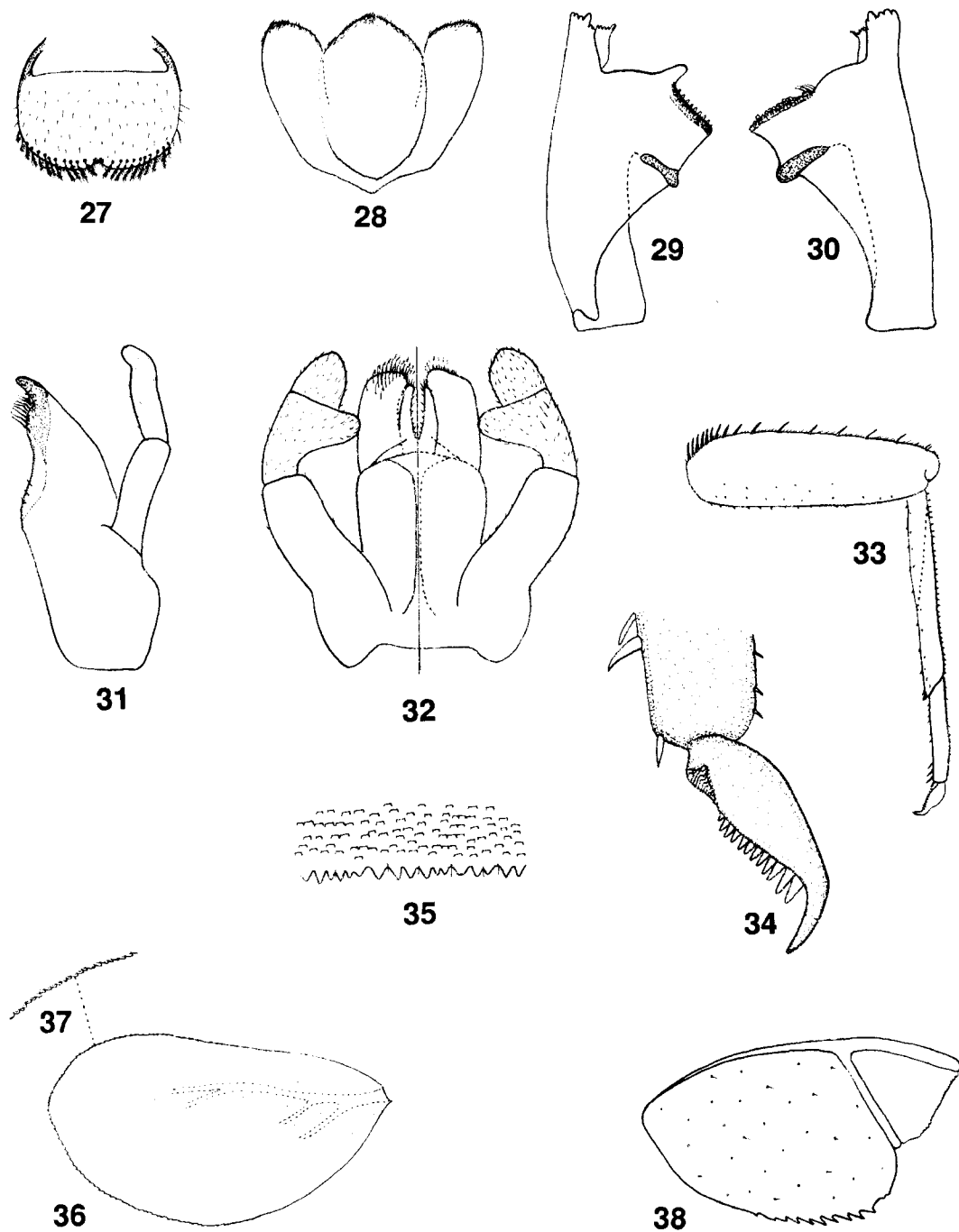
*Etymology.* The specific epithet is derived from the Masai people of East Africa, and is a noun in apposition.

*Distribution.* Kenya.

*Remarks.* *Labiobaetis masai* is most similar to *L. nadineae*, described below. Larvae differ from that species in lacking vermiform markings on the frons and in the unmodified antennal scapes, a more setose labrum (Fig. 27), slightly longer mandibular incisors with a peculiar arrangement of denticles (Figs 29, 30), maxillary palps with a longer segment 1 and a more pronounced distomedial concavity on segment 2 (Fig. 31), more setose labial palps (Fig. 32), distinctive setation of the legs (Fig. 33), distinctive thoracic and abdominal coloration, more irregular spination on the posterior margin of the terga (Fig. 35), relatively poor gill tracheation (Fig. 36), and more setose paraprocts (Fig. 38).

*Type material examined.* Holotype: larva, KENYA: Saburu Game Reserve, Ewaso Ng'iro R., at Samburu Lodge, 20.xi.1971, G.F. & C.H. Edmunds (PERC) (mouthparts, forelegs, tergum 4, and paraproct mounted on slide (medium: Euparal)).





**Figs 27–38.** *Labiobaetis masai*, larva. 27, labrum; 28, hypopharynx; 29, left mandible; 30, right mandible; 31, left maxilla; 32, labium (left = ventral; right = dorsal); 33, left foreleg; 34, tarsal claw; 35, tergum 4 (detail); 36, gill 4; 37, gill margin (detail); 38, paraproct.

***Labiobaetis mtonis* (Gillies) comb. n.***Baetis mtonis* Gillies, 1994: 105.*Distribution.* Tanzania.

*Remarks.* Gillies (1994) described *L. mtonis* from larvae and male adults. Larvae are distinguished from other Afrotropical species of *Labiobaetis* by the fanlike mandibular incisors (Gillies 1994: Figs 5, 6); a pronounced distomedial concavity on maxillary palp segment 2 (Gillies 1994: Fig. 9); a large, subquadrangular distomedial process on labial palp segment 2 (Gillies 1994: Fig. 7); somewhat slender glossae nearly 0.80 times length of paraglossae (Gillies 1994: Fig. 7); and the presence of hind wing pads. Adults are distinguished by the hind wings lacking a costal process (Gillies 1994: Figs 1, 2), a partially fused, small segment 3 of the genital forceps (Gillies 1994: Fig. 3), and the presence of a subapical ventral spur on the paraprocts (Gillies 1994: Fig. 3). It is possible that this species is a junior synonym of *L. kalengoensis*.

***Labiobaetis nadineae* sp. n., Figs 39–50***Description*

*Larva.* Lengths. Body: 4.5–7.5 mm; caudal filaments: 2.5–4.5 mm.

*Head.* Coloration generally medium-brown, with cream areas on frons and around compound eyes and vermiform cream to pale-yellow-brown markings on vertex. Antennae 2.2–2.5 times length of head capsule; scapes (Fig. 39) slightly chamfered at distolateral margin, without notch. Labrum (Fig. 40) broadly rounded anteriorly, dorsally with 8–10 branched setae submarginally on each side of midline; dorsal submedial pair of setae absent. Hypopharynx as in Fig. 41. Left mandible (Fig. 42) with 4 + 3 denticles; prostheca robust, apically denticulate; triangular process at base of mola elongate. Right mandible (Fig. 43) with 3 + 3 denticles; prostheca robust, apically denticulate; small tuft of short, fine, simple setae at base of mola. Maxillae (Fig. 44) with four denticles on apex of galealaciniae and 4–5 simple setae submarginally near medial hump; medial hump with short, stout, simple seta; palp segment 1 slightly longer than segment 2; palp segment 2 with slight distomedial concavity. Labium (Fig. 45) with many long, simple setae medially on glossae and three rows of distally pectinate setae apically on paraglossae; palp segment 1 slender, subequal to

segments 2 and 3 combined; segment 2 with thumb-like distomedial process and 4–5 long, simple setae dorsally; palp segment 3 somewhat elongate and apically pointed, with numerous short, fine, simple setae scattered over surface.

*Thorax.* Coloration medium-brown, with complex and variable patterns. Hind wing pads present. Legs (Fig. 46) yellow-brown; femora with conspicuous villopore, 14–16 long, relatively robust, apically pointed, simple setae dorsally, and scattered, short, stout, simple setae ventrally, and large medium-brown anterior mark; tibiae with scattered, short, stout, simple setae and tufts of short, fine, simple setae dorsally and numerous short, stout, simple setae ventrally; tarsi with scattered, short, stout, simple setae dorsally and 8–9 apically-pointed setae of increasing length ventrally; tarsal claws (Fig. 47) with 11–12 sharp denticles, increasing slightly in length distally.

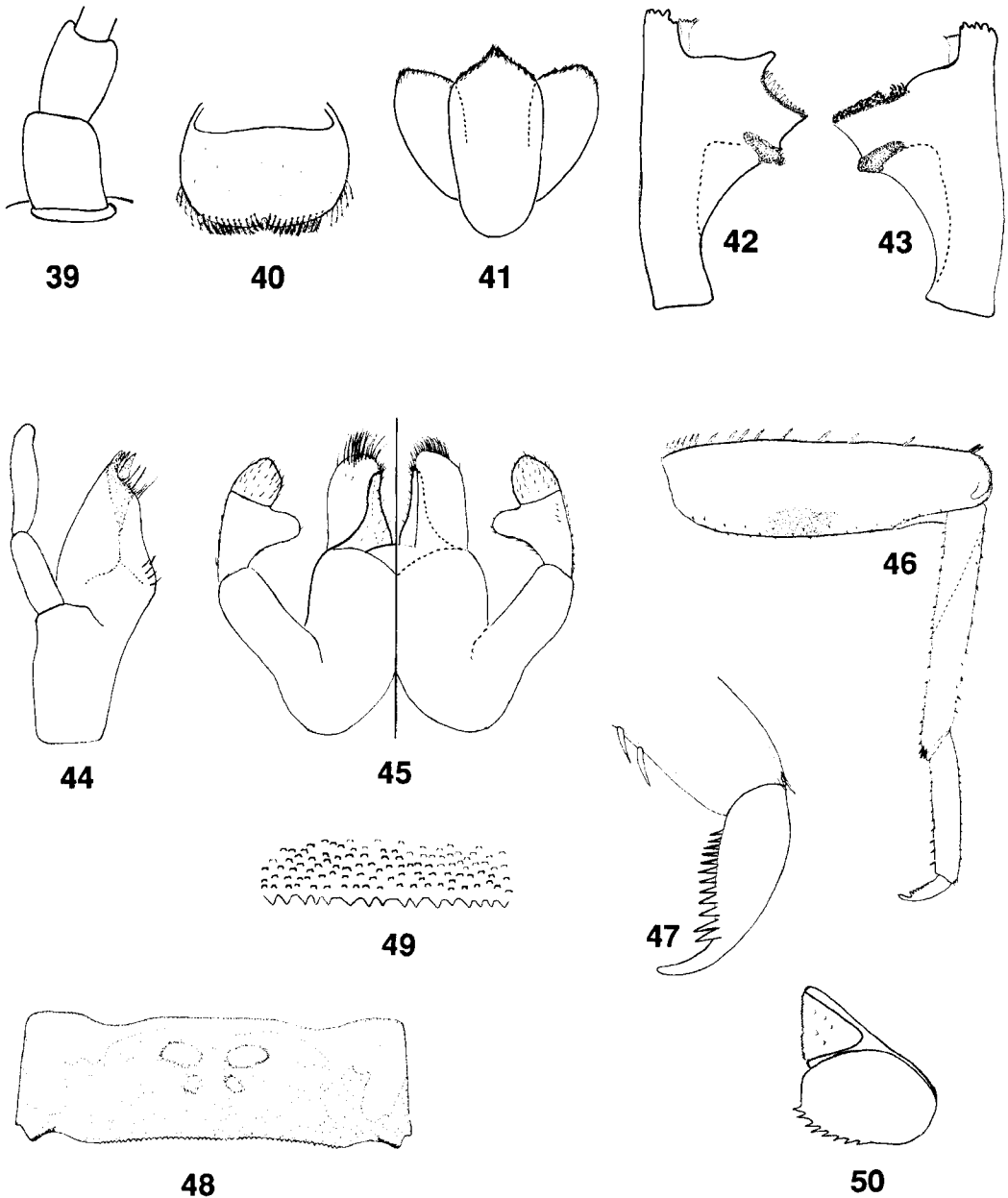
*Abdomen.* Coloration generally medium to dark-brown, with pair of submedial crescent-like cream markings on pronotum and various markings on meso- and metanota. Tergum 1 medium-brown; terga 2–5 and 7–9 medium-brown, generally with two pairs of submedial cream to yellow-brown dots (anterior pair usually larger than posterior pair), cream to yellow-brown anteriorly and laterally (Fig. 48); tergum 6 cream to yellow-brown, anteriorly medium-brown; tergum 9 posteriorly cream to yellow-brown; tergum 10 anteriorly cream to yellow-brown, posteriorly medium-brown. Tergal surfaces (Fig. 49) with abundant scale bases and scattered, short, fine, simple setae over surface; posterior margins with irregular triangular spination. Sterna yellow-brown to cream. Gills (similar to Fig. 11) on segments 1–7, well tracheated, with small serrations and short, fine, simple setae marginally (similar to Fig. 12); middle gills 1.25–1.50 times length of corresponding segments. Paraprocts (Fig. 50) with 5–6 marginal spines increasing slightly in length distally, and with surface bare. Caudal filaments pale-yellow to cream, unbanded; terminal filament 0.75–0.80 times length of cerci.

*Adult.* Unknown.

*Etymology.* This species is named for Nadine McCafferty, who helped in collecting the many samples noted below.

*Distribution.* South Africa.

*Remarks.* Larvae of *L. nadineae* are most similar to *L. masai*, but are distinguished by the presence of vermiform markings on the frons, slightly laterally



**Figs 39–50.** *Labiobaetis nadineae*, larva. 39, scapes; 40, labrum; 41, hypopharynx; 42, left mandible; 43, right mandible; 44, right maxilla; 45, labium (left = ventral; right = dorsal); 46, left foreleg; 47, tarsal claw; 48, tergum 4 (color pattern); 49, tergum 4 (detail); 50, paraproct.

chamfered antennal scapes (Fig. 39), less setose labrum (Fig. 40), slightly shorter mandibular incisors and distinctive arrangement of the mandibular denticles (Figs 42, 43), maxillary palps

with a shorter segment 1 and a slight distomedial concavity on segment 2 (Fig. 44), less setose labial palps (Fig. 45), distinctive setation of the legs (Fig. 46), distinctive thoracic and abdominal colour

pattern (Fig. 48), more regular spination on the posterior margin of the terga (Fig. 49), well-tracheated gills (similar to Fig. 11), and bare paraprocts (Fig. 50).

*Type material examined.* Holotype: larva, SOUTH AFRICA: Mpumalanga, Kruger Ntl. Park, Sabie R. at Molondozi, 25.09S 32.00E, 23.x.1990, W.P. & N. McCafferty (PERC). Paratypes: 11 larvae, same data as holotype (3 larvae in AMGS, 8 larvae in PERC (antenna, mouthparts, forelegs, tergum 3, and paraproct of one larva mounted on slide (medium: Euparal)); 5 larvae, Free State Province, Wilge R., Rt 714 between Warden and Bethlehem, 16.x.1990, W.P. & N. McCafferty (PERC).

*Additional material examined.* SOUTH AFRICA: 76 larvae, 3 exuviae, same data and deposition as holotype (antenna, mouthparts, forelegs, tergum 4, and paraproct of one larva mounted on slide (medium: Euparal)); Eastern Cape Province, 4 larvae, Great Fish R., just N of Karoo Sulphur Springs, nr Cradock, 10.xi.1990, W.P. & N. McCafferty (PERC); Free State Province, 8 larvae, Wilge R., Rt 714 between Warden and Bethlehem, 16.x.1990, W.P. & N. McCafferty (PERC); 2 larvae, Umgeni R. above Nagel Dam impoundment, 29.34S 30.36E, 21.ix.1990, W.P. & N. McCafferty (mouthparts, forelegs, tergum 4, and paraproct of one larva on slide (medium: Euparal)) (PERC); KwaZulu-Natal, larva, Umlaas R., at Durban waterworks filtration plant, nr Pinetown, 22.3 °C, 7.x.1971, G.F. & C.H. Edmunds (PERC); Mpumalanga, 5 larvae, tributary of Sand R. nr Thulamahashi (Gazankulu), 29.43S 31.13E, 19.x.1990, W.P. & N. McCafferty (PERC); 2 larvae, Kruger Ntl. Park, Sabie R. below measuring wall, 9 km N of Skukuza, 24.57S 31.34E, 24.x.1990, W.P. & N. McCafferty (PERC); larva, Kruger Ntl. Park, Olifants R. at bridge on dirt road, nr Olifants Camp, 24.03S 31.44E, 29.x.1990, W.P. & N. McCafferty (PERC).

### ***Labioaetis piscis* sp. n., Figs 51–62**

#### **Description**

*Larva.* Lengths. Body: 6.8–7.2 mm; caudal filaments: 4.8–5.2 mm.

*Head.* Coloration pale-yellow-brown to cream, with no distinct pattern. Antennae nearly 2.5 times length of head capsule; scapes not modified at distolateral margin. Labrum (Fig. 51) broadly rounded anteriorly, dorsally with 14–16 branched setae submarginally on each side of midline (similar to Fig. 15); dorsal submedial pair of setae

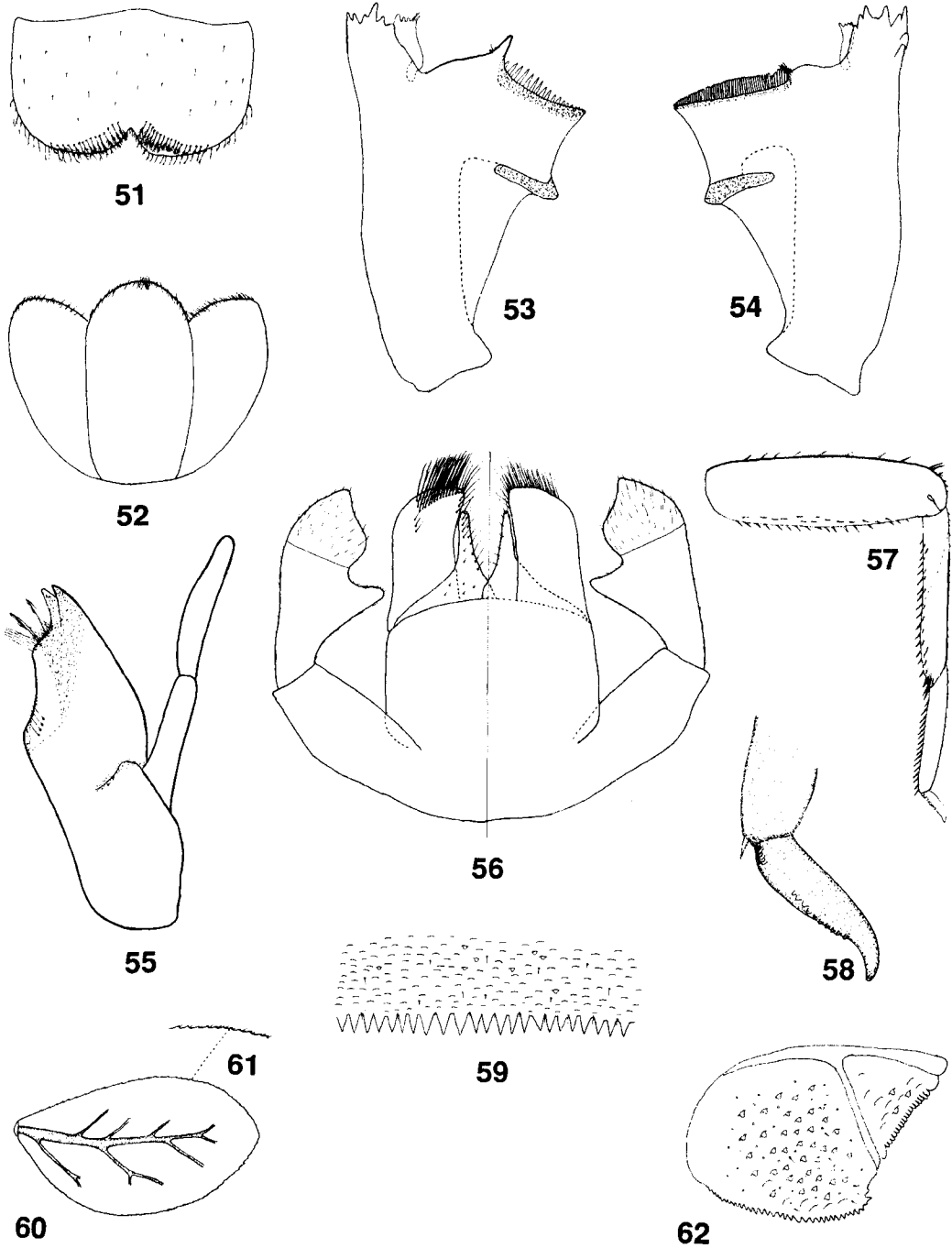
absent. Hypopharynx as in Fig. 52. Left mandible (Fig. 53) incisors with 2 + 4 denticles; prostheca robust, apically denticulate; triangular process at base of mola slender and slightly elongate. Right mandible incisors with 4 + 5 denticles (Fig. 54); prostheca somewhat slender, apically denticulate; small tuft of short, simple setae at base of mola. Maxillae (Fig. 55) with four denticles on apex of galealaciniae and 4–5 setae submarginally near medial hump; palps segments 1 and 2 subequal, extending beyond galealaciniae; palp segment 2 with slight distomedial concavity. Labium (Fig. 56) with long, robust, simple setae medially on glossae and three rows of pectinate setae apically on paraglossae; palp segment 1 slender, subequal to segments 2 and 3 combined; palp segment 2 with somewhat slender distomedial process and 4–5 long, fine, simple setae dorsally; palp segment 3 apically acute and slightly distomedially concave, with numerous long, fine, simple setae scattered over surface.

*Thorax.* Coloration pale-yellow-brown to cream, with no distinct pattern. Hind wing pads present. Legs (Fig. 57) pale-yellow-brown to cream; femora without villopore, and with 7–9 apically-pointed, simple setae dorsally, and numerous apically-pointed simple setae ventrally; tibiae with numerous fine, simple setae dorsally, and apically-pointed simple setae of various lengths ventrally; tarsi with numerous fine, simple setae dorsally and 14–16 apically-pointed setae of increasing length distally; tarsal claws (Fig. 58) with 9–10 sharp denticles, increasing in length distally.

*Abdomen.* Coloration pale-yellow-brown to cream, with no distinct pattern. Tergal surfaces (Fig. 59) with abundant scales and scale bases, and short, fine, simple setae scattered over surface; posterior margins with sharp triangular spination. Sterna cream. Gills (Fig. 60) on segments 1–7, well tracheated, with small serrations and short, fine, simple setae marginally (Fig. 61); middle gills 1.25–1.50 times length of corresponding segments. Paraprocts (Fig. 62) with 35–40 small marginal spines, and with numerous scales and fine, simple setae scattered over surface. Caudal filaments pale-yellow-brown to cream; terminal filament nearly 0.60 times length of cerci.

*Adult.* Unknown.

*Etymology.* The specific epithet is a Greek noun in apposition meaning fish. It is an allusion to the type locality, the Great Fish River in the Eastern Cape Province of South Africa.



**Figs 51–62.** *Labiobaetis piscis*, larva. 51, labrum; 52, hypopharynx; 53, left mandible; 54, right mandible; 55, left maxilla; 56, labium (left = ventral; right = dorsal); 57, left foreleg; 58, tarsal claw; 59, tergum 4 (detail); 60, gill 4; 61, gill margin (detail); 62, paraproct.

*Distribution.* South Africa.

*Remarks.* *Labiobaetis piscis* is most similar to *C. gambiae*. It differs from that species in having the labium with palp segment 2 with a somewhat slender and acute distomedial process and palp segment 3 with a slight distomedial concavity (Fig. 56), the presence of hind wing pads, well-tracheated gills (Fig. 60), and numerous small marginal spines on the paraprocts (Fig. 62).

*Type material examined* Holotype: larva, SOUTH AFRICA: Eastern Cape Province, Great Fish R., just N of Karoo Sulphur Springs, nr Cradock, 10.xi.1990, W.P. & N. McCafferty (PERC). Paratypes: 7 larvae, same data as holotype (2 larvae in AMGS, 5 larvae in PERC); KwaZulu-Natal, 6 larvae, Umlaas R. at Durban waterworks filtration plant, 22.3 °C, 4.x.1971, G.F. & C.H. Edmunds (PERC); 2 larvae, Molweni R. at Krantzkloof Nature Reserve, nr Durban, 21.ix.1990, W.P., N. McCafferty & B. Fowles (PERC); Mpumalanga, exuvia, Kruger Ntl. Park, Sabie R. at Molondozi, 23.x.1990, W.P. & N. McCafferty (PERC); larva, Kruger Ntl. Park, Olifants R. at bridge road nr Olifants Camp, 24.03S 31.44E, 29.x.1990, W.P. & N. McCafferty (PERC) (antenna, mouthparts, forelegs, segment 4, and paraproct on slide (medium: Euparal)).

*Additional material examined.* SOUTH AFRICA: 38 larvae, same data and deposition as holotype (tergum 4 on slide (medium: Euparal)); KwaZulu-Natal, larva, Sani Pass road at police post, 1950 m, 16.4 °C, 29.36S 29.21E, 1.x.1971, G.F. & C.H. Edmunds (PERC); 3 larvae, Albert Falls, Umgeni R., 29.26S 30.26E, no date, G.F., C.H. Edmunds & F.M. Chutter (PERC); 5 larvae, Umlaas R. between Camperdown and Eston, 21.5 °C, 3.x.1971, G.F. & C.H. Edmunds (PERC); 73 larvae, Umlaas R. at Durban waterworks filtration plant nr Pinetown, 22.3 °C, 4.x.1971, G.F. & C.H. Edmunds (PERC); 2 larvae, Molweni R. at Krantzkloof Nature Reserve, nr Durban, 21.ix.1990, W.P., N. McCafferty & B. Fowles (PERC); 13 larvae, Umgeni R. just above Nagel Dam impoundment, 29.34S 30.36E, 21.ix.1990, W.P., N. McCafferty & B. Fowles (PERC); Mpumalanga, 4 larvae, Buffelspruit at Shalom (Aalwan), 4 km W of Badplaas, 1167 m, 17.x.1990, W.P. & N. McCafferty (PERC); 36 larvae, Sabie-Sand Game Reserve, Sand R. at Londoloz, 20.x.1990, W.P. & N. McCafferty (PERC); 3 larvae, Kruger Ntl. Park, Sabie R. at Molondozi, 23.x.1990, W.P. & N. McCafferty (PERC); 3 larvae, Long Tom State Forest, upper Sabie R., 26.x.1990, W.P. & N. McCafferty (PERC); 16 larvae, Kruger Ntl. Park,

Olifants R. at bridge on dirt road, nr Olifants Camp, 24.03S 31.44E, 29.x.1990, W.P. & N. McCafferty (PERC).

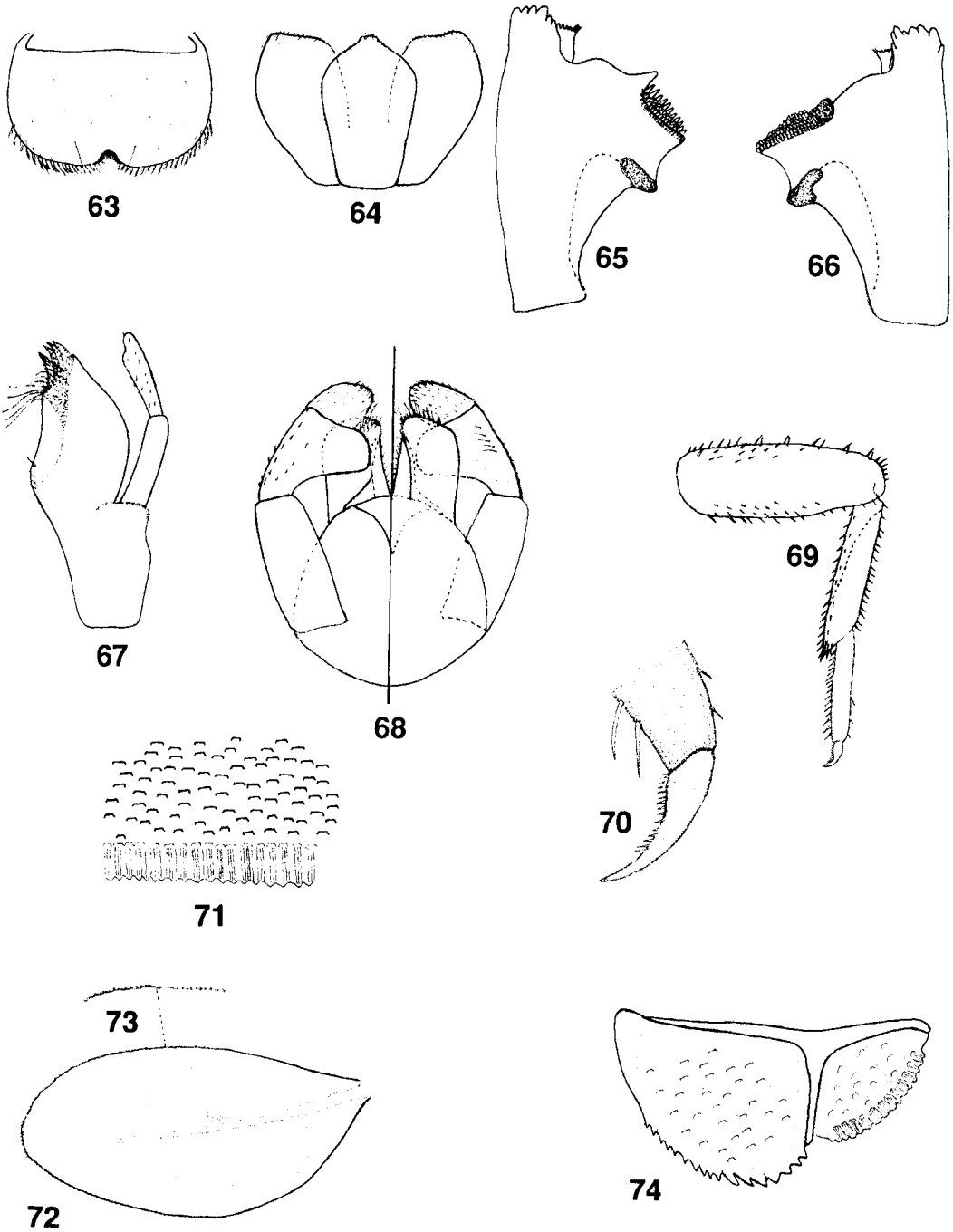
### ***Labiobaetis plumbago* sp. n., Figs 63–74**

#### *Description*

*Larva. Lengths.* Body: 5.6–5.7 mm; caudal filaments: 2.9–3.1 mm.

*Head.* Coloration yellow-brown, with no distinct pattern. Antennae 2.5 times length of head capsule; scapes (similar to Fig. 39) slightly chamfered distolaterally, without notch, and with scattered, short, fine, simple setae. Labrum (Fig. 63) broadly rounded anteriorly, dorsally with 16–18 branched setae (similar to Fig. 15) marginally on each side of midline; dorsal submedial pair of long, fine, simple setae present. Hypopharynx as in Fig. 64. Left mandible (Fig. 65) incisors with 3 + 3 denticles; prosthema robust, apically denticulate; broad hump between prosthema and mola; triangular process at base of mola somewhat short. Right mandible (Fig. 66) incisors with 4 + 4 denticles; prosthema robust, apically denticulate; small tuft of short, fine, simple setae at base of mola. Maxillae (Fig. 67) with four sharp denticles on apex of galealaciniae and 3–4 short, fine, simple setae submarginally near median hump; medial hump with short, stout, simple seta; palp segments 1 and 2 reaching galealaciniae; palp segment 1 slightly longer than segment 2; palp segment 2 with pronounced distomedial concavity and short, fine, simple setae scattered over surface. Labium (Fig. 68) with many long, robust, simple, setae medially on glossae and three rows of pectinate setae apically on paraglossae; palp segment 1 slender, as long as segments 2 and 3 combined; palp segment 2 anteriorly convex, with broad distomedial process and 4–5 long, fine, simple setae dorsally; palp segment 3 somewhat elongate, with numerous short, fine, simple setae scattered over surface.

*Thorax.* Coloration yellow-brown, with no distinct pattern. Hind wing pads absent. Legs (Fig. 69) yellow-brown; femora without villopore, 14–16 sharp, simple setae dorsally and scattered, short, apically pointed, simple setae ventrally and anteriorly; tibiae with 16–18 short, apically pointed, simple setae ventrally, increasing in length distally, and 18–20 short, apically-pointed, simple setae dorsally; tarsi with 15–17 short,



**Figs 63–74.** *Labiobaetis plumbago*, larva. **63**, labrum; **64**, hypopharynx; **65**, left mandible; **66**, right mandible; **67**, left maxilla; **68**, labium (left = ventral; right = dorsal); **69**, left foreleg; **70**, tarsal claw; **71**, tergum 4 (detail); **72**, gill 4; **73**, gill margin (detail); **74**, paraproct.

apically-pointed, simple setae, somewhat increasing in length distally, and scattered, short, apically pointed, simple setae dorsally; tarsal claws (Fig. 70) with 15–17 sharp, slender denticles, increasing in length distally.

*Abdomen.* Coloration yellow-brown, with no distinct pattern. Tergal surfaces (Fig. 71) with abundant scale bases; posterior margins with elongate furrows and small, blunt, subtriangular spination. Sterna pale-yellow-brown. Gills (Fig. 72) on abdominal segments 2–7, poorly tracheated, with small serrations and short, fine, simple setae marginally (Fig. 73); middle gills 1.25–1.50 times length of corresponding segments. Paraprocts (Fig. 74) with 14–16 marginal spines increasing in length distally, and with scale bases scattered over surface. Caudal filaments pale-yellow to cream, with broad brown medial band; terminal filament nearly 0.75 times length of cerci.

*Adult.* Unknown.

*Etymology.* The specific epithet, a noun in apposition, is the Latin word for graphite. Madagascar is one of the main sources of graphite in the world.

*Distribution.* Madagascar.

*Remarks.* *Labiobaetis plumbago* is distinguished by slightly distolaterally chamfered antennal scapes (similar to Fig. 39), a submedial pair of setae and a marginal row of branched setae dorsally on both sides of the labrum (Fig. 63), a slightly anteriorly convex segment 2 of the labial palps (Fig. 68), somewhat narrow-elongate tarsal claws (Fig. 70), terga with long grooves on the posterior margin (Fig. 71), and gills on abdominal segments 2–7.

*Type material examined.* Holotype: larva, MADAGASCAR: *Antananarivo* (= *Tananarive*) Province, Ankeniheny R., 4 km S of Manjakatempo Forest Stat., 28 °C, 1.xi.1971, G.F., C.H. Edmunds & F. Emmanuel (PERC). Paratype: larva, *Toamasina* (= *Tamatave*) Province, Amboasary R., Perinet (= Andasibe), 13.x.1971, G.F., C.H. Edmunds & F. Emmanuel (PERC) (mouthparts, forelegs, tergum 4, and paraproct mounted on slide (medium: Euparal)).

***Labiobaetis vinosus* (Barnard) comb. n., Figs 75–86**

*Pseudocloeon vinosum* Barnard, 1932: 220.

*Baetis vinosus* (Barnard): Gillies 1994: 117.

*Pseudocloeon minutum* Crass, 1947: 62.

*Baetis minutus* (Crass): Gillies 1994: 117.

**Redescription**

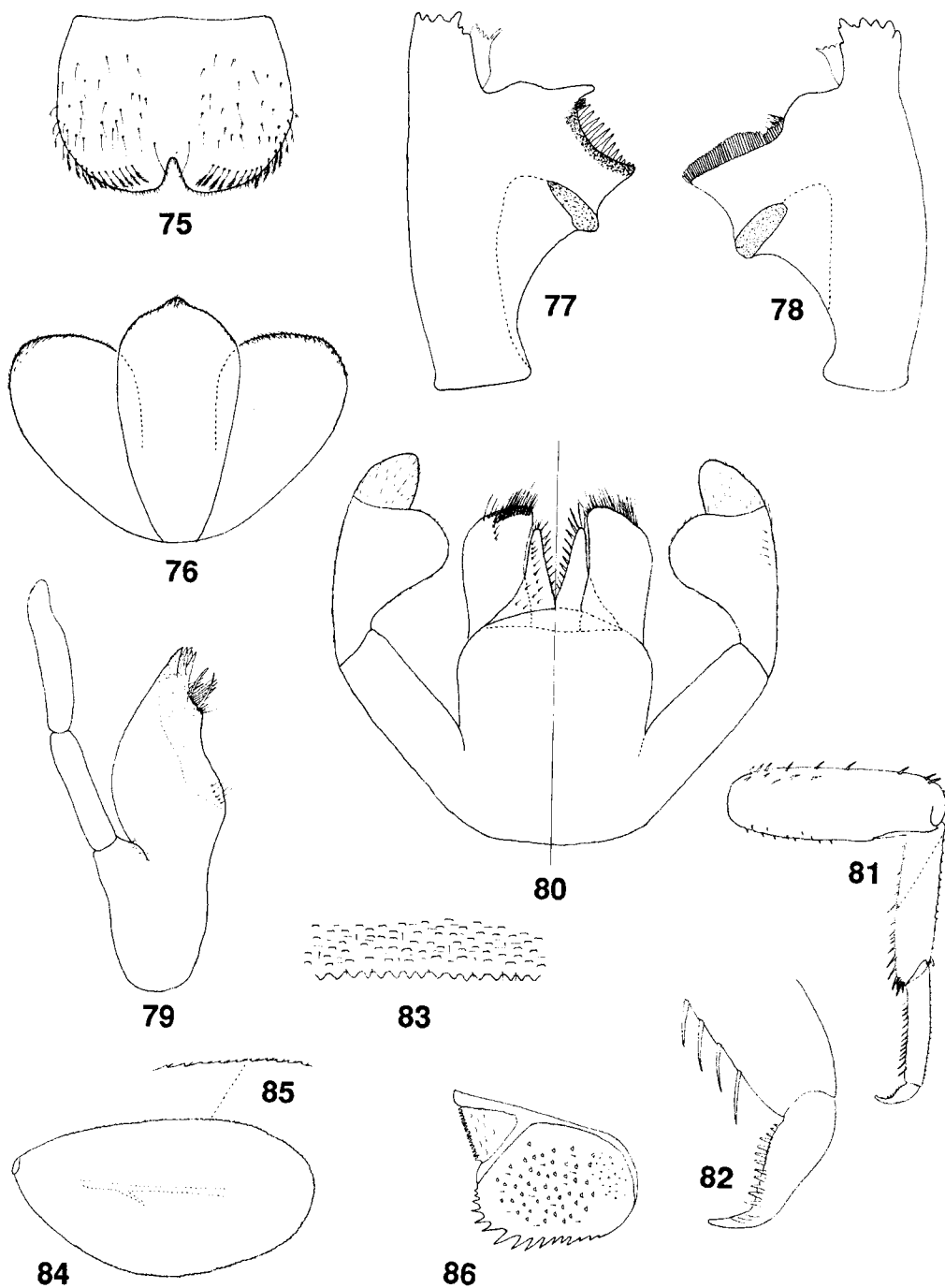
*Larva.* Lengths. Body: 4.8–5.1 mm; caudal filaments: 3.5–3.8 mm.

*Head.* Coloration yellow-brown, with no distinct pattern. Antennae 2.2–2.5 times length of head capsule; scapes slightly chamfered distolaterally (similar to Fig. 39), without notch. Labrum (Fig. 75) broadly rounded anteriorly, dorsally with 8–10 branched setae (similar to Fig. 15) on each side of midline and numerous long, fine, simple setae over entire surface; dorsal submedial pair of long, fine, simple setae present. Hypopharynx as in Fig. 76. Left mandible (Fig. 77) incisors with 3 + 3 denticles; prostheca robust, apically denticulate; broad hump between prostheca and mola. Right mandible (Fig. 78) incisors 4 + 1 + 3; prostheca robust, apically denticulate; broad hump between prostheca and mola; small tuft of relatively short, simple setae at base of mola. Maxillae (Fig. 79) with four denticles on apex of galealaciniae and 4–5 long, simple setae near medial hump; palp segments 1 and 2 subequal, extending beyond galealaciniae; palp segment 2 with pronounced distomedial concavity. Labium (Fig. 80) with many long, robust, simple setae medially on glossae and three rows of pectinate setae apically on paraglossae; palp segment 1 slender, subequal to segments 2 and 3 combined; palp segment 2 with broadly rounded distomedial process and 4–5 long, simple setae dorsally; palp segment 3 somewhat apically-pointed with numerous long, fine, simple setae over surface.

*Thorax.* Coloration yellow-brown, with no distinct pattern. Hind wing pads absent. Legs (Fig. 81) pale-yellow-brown; femora without villopore, and with 8–10 apically-pointed simple setae dorsally, scattered apically-pointed simple setae near dorsal margin, and scattered short, stout, simple setae ventrally; tibiae with numerous short, stout, simple setae dorsally and apically-pointed simple setae of various lengths ventrally; tarsi with numerous short, stout, simple setae dorsally and 13–15 apically-pointed setae of increasing length distally; tarsal claws (Fig. 82) with 9–10 sharp denticles, somewhat increasing in length distally.

*Abdomen.* Coloration yellow-brown to pale-yellow-brown, with no distinct pattern. Tergal surfaces (Fig. 83) with abundant scale bases, and with fine, simple setae scattered over surface; posterior margins with blunt triangular spination. Sterna pale-yellow-brown to cream. Gills (Fig. 84) on abdominal segments 2–7, poorly tracheated,





**Figs 75–86.** *Labiobaetis vinosus*, larva. **75**, labrum; **76**, hypopharynx; **77**, left mandible; **78**, right mandible; **79**, right maxilla; **80**, labium (left = ventral; right = dorsal); **81**, left foreleg; **82**, tarsal claw; **83**, tergum 4 (detail); **84**, gill 4; **85**, gill 4 (detail); **86**, paraproct.

with small serrations and short, fine, simple setae marginally (Fig. 85); middle gills 1.25–1.50 times length of corresponding segments. Paraprocts (Fig. 86) with 14–16 marginal spines and abundant scales, and with short, fine, simple setae scattered over surface. Caudal filaments pale-yellow-brown to cream, usually with broad pale-brown median band; terminal filament nearly 0.80 times length of cerci.

*Adult.* Adequately described by Barnard (1932) and Crass (1947).

*Distribution.* South Africa.

*Remarks.* Larvae of *L. vinosus* are distinguished from other Afrotropical species by the laterally chamfered antennal scapes (similar to Fig. 39); a pair of submedial setae and a relatively long submarginal row of branched setae on both sides of the labrum (Fig. 75); labial palp segment 2 with a broad, round distomedial process (Fig. 80); short, blunt spines on the posterior margin of the terga (Fig. 83); poorly-tracheated gills (Fig. 84); gills on abdominal segments 2–7; and few and relatively large marginal spines on the paraprocts (Fig. 86). Male adults are distinguished by the absence of hind wings and small genital forceps segment 3 (Crass 1947: Fig. 10g).

Demoulin (1970) synonymized *P. minutum* with *P. vinosum* without providing a reason. It is possible, however, that Demoulin (1970) based his synonymy on Agnew's (1961) citation of a letter from Crass in which he stated that *P. minutum* was a synonym of *P. vinosum*. In any case, the synonymy could be questioned if Barnard's (1932) and Crass's (1947) sketchy larval descriptions are strictly considered because they appear distinctive. Barnard (1932) indicated that the mouthparts of *P. vinosum* were generally similar to those of *Baetis bellus* Barnard and *Cheleocloeon excisum* (Barnard). He also interpreted the maxillary palps as being three-segmented, but did not comment on the denticulation of the tarsal claws. Crass (1947) indicated that the maxillary palps of *P. minutum* were two-segmented, but pointed out that the tarsal claws were edentate. Both Barnard (1932) and Crass (1947) indicated that their species only had gills on abdominal segments 2–7. In our extensive examination of material from South Africa, we have only seen one species of *Labiobaetis* with gills on abdominal segments 2–7, and we regard that species as being referable to *L. vinosus*. The inconsistencies in Barnard's (1932) and Crass's (1947) original descriptions are entirely explicable

if Barnard (1932) mistook the distomedial constriction on segment 2 of the maxillary palps for a segment, and Crass (1947) overlooked the tarsal claw denticles. A three-segmented maxillary palp is not found in this group of baetids, and claw denticles are generally narrow and somewhat translucent and easily overlooked. Although the original larval material could not be found, all other evidence suggests that the inadvertent mistakes indicated above were made by the original describers. We therefore concur with Demoulin's (1970) synonymy, noting that he must have drawn the same conclusions, and recombine the species in *Labiobaetis* based on the presence of a distomedial constriction on the maxillary palps.

*Material examined.* SOUTH AFRICA: *KwaZulu-Natal*, 32 larvae, Umzinkulu R., between Underberg and Boesmansnek, 15.5 °C, 2.x.1971, G.F. & C.H. Edmunds (PERC); larva, Umlaas R. at Durban waterworks filtration plant, nr Pinetown, 22.3 °C, 4.x.1971, G.F. & C.H. Edmunds (PERC); larva, Mooi R. at Niekerk's Fontein below weir, 20.ix.1990, W.P. & N. McCafferty (PERC); 4 larvae, Kamberg Nature Reserve, Mooi R., 19.ix.1990, W.P. & N. McCafferty (PERC); larva, Highmoor Forest, tributary of Little Mooi R., 1800 m, 19.ix.1990, W.P. & N. McCafferty, (PERC); *Mpumalanga*, 10 larvae, Buffelspruit at Shalom (Aalwan), 4 km W of Badplaas, 1167 m, 17.x.1990, W.P. & N. McCafferty (PERC); 27 larvae, Sabie-Sand Game Reserve, Sand R. at Londolozzi, 20.x.1990, W.P. & N. McCafferty (PERC); 3 larvae, Kruger Ntl. Park, Sabie R. at Sabie Gorge, Mozambique/South African border, 25.11S 32.02E, 22.x.1990, W.P. & N. McCafferty (antenna, mouthparts, and forelegs of one larva mounted on slide (medium: Euparal)) (PERC); 4 larvae, Kruger Ntl. Park, Sabie R. at Molondozi, 25.09S 32.00E, 23.x.1990, W.P. & N. McCafferty (PERC); larva, Long Tom State Forest, upper Sabie R., 25.09S 30.40E, 26.x.1990, W.P. & N. McCafferty (PERC); 40 larvae, Kruger Ntl. Park, Olifants R. at bridge on dirt road, nr Olifants Camp, 24.03S 31.44E, 29.x.1990, W.P. & N. McCafferty (PERC); larva, Kruger Ntl. Park, Olifants R., 15 km from Blacktop Road, at Fig Tree Site, 29.x.1990, W.P. & N. McCafferty (PERC).

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