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A revision of Leptophlebiidae of Cuba (Ephemeroptera)

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A revision of Cuban leptophlebiid species is given. 7 species and subspecies are described as new: *Hagenulus (Borinquena) sextus* sp. n., *H. (Turquinophlebia) grandis* sp. n., *H. (Poecilophlebia) pacoi* sp. n., *H. (Careospina) hespera sierramaestrae* subsp. n., *H. (C.) baconaoi* sp. n., *H. (C.) evanescens* sp. n., and *H. (Traverina) oriente* sp. n. Additional characters of *Farrodes bimaculatus, Hagenulus (Hagenulus) caligatus, H. (H.) morrisonae, H. (Careospina) hespera hespera,* and *H. (Traverina) cubensis* are described. For all above mentioned Cuban leptophlebiid species male and female imagos, subimagos, and nymphs are known. *Borinquena, Careospina* and *Traverina* originally described as separate genera are regarded as subgenera of the genus *Hagenulus* s. l. New diagnoses of the genus *Hagenulus* s. l. and its subgenera are given, two new subgenera, *Turquinophlebia* subgen. n. and *Poecilophlebia* subgen. n., are described. For the genera *Farrodes* and *Hagenulus* s. l. a new tribe, Hagenulini tribus n., is established.

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Peters (1971) described seven Cuban species of the family Leptophlebiidae. Four of them *(Hagenulus caligatus, H. morrisonae, Traverina cubensis,* and *Careospina hespera)* were described from imagos and nymphs, but imagos were not reared from nymphs; for two species *(Farrodes bimaculatus* and *Careospina minuta)* only imagos were described; one species was only mentioned as a nymph without name (*Traverina* sp.: Peters, 1971, p. 11). No other data on Cuban Leptophlebiidae have been published since 1971.

The present research is based on the material collected by J.C. Naranjo (University Oriente, Santiago de Cuba) in 1983-1986 in the Eastern provinces of Cuba (provinces Santiago de Cuba, Granma, and Guantanamo) and by the author of this paper in January-April of 1989 in the same Eastern provinces and also in Soroa (Western Cuba, prov. Pinar del Rio) and in the Trinidad Mountains (Central Cuba). This collection contains 12 species and subspecies; for all of them, except *Hagenulus (Careospina) evanescens* sp. n., male and female imagos have been reared from nymphs by the author. Seven of these species are new. Only two species described by Peters are not represented in our collection: *Careospina minuta* Peters, 1971 and *Traverina* sp. The type specimens of *C. minuta* were collected in "Trinidad Mountains, Mina Carlota, 22 March 1935", and nymphs of *Traverina* sp. were collected in "Rio de San Antonio, by Charco Azul, Trinidad Mts., 23-29 March 1939" by J.G. Needham. These geographical names are absent in the modern geographical atlas of Cuba (printed in Habana, 1978). During a special trip to the Trinidad Mountains 12-18.IV.1989 the author found only two species of Leptophlebiidae, the widely distributed *Farrodes bimaculatus* and the eastern *Hagenulus morrisonae.*

Holotypes of the new species described here are preserved in the Zoological Institute, Russian Academy of Sciences, St.Petersburg.

All the Cuban species of Leptophlebiidae belong to a natural group which is described here as the tribe Hagenulini trib. n.

Key to Cuban species of Leptophlebiidae

Nymphs

1(4). Dorsal and ventral lamellae of tergaliae terminate in three processes (Figs 215-217).

2(3). Apical denticle of claw distinctly larger than the others (Fig. 212)..... .....**Hagenulus (Traverina) oriente** sp. n.

3(2). Denticles of claw progressively increasing in size, the apical one not particularly enlarged (Fig. 197).....**Hagenulus (Traverina) cubensis**

4(1). Dorsal and ventral lamellae of tergaliae terminate in a single process (Figs 64-66, 77-79, 127-129).

5(8). Fore tibiae with longitudinal rows of very long bristles (Figs 26, 27). Segment 2 of labial palp with 2 regular longitudinal rows of very long bristles (Fig. 25). Labrum with proximal row of bristles nearer to its proximal margin (Peters, 1971: Figs 186, 188).

6(7). Labrum wider than head (Peters, 1971: Fig. 1; in immature nymph narrower than head). Maxillae of mature nymph with short apical process (Peters, 1971: Fig. 152). Bristles scattered on body surface stick-shaped, with bases much narrower than the remaining part (Fig. 21) ..... **.....Hagenulus (Hagenulus) caligatus**

7(6). Labrum narrower than head (Peters, 1971: Fig. 2). Maxillae of mature nymph with very long apical process (Fig. 32; Peters, 1971: Fig. 153) (in immature nymphs apical process shorter or absent). Bristles on body surface simple, thickest at their bases (Fig. 33)..... **Hagenulus (Hagenulus) morrisonae**

8(5). Fore tibiae without very long bristles (Figs 39, 68, 104, 153). Segment 2 of labial palp without regular rows of bristles (Figs 63, 83, 110). Labrum with proximal row of bristles nearer to its distal margin (Figs 61, 80, 99, 145, 152, 193, 214).

9(10). Posterior margin of abdominal sternum IX convex in the middle (Figs 1-3). Abdomen, femora, and tibiae with contrasting pigmented patterns on cuticle (Fig. 11). Claws with apical denticle strongly enlarged (Fig. 5)..... **Farrodes bimaculatus**

10(9). Posterior margin of abdominal sternum IX concave in the middle (Figs 48, 49, 74, 75, 125, 126, 150, 174, 175, 188, 189). Abdomen, femora, and tibiae without contrasting pigmented patterns on cuticle (only contrasting hypodermal patterns present). Claws with apical denticle not strongly enlarged (Figs 44, 71, 101, 151, 156, 187).

11(12). Segment 3 of labial palp longer than 1/2 of segment 2 (Fig. 63). Hypodermal colour patterns on abdominal terga as in Fig. 56..... **.....Hagenulus (Borinquena) sextus** sp. n.

12(11). Segment 3 of labial palp shorter than 1/2 of segment 2 (Figs 83, 110). Hypodermal colour patterns not as above.

13(14). Segment 3 of labial palp longer than 1/3 of segment 2 (Fig. 83). Anteromedian emargination of labrum narrow, without denticles (Figs 80, 81). Hypodermal colour patterns on abdominal terga as in Fig. 93 ..... **.....Hagenulus (Turquinophlebia) grandis** sp. n.

14(13). Segment 3 of labial palp shorter than 1/3 of segment 2 (Fig. 110). Anteromedian emargination of labrum wide, with several denticles (Figs 100, 145, 152, 191-193). Hypodermal colour patterns not as above.

15(16). Hind tibiae strongly flattened, with dorsal surface concave, with row of bristles on outer margin consisting of subequal bristles (Figs 106, 109). Hypodermal colour patterns on abdominal terga as in Fig. 116.....**Hagenulus (Poecilophlebia) pacoi** sp. n.

16(15). Hind tibiae subcylindrical or moderately flattened, with dorsal surface convex (Figs 135, 146, 159), with row of bristles on outer margin consisting of bristles of very different length (Fig. 160). Hypodermal colour patterns on abdominal terga not as above.

17(18). Hypodermal colour patterns on abdominal terga as in Fig. 182: without median and submedian light maculae (only a narrow light median line may be present), with light anterior and posterior marins. Abdominal terga I-VI without denticles on posterior margin or with very small denticles; terga VII-VIII having denticles only in lateral parts (Fig. 190). Distal row of bristles on labrum irregular (Fig. 193). Hind wing pads of mature nymph with hind part smaller than costal projection (Fig. 186)..... **.....Hagenulus (Careospina) evanescens** sp. n.

18(17). Hypodermal colour patterns on abdominal terga as in Figs 133, 134, 140, 141, 168: with more or less developed median or submedian light maculae. Abdominal terga I-X with well developed denticles on posterior margin (Figs 147, 161). Distal row of bristles on labrum regular in its lateral parts (Figs 145, 152). Hind wing pads of mature nymph with hind part much larger than costal projection (Figs 148, 173).

19(20). In mature male nymph penis lobes short, curved, divergent (Fig. 175). Apices of denticles on claw forming convex line (Fig. 156). Labrum with deeply emarginate distal margin (Fig. 152). Hypodermal colour patterns on abdominal terga as in Fig. 168.....**Hagenulus (Careospina) baconaoi** sp. n.

20(19). In mature male nymph penis lobes very long, straight, parallel (Fig. 150). Apices of denticles on claw forming nearly straight line (Fig. 151). Labrum with moderately emarginate distal margin (Fig. 145). Hypodermal colour patterns on abdominal terga as in Figs 133, 134, 140, 141.

21(22). Tarsus as pale as tibia. Hind tibia slightly flattened (Fig. 135). Western Cuba (Cordillera de Guani-Guanico)..... **.....Hagenulus (Careospina) hespera hespera**

22(21). Tarsus darker than tibia. Hind tibia strongly flattened (Fig. 146). Eastern Cuba (Sierra Maestra) **Hagenulus (Careospina) hespera sierramaestrae** ssp.n.

Male imagos and subimagos

1(2). *ICu* not connected basally to *CuP* (Peters, 1971: Fig. 12). (Gen. *Farrodes*).....**Farrodes bimaculatus**

2(1). *ICu* connected basally to *CuP* (Figs 57, 88, 120, 167, 183). (Gen. *Hagenulus*).

3(14). Penis lobes deeply divided, long and narrow, nearly straight or curved dorso-laterally, without appendages (Figs 130, 136-138, 163-165, 171, 176-179, 204, 205, 207).

4(5). Hind wing with its hind part shorter than costal projection (Fig. 180). Upper eyes widely separated (Fig. 181). Genitalia as in Figs 176-179. Abdominal colour patterns as in Fig. 182..... **.....Hagenulus (Careospina) evanescens** sp. n.

5(4). Hind wing with its hind part much longer than costal projection (Figs 139, 166). Upper eyes not so widely separated (Fig. 132) or contiguous (Figs 143, 169).

6(7). Hind wing narrow (Fig. 166). Styliger with sharp median emargination (Fig. 162). Penis lobes with prominent median plate (Figs 163-165). Abdominal colour patterns as in Fig. 168. Upper eyes wide (Figs 169, 170)..**Hagenulus (Careospina) baconaoi** sp. n.

7(6). Hind wings wide (Fig. 139). Styliger without sharp median emargination, slightly concave or

slightly convex (Figs 136, 207). Penis, coloration of abdomen, and upper eyes not as above.

8(11). In imago proximal wide portion of basal segment of forceps (i. e. true first segment) relatively wide and short, only slightly longer than one of terminal segments (Fig. 136). Penis lobes very deeply divided, their form as in Figs 130, 131, 136-138.

9(10). Upper eyes contiguous by their bases, only their facet surfaces separated (Fig. 143). Each of abdominal terga III-VII with more or less distinct light median triangular macula and a pair of light maculae lateroposteriad to it (Figs 140, 141) ..... **Hagenulus (Careospina) hespera sierramaestrae** ssp.n.

10(9). Upper eyes not contiguous by their bases (Fig. 132). Abdominal terga usually not as above (Figs 133, 134) ..... **Hagenulus (Careospina) hespera hespera**

11(8). In imago proximal portion of basal segment of forceps relatively narrow and long, as long as two terminal segments together (Fig. 207).

12(13). Penis lobes slightly widened near apex (Fig. 204). Upper eyes contiguous by their facet surfaces (Fig. 202). Length of fore wing 6-8 mm..... **Hagenulus (Traverina) cubensis**

13(12). Penis lobes not widened near apex (Fig. 207). Upper eyes contiguous only by their bases, their facet surfaces separated (Fig. 208). Length of fore wing 5-5.5 mm..... **Hagenulus (Traverina) oriente** sp. n.

14(3). Penis lobes not as above, short (Figs 14, 15, 37, 38, 51, 52, 92, 94, 114, 115).

15(18). Hind wing with its hind part shorter than costal projection (Figs 36, 53).

16(17). Basal segment of forceps with prominent angle on inner margin, its wide proximal portion (i. e. true first segment) parallel-sided, 3 times longer than its narrow distal portion (i. e. true second segment); in imago basal segment of forceps unusually long (Fig. 52). Penis of imago and subimago with ventral denticles (Figs 51, 52). Hind wing as in Fig. 53. Abdominal terga II-VII light, with small paired dark markings (Fig. 56). **Hagenulus (Borinquena) sextus** sp. n.

17(16). Basal segment of forceps without angle on inner margin, its wide proximal portion narrowed distally, not more than twice longer than its narrow distal portion (Fig. 37). Penis of imago without ventral denticles (Fig. 37), penis of subimago with small denticles (Fig. 38). Hind wing as in Fig. 36. Abdominal terga IV-VII with a large transverse dark macula (Peters, 1971: Figs 131, 132) ..... **Hagenulus (Hagenulus) morrisonae**

18(15). Hind wing with its hind part longer than or subequal to costal projection (Figs 17, 89, 117).

19(20). Upper eyes widely separated (Fig. 23). Hind wing with costal projection and hind part subequal, strongly divergent (Fig. 17). Genitalia as in Figs 14, 15. Abdominal terga as in Fig. 18..... **Hagenulus (Hagenulus) caligatus**

20(19). Upper eyes contiguous at least at their bases (Figs 91, 118). Hind wings, genitalia, and abdominal terga not as above.

21(22). Lateral ocelli widely separated (Fig. 118). Fore wing with distinct maculation (Fig. 120). Hind wing wide (Fig. 117). Abdominal terga as in Fig. 116. Genitalia as in Figs 114, 115..... **Hagenulus (Poecilophlebia) pacoi** sp. n.

22(21). Lateral ocelli contiguous (Fig. 91). Fore wing without maculation (Fig. 88). Hind wing narrow (Fig. 89). Abdominal terga as in Fig. 93. Genitalia as in Figs 92, 94 ..... **Hagenulus (Turquinophlebia) grandis** sp. n.

Female imagos and subimagos

1(2). *ICu* not connected basally to *CuP* (Peters, 1971: Fig. 12). Ninth abdominal sternum not cleft (Peters, 1971: Fig. 104). (Gen. *Farrodes*) ..... **Farrodes bimaculatus**

2(1). *ICu* connected basally to *CuP* (Figs 57, 88, 120, 167, 183). Ninth abdominal sternum cleft (Figs 75, 189; Peters, 1971: Figs 105-110). (Gen. *Hagenulus*).

3(8). Ovipositor much longer than abdominal segment (Fig. 58).

4(7). Pronotum with a pair of dark longitudinal maculae and dark margins. Antelateroparapsidal suture of mesonotum of the same colour as the area around it. Episternum brown, with anterior paracoxal suture somewhat lighter. Lateropostnotum dark brown. Thoracic nerve ganglia dark brown on paler background. In subimago no light space between lateroparapsidal suture and posterior scutal protuberance (Fig. 20).

5(6). Hind wing wide, with hind portion not shorter than costal projection (Fig. 19) ..... **Hagenulus (Hagenulus) caligatus**

6(5). Hind wing narrow, with hind portion reduced (Fig. 36)..... **Hagenulus (Hagenulus) morrisonae**

7(4). Pronotum without dark longitudinal maculae, only margins dark. Antelateroparapsidal suture contrastingly lighter than darkened area around it. Episternum pale, with darker anterior paracoxal suture. Lateropostnotum pale. Thoracic nerve ganglia pale, invisible on pale background. Subimago with distinct light space between lateroparapsidal suture and posterior scutal protuberance (Fig. 50). Hind wing wide, with hind portion shorter than costal projection (Fig. 53) ..... **Hagenulus (Borinquena) sextus** sp. n.

8(3). Ovipositor much shorter than abdominal segment (Figs 95, 123).

9(10). Hind wing with hind part reduced (Fig. 185)... **Hagenulus (Careospina) evanescens** sp. n.

10(9). Hind wing with hind part longer than costal projection (Figs 96, 97, 122, 144, 172, 211).

11(12). Fore wing with dark maculae on crossveins (Fig. 120)... **Hagenulus (Poecilophlebia) pacoi** sp. n.

12(11). Fore wing without maculation (Fig. 88).

13(14). Hind wing with costal projection wide, with hind margin only slightly convex (Figs 96, 97). Middle dark band of femur transformed into longitudinal lines, occupying more than 1/3 length of femur. Length of fore wing 10-11 mm..... **Hagenulus (Turquinophlebia) grandis** sp. n.

14(13). Hind wing with costal projection more slender, with hind margin strongly convex (Figs 144, 172, 211). Middle dark band on middle and hind femur entire, occupying less than median 1/3 length of femur. Length of fore wing 5-8 mm.

15(16). All legs with apex of tibia contrastingly darker than tarsus. Hind wing as in Fig. 144..... **Hagenulus (Careospina) hespera**

16(15). At least hind legs with apex of tibia of the same

colour as tarsus.

17(18). Length of fore wing 7-8 mm. All femora with wide dark middle band..... .....**Hagenulus (Traverina) cubensis**

18(17). Length of fore wing 5-6 mm. Hind femur with roundish dark middle macula, middle femur with small indistinct middle macula.

19(20). Hind wing wide (Fig. 211). Femur with strongly contrasting apical dark band..... .....**Hagenulus (Traverina) oriente** sp. n.

20(19). Hind wing narrow (Fig. 172). Femur with moderately contrasting apical dark band..... .....**Hagenulus (Careospina) baconaoi** sp. n.

Tribe **HAGENULINI** trib. n.

This tribe belongs to the subfamily Atalophlebiinae Peters, 1980 and has all features typical of this subfamily or, at least, found in the bulk of its representatives: (1) styliger plate of imago not deeply cleft; (2) upper portion of eyes of males with square facets (Fig. 121); (3) mesothoracic basisternum of imago flat, without median carina, with median invagination in its posterior part (Tsui & Peters, 1972: Figs 53-55); (4) lingua of hypopharynx in nymph with lateral projections (Peters, 1971: Figs 159-163); (5) maxilla without primary apical denticles (maxillary canines), with a single stout comb-like subapical bristle (dentiseta) on inner margin (Fig. 4); (6) anteromedian emargination of labrum with flattened denticles (Figs 6, 7, 60, 100, 191, 192, 198) or, if emargination very narrow, only with a pair of flat plates on sides (Figs 81-82); (7) anterolateral margins of labrum without thickened bristles; (8) dorsal surface of labrum with two transverse rows of bristles, here named the distal and the proximal rows. In *Farrodes bimaculatus* both rows are regular (Figs 6-7). In the genus *Hagenulus* only proximal row is regular all over its length, while distal one is irregular at least in the middle (Figs 82, 198), in its lateral parts the distal row may be regular (Figs 99, 145, 152, 214) or also irregular (Figs 61, 80, 193; Peters, 1971: Figs 186, 188); usually both rows are situated near the anterior margin, but in the subgenus *Hagenulus* s. str. the proximal row is very strongly turned proximally (Peters, 1971: Figs 186, 188).

From the other groups of the subfamily Atalophlebiinae the tribe Hagenulini can be distinguished by the following characters of imago and subimago: (1) fore wing with *MA* fork asymmetrical and *MP* fork symmetrical (Figs 57, 88, 120, 167, 183) (apart from Hagenulini, such venation occurs only in the African genera *Castanophlebia, Hagenulodes,* and *Nesophlebia*); (2) hind wing with long acute costal projection, costal field not extended distally over the base of costal projection (Figs 17, 19, 89, 96, 97, 117, 122, 139, 144, 166, 172, 206, 211); if hind wing is diminished, costal projection retains its size and seems relatively large (Figs 36, 53, 180, 185) (this character allows Hagenulini to be distinguished from all other Leptophlebiidae except for the forms without hind wings); (3) claws of imago and subimago on each leg dissimilar: one blunt, without sclerotization, another pointed and hooked, without opposite tooth (Fig. 119); (4) posterior part of lateroparapsidal suture and furrow bordering anteriorly posterior scutal protuberance merged into an integral cavity with straight or slightly convex posterior margin (Figs 13, 16, 20, 50, 87, 113, 201, 222); (5) mesonotum of subimago completely covered with microtrichia, without a bare median stripe.

Nymphs of Hagenulini can be characterized only by features that are not unique for this group, being present also in some non-related groups of Atalophlebiinae: (1) glossae small, dorsal to paraglossae, not expanded apically (Figs 63, 83, 110); (2) tibio-patellar suture reduced in all legs (in contrast to some other Leptophlebiidae, where its rudiment retains on dorsal side of hind leg or in hind and middle legs); (3) at least middle and hind tibiae with inner-dorsal row of stout bristles; (4) hind tibia with outer row of bristles and with transverse subapical ventral row of bristles, middle and fore tibiae without these rows (Figs 40-47, 153-160); (5) abdominal posterolateral spines weakly developed, distinct only on segments VIII and IX; on segments V-VII very short, obtuse, indistinct or absent; (6) minute denticles or spines may be present on posterior margin of abdominal terga and sternum IX, but not on sterna I-VIII; (7) tergaliae of all 7 pairs well developed and have similar structure, with long, slender, pointed apices.

The tribe Hagenulini has a Neotropical distribution.

Discussion. Flowers & Dominguez (1991) have suggested the "parsimonious" phylogenetic tree for Neotropical Atalophlebiinae, where Hagenulini in general and *Hagenulus* s. str. are shown as paraphyletic taxa ancestral to the *Hermanella-Traverella* complex. In their work a parsimonial computer programme was applied; such a method should be regarded

as wrong in principle, being not based on any natural law (see Pesenko, 1989). Actually *Hagenulus* s. str. is not a paraphyletic, but a holophyletic taxon, endemic to Cuba and including two vicarious species. Flowers and Dominguez have shown 5 characters common for the *Hermanella-Traverella* complex + *Hagenulus caligatus*, but not found in *Hagenulus morrisonae*: (1) setae on outer margin of stipes absent, (2) outer margin of mandible rectangular, (3) *Sc* of hind wing shorter than 0.6 of the wing, (4) spines on penis present, and (5) subapical denticle of claw enlarged. None of these characters can be regarded as synapomorphies of these taxa for the following reasons. (1) In figures by Peters (1971: Figs 149-153) two small setae are shown on stipes of *Traverina* sp. and *Hagenulus morrisonae*, no setae are shown on that of *H. caligatus* and *Careospina hespera*; actually it is an individual character, several setae may be present or absent in the same species or on right and left maxilla of the same specimen. (2) According to the figures given by Dominguez & Flowers (1989: Figs 43, 55, 67, 78) and by Allen (1973: Figs 12, 13), the shape of mandibles in *Hermanella-Traverella* complex is more similar to that of *H. morrisonae* than to that of *H. caligatus* (Peters, 1971: Figs 171, 172). (3) It is not clear which particular proportion of the hind wing was implied by the authors, but in all the cases the ratio of *Sc* length to the wing length should be regarded as an artificial character depending on the ratio of costal projection length to that of hind part of wing, which is very different in closely related species of Hagenulini (compare Figs 17 and 36, 139 and 180). (4) Spines on the penis are preserved in subimago of *H. morrisonae* (Fig. 38) and subimagos of some other Hagenulini (Figs 94, 114), which have such spines reduced in the imago. As these spines can function in imago, but not in subimago, the only possible explanation of their absence in the imago of *H. morrisonae* is their secondary reduction. Thus their presence in *H. caligatus* and *Hermanella-Traverella* complex is a symplesiomorphy. (5) Actually *H. caligatus* and *H. morrisonae* do not differ in the structure of their nymphal claws. The enlargement of the apical denticle of claw cannot be regarded as a good apomorphy or plesiomorphy. The most distal of the claw denticles (here "apical" or "subapical") easily enlarges or diminishes (becoming larger than or equal to the other denticles) independently in different phylogenetic branches (compare Figs 197 and 212); in all cases it stays out of the row of other denticles (Fig. 102) and probably has another origin, differing in size from the other denticles.

Holophyly of *Hagenulus* s. str. is proved by a number of common characters (see diagnosis of the subgenus *Hagenulus* below and the key to female imagos and subimagos above), especially by the distinct autapomorphy in having rows of filtering setae on fore tibiae of nymph (Figs 26-27).

The genus *Hagenulus* s. l. (including *Traverina, Careospina*, and others) is also a holophyletic, but not paraphyletic taxon, as Flowers and Dominguez thought. They consider *Hagenulus* s. str. to be ancestral to *Hermanella-Traverella* based on a complex of characters in the mouthpart structure connected with their filtering specialization (8 common characters are listed under the numbers 4, 28, 1, 3, 5, 10, 16, 22) and also on the presence of dorsal "spines or setae" on fore tibiae in nymphs. Actually dorsal bristles (= setae, spine-like or hair-like) are present in the groundplan of Atalophlebiinae. As for the mouthpart structure, it is highly specialized indeed and very similar in the both groups. Peters (1971: 30) regarded such structure as independently developed in *Hagenulus* and in *Hermanella-Traverella* complex, similar specialization independently appearing in the Old World genera *Choroterpides* and *Nathanella*. This point of view can be supported by the fact that the both species of *Hagenulus* s. str. have the same structure of labial palpi (Fig. 25), more highly specialized than in the *Hermanella-Traverella* complex; at the same time in many other respects mouthpart specialization in the *Hermanella-Traverella* complex is greater than in *Hagenulus* s. str., and it is identical in all members of the complex (see characters 2, 8, 9, 11, 16, 18 in the phylogenetic tree by Flowers & Dominguez, 1991).

Considering *Hagenulus* to be paraphyletic, Flowers and Dominguez had to assume reversions and parallelisms in the wing structure: in form of furcation of *MA* and *MP*, in attachment of *ICu* of fore wing, and in shape of the costal projection of hind wing. All these characters testify to holophyly of *Hagenulus* s. l., while a single complex of correlated characters (specialized nymphal mouthparts) testifies to its paraphyly. In the phylogenetic tree built by Flowers and Dominguez the mouthpart struc-

ture appears to have the largest weight only because the authors represent this structure as a set of separate characters. There is also a mistake in the character 38 (fork of *MP*) in the data matrix; because of this mistake *Ecuaphlebia* becomes the sister group of *Hagenulus-Hermanella* lineage, which is actually doubtful.

Savage (1987: 212) divided Neotropical Atalophlebiinae into several lineages. The tribe Hagenulini corresponds to the "*Farrodes* lineage" (to which Savage places the genera *Farrodes, Simothraulopsis*, and *Homothraulus*) and to the "super-*Hagenulopsis* lineage", which is divided into "*Hagenulopsis* lineage" (the genera *Hagenulopsis, Borinquena, Askola*), "*Hagenulus* lineage" (the genera *Hagenulus* and *Neohagenulus*), and "*Careospina* lineage" (the genera *Careospina* and *Traverina*). As for the genus *Simothraulopsis* (with a single species *S. surinamensis* Demoulin, 1966), it has no characters of the tribe Hagenulini: fork of *MP* is asymmetrical and claws are similar and hooked in all legs.

Leptophlebiid genera having the characters of the tribe Hagenulini (at least asymmetrical *MA*, symmetrical *MP*, acute costal process of hind wing, and dissimilar claws) can be divided into three groups on the basis of venation of cubital field in fore wing.

(A) Genera *Farrodes* and *Homothraulus*: vein *ICu* is not connected at base to *CuA* or *CuP* (Peters, 1971: Figs 6, 9, 12).

(B) Genus *Hagenulus* s. l. (including *Hagenulus* s. str., *Borinquena, Hagenulopsis, Neohagenulus, Traverina, Careospina*): vein *ICu* is attached at base at least to *CuP* (it may be also connected by a cross vein or not connected to *CuA*) (Figs 57, 88, 120, 167, 183).

(C) Genus *Askola* (with a single Brazilian species *A. froehlichi* Peters, 1969): vein *ICu1* is attached at base to *CuA*, but not to *CuP* (Peters, 1969; Fig. 1).

In the Cuban fauna two genera are represented: *Farrodes* and *Hagenulus* s. l.

Genus Farrodes Peters, 1971

Farrodes Peters, 1971: 5 (imago, nymph).

Type species *Farrodes hyalinus* Peters, 1971 (Jamaica).

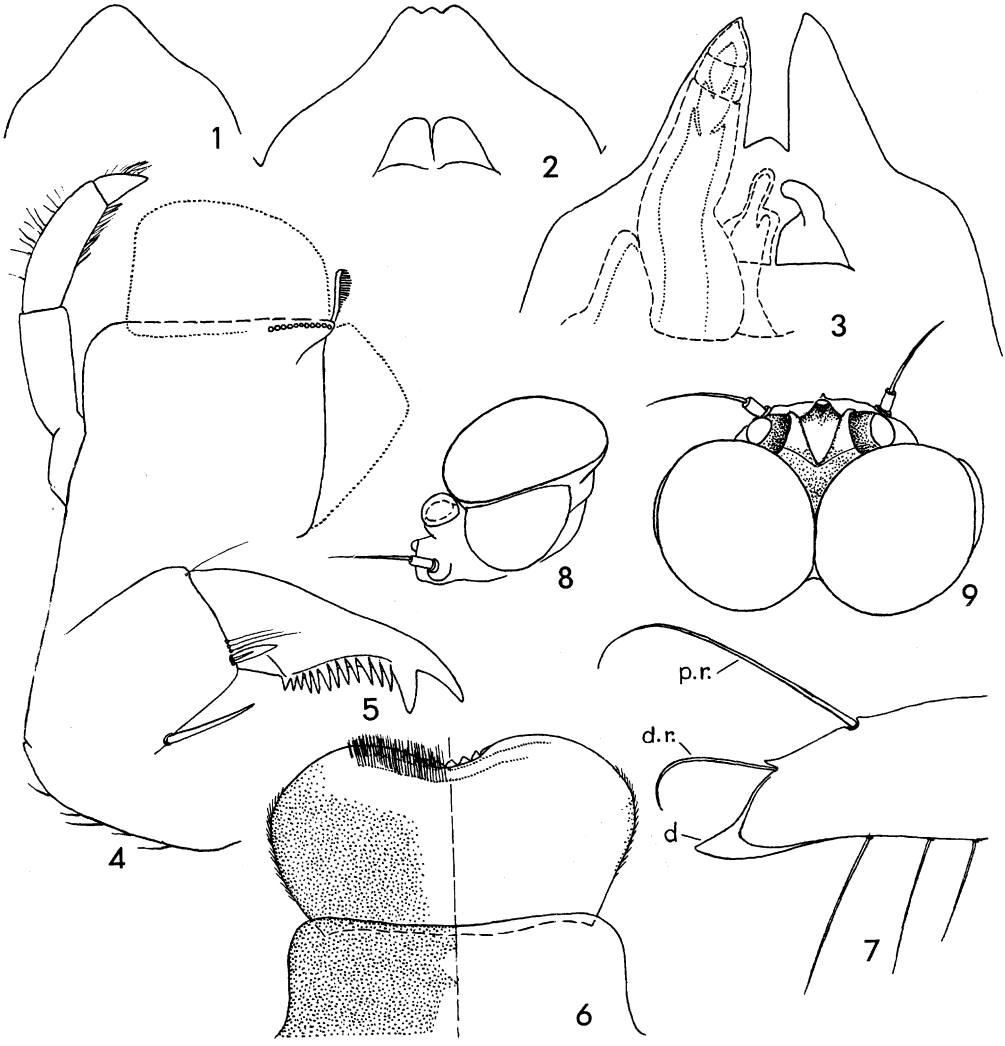
The characters common for *Farrodes* and *Hagenulus* s. l. are given in the characteristics of the tribe Hagenulini (see above). *Farrodes* can be distinguished from *Hagenulus* s. l. by the following characters. In imago and subimago: (1) in fore wing *ICu* not attached basally to *CuP*; (2) medioparapsidal suture posteriorly reaches median suture, being in its posterior part as deep as in the middle part (Fig. 13). In subimago: (3) cuticle of mesoscutum colourless, without pigmented areas along medioparapsidal sutures and on posterior scutal protuberances; (4) parascutellum not separated from lateroscutum (Fig. 13). In male imago and subimago: (5) genitalia as described by Peters, 1971. In female imago and subimago: (6) sternum IX integral. In nymph: (7) sternum IX medially convex (Figs 1-3) (in mature male nymph median convexity situated inside concavity between forceps rudiments as in Fig. 3); (8) cuticle of abdomen, femora, and tibiae with contrasting colour patterns (Fig. 11); (9) lateral and medial portion of subapical ventral row of comb-like bristles of maxilla usually connected (Fig. 4), each portion consisting of 6- 9 bristles.

The generic characters 2, 3, 4, 7, 9 are based only on examination of the single Cuban species *F. bimaculatus*; in other species of *Farrodes*, including the type species, these characters are not examined.

Farrodes bimaculatus Peters & Alayo, 1971 (Figs 1-12)

Farrodes bimaculatus Peters & Alayo in Peters, 1971: 8 (male and female imago).

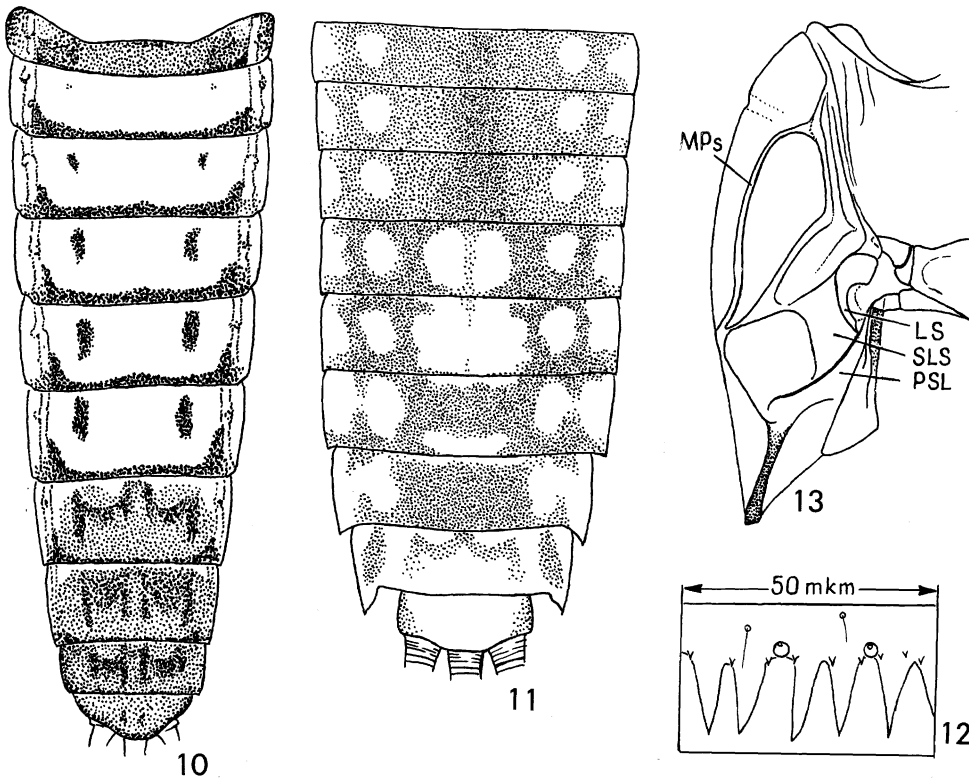
Material. Western Cuba: *prov. Pinar del Rio*: 5 ♂, 1 ♀ imagos, 1 ♂, 2 ♀ subimagos (all reared from nymphs), 16 nymphs, Soroa, 1-7.IV.1989 (N. Kluge). Central Cuba: *prov. Sancti Spiritus*: 4 ♂ imagos, 2 ♂, 12 ♀ subimagos (all reared from nymphs), 4 nymphs, Caballero River (north of Trinidad), 12-18.IV.1989 (N. Kluge). Eastern Cuba: *prov. Guantanamo*: 1 ♂ imago, 1 ♀ subimago (both reared from nymphs), 3 nymphs, Toa River near Paso de Toa and Naranjal, 13-15.III.1989 (N. Kluge); 7 nymphs, Imias, 12.III.1985 (C. Naranjo); *prov. Santiago de Cuba*: 3 ♂ imagos, 1 ♂, 4 ♀ subimagos (all reared from nymphs), 4 nymphs, arroyo Paco (tributary of Palma Mocha River near Pico Turquino), 18-24.II.1989 (N. Kluge); 8 ♂ imagos, 5 ♂, 5 ♀ subimagos (all reared from nymphs), 18 nymphs, Guamá River near La Alcarraza, El Codillo, and Sandor, 1-9.II.1989 (N. Kluge); 1 ♂ subimago (reared from nymph), 2 ♀ imagos, 1 nymph, Baconao River in Las Yaguas, 12.II.1989 (N. Kluge); 1 nymph, the same locality, 23.I.1986 (C. Naranjo); 7 nymphs, Limoncito (in Gran Piedra, east of Stgo. de Cuba), 24.V.1985 (C. Naranjo); 2 nymphs, La Idalia (in Gran Piedra),



Figs 1-9. *Farrodes bimaculatus* Peters & Alayo. **1-7**, nymph: **1-2**, posterior part of abdominal segment IX (subanal plate) of young male nymph of different ages (dorsal view); **3**, the same of mature male nymph (in right half – dorsal view, in left half – ventral view with subimaginal genitalia shown by interrupted line and imaginal forceps shown by dotted line); **4**, right maxilla (ventral view); **5**, claw; **6**, labrum (dorsal view); **7**, anteromedian part of labrum, longitudinal section. **8-9**, male imago, head: **8**, lateral view; **9**, dorsal view.
d. – denticle in anteromedian emargination, *d.r.* – distal row, *p.r.* – proximal row of bristles on labrum.

23.V.1985 (C. Naranjo); 1 nymph, the same locality, 25.I.1986 (C. Naranjo); 11 nymphs, Carpintero River (east of Stgo. de Cuba), 15.XII.1984 (C. Naranjo); 1 nymph, the same locality, 25.I.1986 (C. Naranjo); 1 nymph, Sto. Domingo, 7.VIII.1984 (C. Naranjo); 1 nymph, Cruce de los Baños, 3.V.1985 (C. Naranjo).

Nymph. Cuticle of head dorsally dark with light spots around ocelli. Structure of mouthparts as in *F. hyalinus* (Peters, 1971: Figs 139, 148, 157, 166, 176). Distal row of bristles on labrum regular all over its length, accompanied by row of minute denticles above it (Figs 6, 7). Labrum with light frontal part and median line, rest of the surface darkened. Mandibles and stipes of maxillae darkened laterally. Maxilla with lateral and medial portions of subapical ventral row of comb-like bristles usually connected, lateral portion including 7-9 bristles, median portion – 5-7 bristles (Fig. 4). Cuticle



Figs 10-13. *Farrodes bimaculatus* Peters & Alayo. **10**, male imago: abdominal terga (spread on slide); **11-12**, nymph: **11**, cuticular patterns on terga II-X (spread on slide); **12**, posterior margin of tergum VI. **13**, subimago, exuvia of right half of mesonotum (abbreviations as in Figs 14-21).

of pronotum dark, with light lateral margins, with a pair of large light maculae in its lateral parts, a pair of smaller light maculae mediad to them, and light median line. Cuticle of mesonotum dark, with light fore angles, a pair of light maculae before bases of wing pads, unpaired light macula on the place corresponding to imaginal scutellum, and some other light maculae of smaller size. Cuticle of legs light, with dark transverse band or macula in distal part of femur, with dark bands at base and distal 1/2 of tibia, and with tarsi darkened except their bases; some of these dark maculae may be not developed; sometimes femora dark except for 3 light maculae: near base, before distal dark band, and at their top. Fore tibiae subcylindrical, middle and hind tibiae flattened, their transverse sections similar to that of *Hagenulus (Traverina) cubensis* (Figs 194-196); outer margin of middle and hind tibiae straight, inner margin somewhat convex: in proximal part they are slightly wider than in distal part. Stout bristles of distal outer part of femur obtuse, bristles of their proximal and inner parts acute. Stout bristles on tibiae as follows: inner-dorsal row on fore tibia indistinct, on middle and hind tibiae dense and not quite regular, consisting of bristles of various size; inner bristles pinnate (with a row of long processes on each side), very numerous and dense on fore tibia, numerous (3-4 in transverse section) on middle tibia, more numerous (4-5 in transverse section) on hind tibia; outer row of hind tibia dense, not quite regular, becoming denser at apex. Claws with strongly enlarged apical denticle. Cuticle of abdomen darkened, with a pair of roundish lateral light maculae on each of terga I-IX and with a large median light macula on tergum VI, sometimes also on tergum V (Fig. 11) or VII. Hind margins of terga I-X with long denticles.

Male and female imago. Adequately described by Peters, 1971. Proportions of male

Table 1. Proportions (dimensions divided by fore wing length) of male imagos

Species	Maximum width of head with eyes	Mesonotal length	Fore leg			Middle leg			Hind leg		
			femur	tibia	tarsus	femur	tibia	tarsus	femur	tibia	tarsus
Farrodes bimaculatus	0.24	0.26	0.19-0.23	0.37-0.39	0.27-0.31	0.19-0.21	0.18-0.20	0.08	0.21-0.23	0.20-0.23	0.08
Hagenulus caligatus	0.24	0.27	0.25	0.38	0.29	0.23	0.29	0.08	0.27	0.33	0.08
H. morrisonae	0.21	0.25	0.25	0.39	0.35	0.23	0.28	0.10	0.26	0.31	0.10
H. sextus, holotype	0.20	0.22	0.22	0.38	0.31	0.21	0.26	0.08	0.24	0.32	0.08
H. grandis, holotype	0.17	0.23	0.24	0.32	?	?	?	?	0.27	0.27	0.08
H. pacoi, holotype	0.21	0.22	0.22	0.41	0.28	0.21	0.27	0.08	0.23	0.31	0.08
H. hespera sierramaestrae, holotype	0.21	0.23	0.22	0.41	0.27	0.21	0.24	0.08	0.23	0.27	0.08
H. baconaoi, paratype	0.21	0.22	0.20	0.42	0.29	0.19	0.22	0.07	0.23	0.26	0.07
H. evanescens, paratypes	0.18-0.19	0.20-0.21	0.21	0.45-0.46	0.38-0.40	0.19	0.30	0.08	0.22	0.36	0.08
H. cubensis	0.22	0.25	0.24	0.42	0.32	0.24	0.30	0.08	0.26	0.31	0.08
H. oriente, holotype	0.21	0.24	0.19	0.46	0.28	0.18	0.22	0.08	0.22	0.29	0.08

see in Table 1.

Subimago. Cuticle of body and all appendages colourless, only lateral margins of scutellum and posterior wing processes darkened.

Egg. 120 x 80 μm, cylindrical, with flat or concave polar areas. All egg surface (including polar areas) covered with papillae of two kinds: large and small ones. Large papillae about 2 μm in height and about 6 μm in diameter, with concavity on apex and with narrow (2-3 μm in diameter) base. Distance between centres of nearest large papillae about 15 (from 10 to 20) μm. Small papillae about 2 μm in height and 1-3 μm in diameter, with roundish apex and only slightly narrowed base. They form more or less regular rings around each large papilla.

Genus Hagenulus Eaton, 1882 (s. l.)

= *Hagenulus*-complex: Traver, 1960: 24.

The characters common for the genera *Hagenulus* and *Farrodes* are given in the characteristic of the tribe Hagenulini (see above). The genus *Hagenulus* can be distinguished from *Farrodes* by the following characters. In imago and subimago: (1) on fore wing *ICu* attached basally to *CuP* (Figs 57, 88, 120, 167, 183); (2) medioparapsidal suture posteriorly becoming shallow and disappearing without reaching median suture (Figs 16, 20, 50, 87, 113, 201, 222). In subimago: (3) cuticle of mesoscutum with more or less intensely pigmented areas along medioparapsidal sutures, on the largest part of posterior scutal protuberances, on lateroparapsidal and antelateroparapsidal sutures, on the most part of sublateroscutum and lateroscutum; (4) parascutellum separated from lateroscutum and lateral part of sublateroscutum by wide membranous areas (Figs 20, 50, 87, 113, 201, 222). In male imago and subimago: (5) genitalia of various structure, but not as in *Farrodes*. In female imago and subimago: (6) sternum IX cleft (Figs 75, 189 – interrupted line). In nymph: (7) sternum IX medially concave (in mature male nymphs this median concavity situated inside the one between rudiments of forceps) (Figs 30, 31, 48, 49, 74, 75, 125, 126, 150, 174, 175, 188, 189, 199, 200, 221); (8) cuticle of abdomen, femora, and tibiae without contrasting colour patterns; (9)

Table 2. Distribution of selected diagnostic characters in the subgenera of the genus *Hagenulus* s. l.

	Hagenulus s. str.	*Borinquena*	*Turquinophlebia*	*Poecilophlebia*	*Careospina*	*Traverina*
Mouthparts and fore legs of nymph	filtering	not specialized, usual for Atalophlebiinae				
Egg guide of ♀ imago	long (Fig. 58)		very short (Figs 95, 123)			
Apical segment of nymphal labial palp	short (Fig. 25)	long (Fig. 63)	medium size (Fig. 83)	short (Fig. 110)		
Ventral bristles on nymphal glossa	thin, numerous (Figs 63, 83)			stout, not numerous (Figs 110-112)		
Ventral bristles on nymphal paraglossa	close to apical margin (Figs 63, 83)			at a distance from apical margin (Fig. 110)		
Ventral pair of spines on penis of ♂ subimago	present (Figs 14, 38, 51, 94, 114)				absent (Fig. 171)	
Nymphal tergaliae	simple (Figs 64-66, 77-79, 127-129)					3-lobed (Figs 215-217)

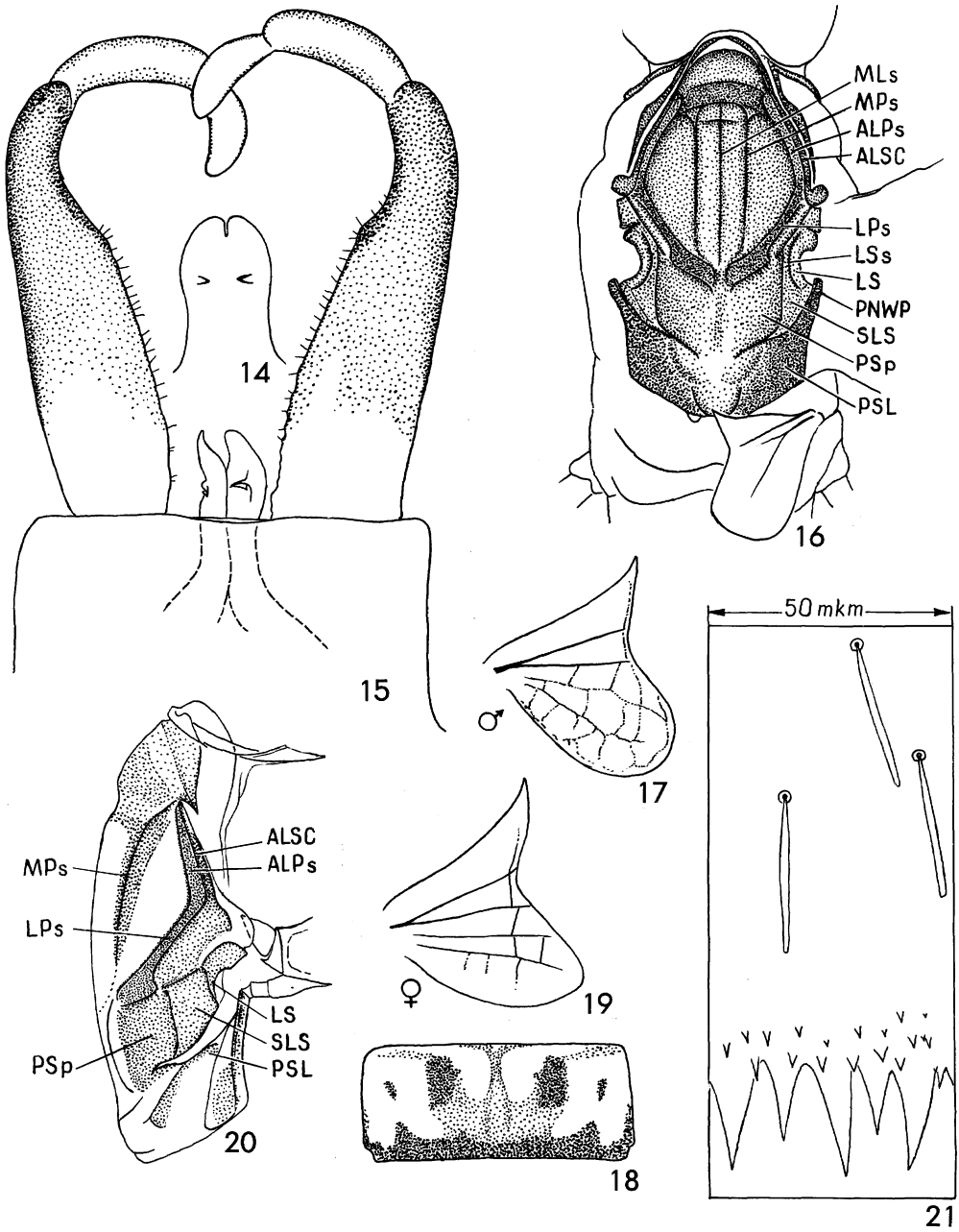
lateral and medial portions of subapical ventral row of comb-like bristles of maxilla usually disjunct (Figs 32, 124), each portion consisting of 9-16 bristles (only 7-9 bristles in the subgenus *Hagenulus* s. str.).

Discussion. In this text, the genus *Hagenulus* is treated in a wider sense than previously accepted. Beside the subgenus *Hagenulus* s. str., I am including here as subgenera the groups *Borinquena, Careospina,* and *Traverina*, previously described as genera. The genera *Hagenulopsis* Ulmer, 1919 and *Neohagenulus* Traver, 1938, which are not represented in the Cuban fauna and were not examined by me, possibly should also be included in the genus *Hagenulus* s. l. Two new subgenera – *Turquinophlebia* and *Poecilophlebia* – are described here. Despite the above mentioned groups having very different nymphal mouthparts and tergaliae, imaginal genitalia, and other characters, they are better given a rank of subgenera and not genera because it is impossible to give them separate diagnoses for both nymphs and imagos. The characters of female imagos do not allow these subgenera to be distinguished (only *Hagenulus* s. str. and *Borinquena* can be separated from the other subgenera by the presence of a long ovipositor). While nymphs of *Hagenulus* s. str. have highly specialized mouthparts and fore legs, and nymphs of *Traverina* have particular form of tergaliae, nymphs of *Borinquena, Turquinophlebia, Poecilophlebia,* and *Careospina* are very similar, and it is not quite clear which of their characters may be used as subgeneric ones. The subgenera can be reliably distinguished only by the combinations of nymphal, imaginal, and subimaginal characters (Table 2).

Subgenus **Hagenulus** Eaton, 1882

Hagenulus: Peters, 1971: 17 (pro gen.; partim: imago, nymph).
Type species *Hagenulus caligatus* Eaton, 1882 (Cuba).

This subgenus can be separated from all the other subgenera of the genus *Hagenulus* s. l. by filtering specialization of nymphal fore legs and mouthparts with the following characters: (1) proximal row of bristles on labrum strongly turned proximally, nearing rather to proximal margin of labrum than to its distal margin (Peters, 1971: Figs 186, 188); (2) mandibles with angulate projection on outer margin (Peters, 1971: Figs 171, 172); (3) stipes of maxilla shortened (Peters, 1971: Figs 152, 153); (4) in subapical ventral row of comb-like bristles



Figs 14-21. *Hagenulus (Hagenulus) caligatus* Eaton. **14**, male subimago, penis (ventral view). **15-18**, male imago: **15**, genitalia; **16**, mesonotum; **17**, hind wing; **18**, abdominal tergum V (spread on slide). **19**, female imago, hind wing; **20**, subimago, exuvia of right half of mesonotum; **21**, nymph, hind margin of tergum VI.
ALPs – antelateroparapsidal suture, *ALSC* – anterolateral scutal costa, *LPs* – lateroparapsidal suture, *LS* – lateroscutum, *LSs* – lateral scutal suture, *MLs* – median (longitudinal) suture, *MPs* – medioparapsidal suture, *PNWP* – posterior notal wing process, *PSL* – parascutellum, *PSp* – posterior scutal protuberance, *SLS* – sublateroscutum.

of maxilla number of bristles in medial portion reduced to 7, in lateral portion – to 9 or 8 (in *H. caligatis*) or 7 (in *H. morrisonae* – Fig. 32); (5) segment 1 of maxillary palp robust; (6) segment 3 of maxillary palp elongate with very long dense bristles (Peters, 1971: Figs 152, 153); (7) segment 1 of labial palp with straight (not convex) fore margin (Peters, 1971: Figs 143, 144); (8) segment 2 of labial palp elongate, with two regular rows of very long bristles, both rows connected proximally on dorsal side of segment (Fig. 25); (9) hypopharynx short and wide (Peters, 1971: Figs 161, 162); (10) fore tibia with two regular rows of very long bristles on its inner-dorsal side, both rows connected proximally; the most dorsal of these rows is regular up to apex of tibia, becoming more and more sparse distally; the row on inner margin is regular only in proximal part, in middle part of tibia becoming irregular; between these rows of long bristles rows of the smaller ones are situated.

In addition, both Cuban species of *Hagenulus* s. str. have following common characters.

Nymph. All tibiae flattened in the same manner (Figs 27-29). Stout bristles on tibiae as follows: inner-dorsal row on middle and hind tibiae consisting of bristles of various size directed toward outer margin of tibia; inner bristles on fore tibia numerous, on middle and hind tibia differently developed in the two species; outer row of hind tibia dense, consisting of short bristles, not becoming denser at apex; besides, longer and more slender irregularly situated ventral bristles present in distal half of hind tibia (usually 3 in transverse section), they have the same size as bristles of transverse ventro-apical row of hind tibia. Hind tarsus with 1-2 stout bristles on outer margin (apart from a well developed usual row of stout bristles on inner margin). Claws with distal denticle slightly enlarged (Paters, 1971: Fig. 201). All abdominal terga with long denticles on hind margin (Figs 21, 33).

Female imago. Ovipositor long (Peters, 1971: Figs 114, 115).

Subimago. Mesonotal cuticle with dark macula along medioparapsidal suture long, but not wide, anterolateral scutal costa mostly dark, posterior scutal protuberances with light band along medial margin, without light space on fore margin (Fig. 20).

Discussion. This subgenus includes 2 Cuban species – *H. caligatus* and *H. morrisonae*. Peters (1971) placed in his genus *Hagenulus* also unnamed nymph from Jamaica and 3 species described only from imagos. The only character which had allowed him to place the nymph from Jamaica and the Cuban species in the same taxon, is the absence of two even rows of hairs on labrum. But this character is artificial: while in the Cuban species the proximal row is regular, but strongly turned proximally, in *Hagenulus* sp. from Jamaica no regular rows are figured (Peters, 1971: Fig. 190). The distal row may be irregular in different subgenera of *Hagenulus* s. l. – in *Careospina* (Fig. 193), *Borinquena* (Fig. 61), *Turquinophlebia* (Fig. 80). Thus *Hagenulus* sp. from Jamaica should not be placed to the subgenus *Hagenulus* s. str. The subgeneric position of *Hagenulus eatoni* Banks, 1924 (Haiti), *H. jamaicensis* Peters, 1971 (Jamaica), and *H. rangelae* Peters, 1971 (Puerto Rico) is unclear while nymphs of these species are unknown.

Hagenulus (Hagenulus) caligatus Eaton, 1882
(Figs 14-31)

H. caligatus: Eaton, 1883-1888: 113 (partim), Pl. XV, 21bis – fore and hind wings (not figure of genitalia, belonging in fact to *Careospina minuta* Peters, 1971; information of W.L. Peters).

H. caligatus: Peters, 1971: 20 (male and female imagos, nymph).

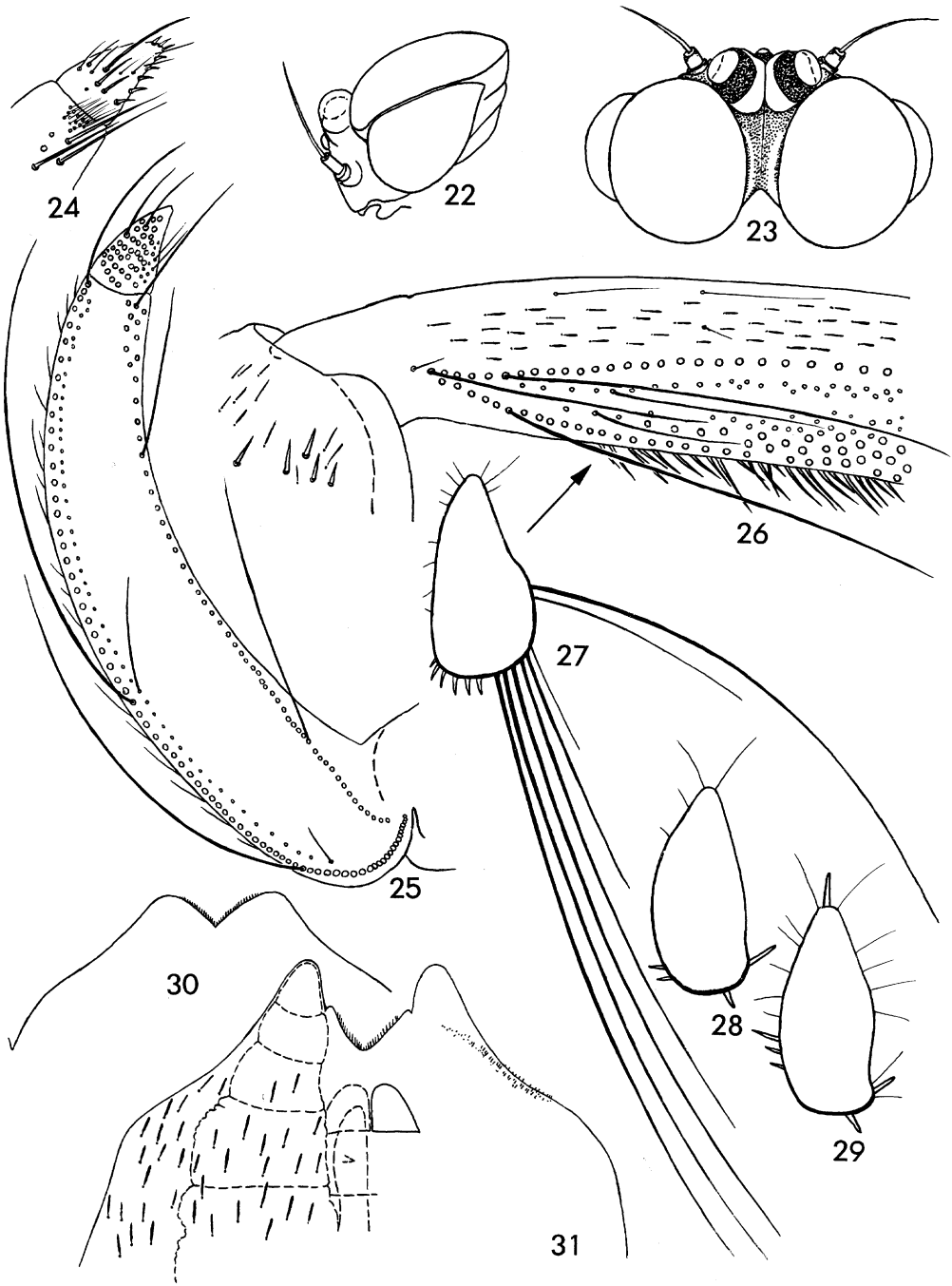
Material. Western Cuba: *prov. Pinar del Rio*: 11 ♂, 9 ♀ imagos, 3 ♂, 4 ♀ subimagos (all reared from nymphs), 43 nymphs, Soroa, 1-7.IV.1989 (N. Kluge).

Nymph. Inner bristles on middle and hind tibiae numerous (2-3 in transverse section). Dorsal surface of head, labrum, mandibles, thorax, legs, dorsal and ventral surfaces of abdomen bearing sparse light stick-shaped bristles with bases narrower than the remaining part (Fig. 21). Other characters as in Peters (1971) and in the characteristics of the subgenus.

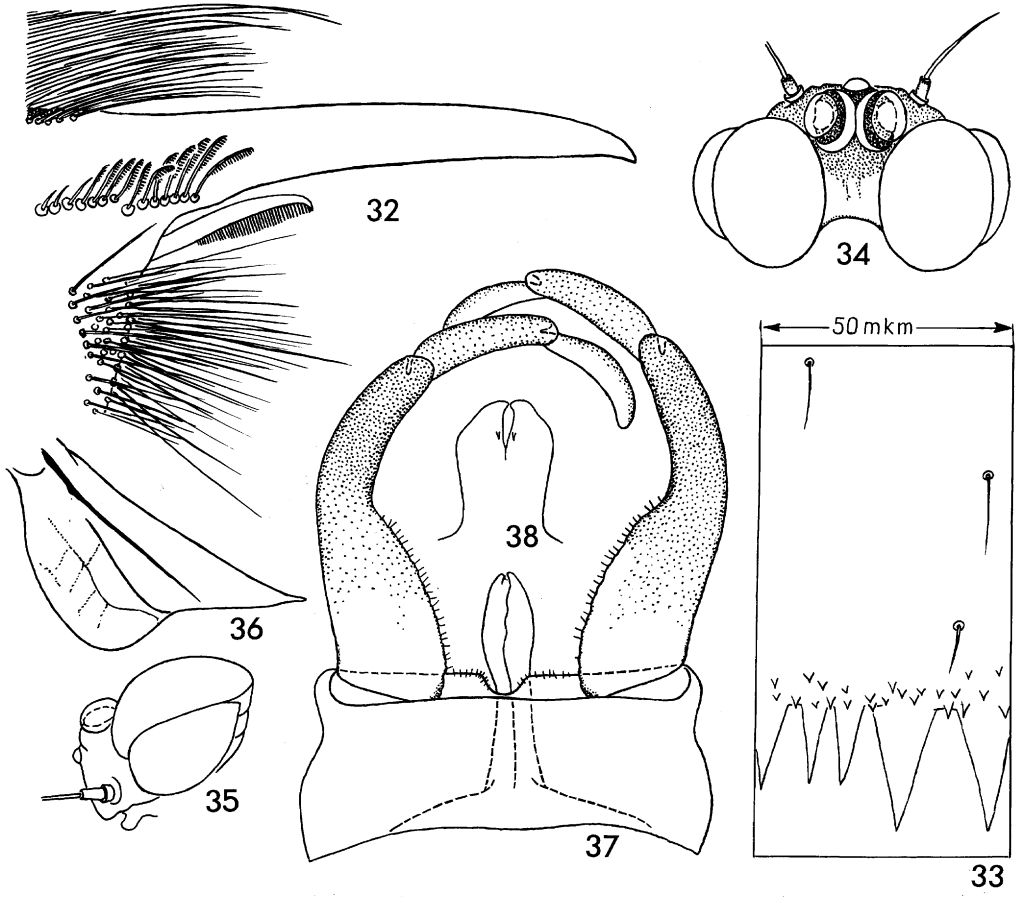
Male and female imagos. Adequately described by Peters, 1971. Body proportions of male imago to be seen from Table 1.

Subimago. Cuticle of mesonotum with brown colour pattern typical for the subgenus. Cuticle of legs, abdomen, and caudal filaments light brownish. Penis with a pair of ventral denticles similar to those of imago.

Egg. Oval, 150 x 90 μm. Surface with small (about 2-3 μm in diameter) cavities and small



Figs 22-31. *Hagenulus (Hagenulus) caligatus* Eaton. **22-23**, male imago, head: **22**, lateral view; **23**, dorsal view. **24-31**, nymph: **24**, segment 3 of labial palp (ventral view); **25**, segments 2 and 3 of labial palp (dorsal view); **26**, proximal half of fore tibia (dorsal view); **27-29**, transverse sections of fore, middle, and hind tibiae; **30**, posterior part of sternum IX (subanal plate) of young male nymph; **31**, the same of mature male nymph (in right half – dorsal view, in left half – ventral view with subimaginal genitalia shown). Figs 24-29 – the same magnification.



Figs 32-38. *Hagenulus (Hagenulus) morrisonae* Peters & Alayo. 32-33, nymph: 32, medio-apical corner of maxilla (ventral view); 33, hind margin of tergum VI. 34-37, male imago: 34, head (dorsal view); 35, head (lateral view); 36, hind wing; 37, genitalia. 38, male subimago (dissected from nymph), penis, ventral view.

(about 1 μm) papillae.

Measurements. Length of fore wing 6-7 mm.

Hagenulus (Hagenulus) morrisonae Peters & Alayo, 1971
(Figs 32-38)

H. morrisonae Peters & Alayo in Peters, 1971: 21.

Material. Eastern Cuba: *prov. Santiago de Cuba*: 12♂, 7♀ imagos, 2♂ subimagos (all reared from nymphs), 2 nymphs, Las Yagias, 12-13.II.1989 (N. Kluge); 3 nymphs, 22.V.1985 (C. Naranjo); 2 ♂, 1 ♀ imago, 63 nymphs, 23.I.1986 (C. Naranjo); 1 ♀ imago, Sto. Domingo, 18.VI.1985 (C. Naranjo); 1 ♀ imago, 17 nymphs, 22.VIII.1983 (C. Naranjo); 5 ♂, 8 ♀ imagos (all reared from nymphs), 5 nymphs, Guamá River near La Alcarraza, El Codillo, and Sandor, 1-9.II.1989 (N. Kluge). Central Cuba: *prov. Sancti Spiritus*: 1 nymph, Caballero River (north of Trinidad), 12-18.IV.1989 (N. Kluge).

Nymph. Inner bristles on middle and hind tibiae small and sparse, forming a single row. Surface of body without such stick-shaped bristles as in *H. (H.) caligatus*, only with bristles of usual form (Fig. 33). Other characters as in Peters, 1971 and in the characteristics of the subgenus.

Male and female imagos. Adequately described by Peters, 1971. Body proportions of male imago as in Table 1.

Subimago. Cuticle of mesonotum with brown colour pattern typical of the subgenus. Cuticle of abdomen pale, nearly colourless, cuticle of legs, caudal filaments, and genitalia brownish.

Penis with ventral pair of very small denticles, absent in imago. Length of fore wing 6-7 mm.

Subgenus **Borinquena** Traver, 1938

Borinquena Traver, 1938: 16 (pro gen.); Peters, 1971: 24 (pro gen.: imago, nymph).
Type species *Borinquena carmentica* Traver, 1938 (Puerto Rico).

Discussion. The genus *Borinquena* was established for two Puerto Rican species – *B. carmentica* and *B. contradicens* Traver, 1938. Later the third species – *Borinquena (Australophlebia) traverae* Peters, 1971 was described from Dominica; this species was placed in the separate subgenus *Australophlebia* Peters, 1971 characterized by the absence of hind wings. Another unnamed species of *Borinquena* from St. Lucia without hind wings was mentioned by Peters (1971: 25). Two undescribed species of *Borinquena* (*Australophlebia*) from Costa Rica are mentioned by McCafferty (1985: 10).

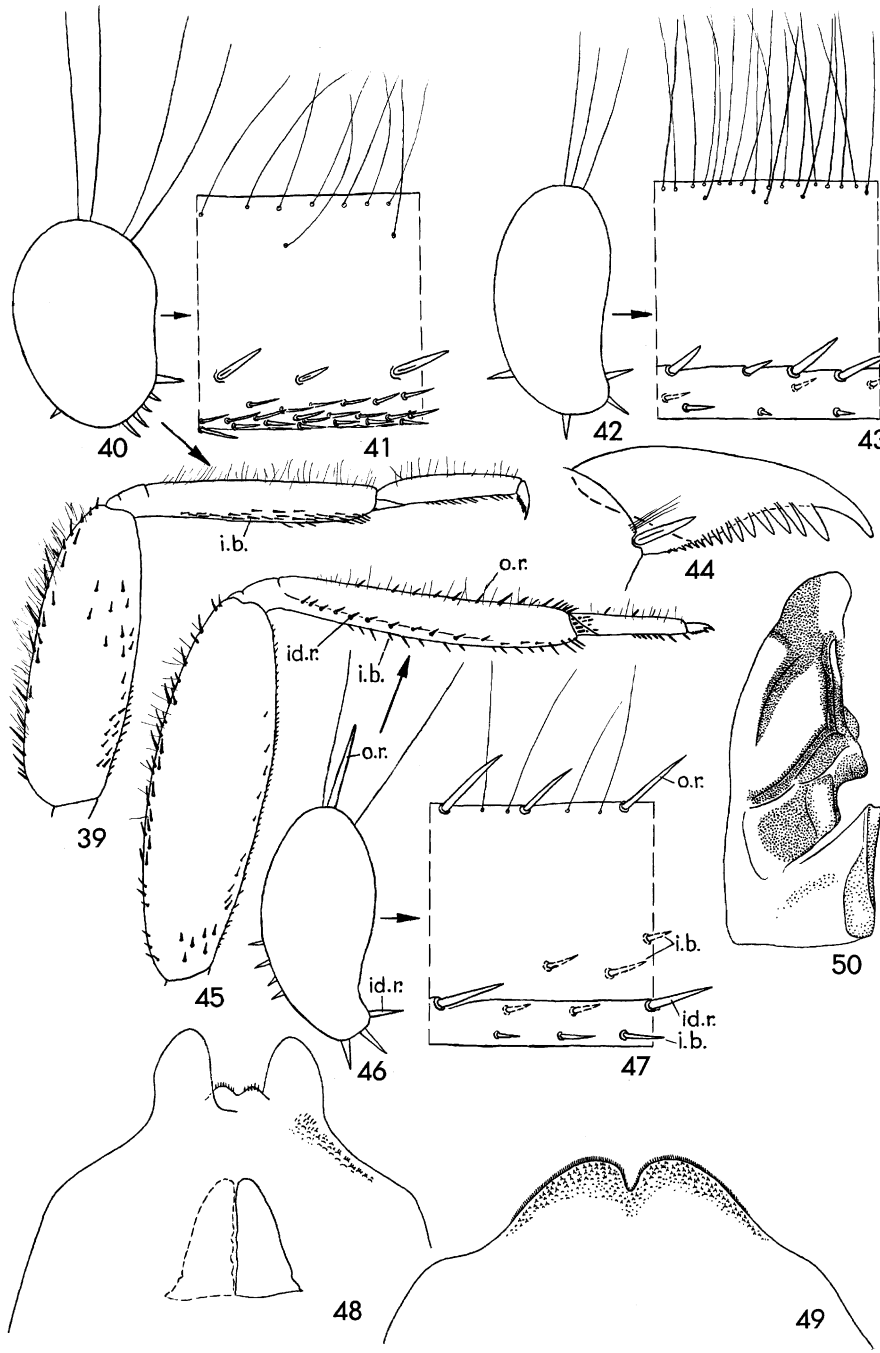
The new Cuban species *H. (B.) sextus* sp. n. has an obvious similarity to the type species of *Borinquena* in imaginal structure. Male imagos of both species have an unusually long straight first segment of forceps and similar penis with a pair of ventral denticles (Fig. 52; Traver, 1938: Figs 12, 41; Peters, 1971: Figs 92, 93); females have a long egg-guide (Fig. 58). The same type of male genitalia and female egg-guide is described also for *Borinquena contradicens*; this species resembles also *H. (B.) sextus* in the form of hind wing, with costal process strongly divergent from the hind part (Fig. 53; Traver, 1935: Fig. 50; Peters, 1971: Fig. 71). While structures of penis and egg-guide of these species are the same as in *Hagenulus* s. str., their forceps form is unique. It gives me basis to treat them as closely related and to place the new Cuban species into the subgenus *Borinquena*. At the same time nymphal structure of the new species does not agree with the formerly given diagnoses of *Borinquena*. The genus *Borinquena* s. l. (including *Australophlebia*) was characterized as having enlarged apical denticles on the claw and two enlarged denticles in the anteromedian emargination of the labrum (Peters, 1971: 26, Figs 192-196, 202, 203). The subgenus *Borinquena* (sensu Peters, 1971) or genus *Borinquena* s. str. (sensu Traver, 1938) was characterized by single, not bifurcate tergaliae (Peters, 1971: 27, Fig. 209). In the new Cuban species all these characters are missing: claws with denticles progressively larger apically (Fig. 44), labrum with several subequal denticles (Fig. 60), and tergaliae bifurcate (Figs 64-66). The only stated imaginal generic character of *Borinquena* allowing it to be distinguished from *Hagenulus* s. str. is the absence of dark clouds on the cross veins of the fore wing (Traver, 1938: 7; Peters, 1971: 26). In the new Cuban species females have slightly developed clouds (Fig. 57), wings of male lack clouds.

According to the original description, nymphs of *Borinquena carmentica* (which were associated with imago by rearing) have relatively long third segment of labial palp, which is longer than 1/2 of the second segment (Traver, 1938: Fig. 32). The new Cuban species also has labial palp (Fig. 63) of the same structure allowing it to be distinguished from all other Cuban Leptophlebiidae with much shorter third segment of labial palp. But in the redescription of the genus *Borinquena* by Peters (1971) it is stated that "segment three one-fifth to one-third length of segment 2, triangular" and a very short third segment is figured (Peters, 1971: 25, Fig. 146). So it seems that nymphs of some other species were described and figured by W. Peters under the name of "*Borinquena carmentica*".

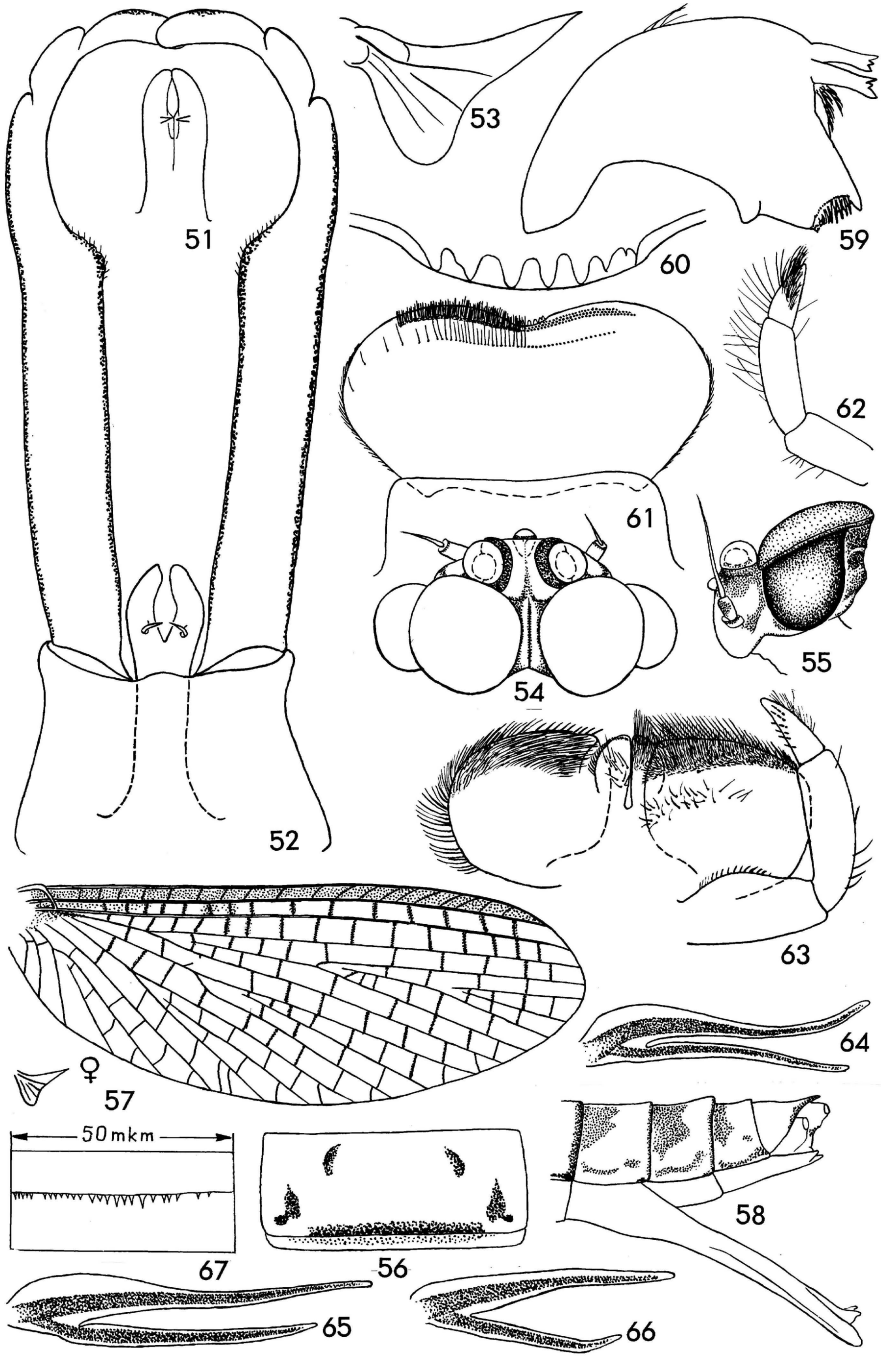
The subgenus *Borinquena* may presumably be characterized as follows. It is closely related to the subgenus *Hagenulus* s. str. in having the same structure of penis and egg-guide and differs in two apomorphies: (1) unusually long first segment of forceps and (2) secondarily enlarged third segment of nymphal labial palp; in contrast to *Hagenulus* s. str., *Borinquena* has no apomorphies connected with filtering specialization of nymphal mouthparts and fore legs. Relation of "*Borinquena (Australophlebia) traverae*" to true *Borinquena* is doubtful, as the features that it shares with the Puerto Rican species of *Borinquena* (enlarged apical denticle of claw and enlarged pair of denticles on labrum) appear independently in different subgenera of the genus *Hagenulus* (Figs 197 and 212; 191 and 192).

Hagenulus (Borinquena) sextus sp. n.
(Figs 39-67)

Holotype. ♂ imago (reared from nymph), Eastern



Figs 39-50. *Hagenulus (Borinquena) sextus* sp. n. **39-49**, nymph: **39-41**, fore leg: **39**, dorsal view; **40**, transverse section of tibia; **41**, part of tibia, dorsal view. **42-43**, middle tibia: **42**, transverse section; **43**, dorsal view. **44**, claw; **45-47**, hind leg: **45**, dorsal view; **46**, transverse section of tibia; **47**, part of tibia, dorsal view. **48**, posterior part of sternum IX (subanal plate) of mature male nymph (in right half – dorsal view, in left half – ventral view); **49**, the same of mature female nymph (ventral view); **50**, subimago: exuvia of right half of mesonotum. *id.r.* – inner-dorsal row of bristles, *i.b.* – inner bristles, *o.r.* – outer row of bristles on tibia.



Figs 51-67. *Hagenulus (Borinquena) sextus* sp. n. **51**, male subimago: penis, ventral view; **52-56**, male imago: **52**, genitalia; **53**, hind wing; **54**, head, dorsal view; **55**, head, lateral view; **56**, abdominal tergum VI (spread on slide). **57-58**, female imago: **57**, fore and hind wings; **58**, apex of abdomen (lateral view). **59-67**, nymph: **59**, left mandible; **60**, anteromedian emargination of labrum; **61**, labrum; **62**, maxillary palp; **63**, labium (in left half – dorsal view, in right half – ventral view); **64-66**, tergaliae I, IV, and VII; **67**, hind margin of abdominal tergum VI. Figs 59, 61-63 – the same magnification.

Cuba: *prov. Santiago de Cuba*, arroyo Paco (tributary of Palma Mocha River near Pico Turquino), 24.II.1989 (N. Kluge).

Paratypes (all from the same locality as holotype). 2 ♂ imagos, 3 ♀ imagos, 4 ♀ subimagos (all reared from nymphs), 6 nymphs, 18-24.II.1989 (N. Kluge); 6 nymphs, 16.V.1985 (C. Naranjo); 2 nymphs, 2.VI. 1985 (C. Naranjo); 3 nymphs, 21.VI.1985 (C. Naranjo); 1 ♂ and 6 ♀ subimagos, 23.VI. 1985 (C. Naranjo).

Nymph. Labrum somewhat indistinctly darkened in its distal part; its distal row of bristles irregular; in anteromedian emargination 4, 5 or 6 subequal denticles. Mandibles indistinctly darkened laterally. Maxilla with 12-15 bristles in lateral portion of subapical ventral row of comb-like bristles, with 9-10 bristles in median portion of this row. Distal segment of maxillary palp relatively long. Form of hypopharynx as in majority of Atalophlebiinae (Peters, 1971: Figs 157-160). Glossae and paraglossae with very dense long slender bristles on their ventral side; these fields of bristles reaching distal margin of glossa and paraglossa. Distal segment of labial palp relatively long. Pro- and mesonotum with indistinct cuticular maculation, cuticle of pronotum with light lateral margins. Dark hypodermal patterns are visible through cuticle: dark sublateral stripe on pro- and mesonotum and two pairs of large dark maculae, one of them corresponding to the anterolateral scutal costa, and another to the posterior notal wing process. Legs with cuticle nearly colourless. A dark hypodermal mark may be visible through the cuticle in the middle of femur. Middle and hind tibiae slightly flattened. Stout bristles on tibiae as follows: inner-dorsal row sparse on fore tibia, distinct on middle and hind tibiae; inner bristles on fore tibia moderately numerous (3-4 bristles in transverse section), much less numerous on middle and hind tibiae (1-2 bristles in transverse section); inner bristles usually smaller than bristles of inner-dorsal row; outer row of hind tibiae not dense, becoming very dense at apex. Long slender bristles forming a row along outer margin of tibiae. Claws with distal denticle not enlarged, apices of denticles forming nearly straight line. Abdomen light with hypodermal dark patterns. Male nymphs with patterns as in Fig. 56: dark band on hind margin, small paired dark maculae on terga II-VII and widely darkened terga VIII-IX; tergum X light. Female nymphs have wider dark paired maculae on terga II-VII. Posterolateral spines on abdominal segments IX developed, but not pointed. No distinct denticles on hind margin of abdominal segments, only very small irregular spines may be present on posterior abdominal terga. Hind margin of subanal plate with minute spines, those on its dorsal (inner) side very small. 7 pairs of tergaliae with narrow lamellae separated not up to base.

Male imago. Head brown. Upper eyes low, mesally separated, with facet surface light grey and hind surface dark brown. Prothorax pale, pronotum yellowish with dark brown border on postero-lateral corner. Mesonotum generally pale, partly shaded with brown; antelateroparapsidal suture contrastingly pale between intensely shaded submedioscutum and anterolateral scutal costa; in the same way hind portion of lateroscutal suture contrastingly pale between intensely shaded sublateroscutum and hind part of lateroscutum; lateroparapsidal sutures also pale. Lateral and ventral surface of mesothorax pale yellowish, with selected membranous areas dark blackish brown; paracoxal suture of episternum and anterior margin of basisternum shaded with brownish. Metathorax generally pale yellowish, with membranous pleural areas blackish brown. All legs pale yellowish, femora with wide reddish brown bands in the middle, at apex, and sometimes at base; tibiae with apex dark brown. Fore wing hyaline, with brownish shade at base (proximad to costal brace). Longitudinal veins brownish yellow, cross veins in anterior part of wing brown. Hind wing small, colourless, with long costal process. Abdominal segments I-VII whitish, with dark blackish band on hind margin and small paired maculae of the same colour; sterna colourless. Terga VIII-IX yellowish brown. Styliger pale, very narrow. Forceps with very long first segment, pale, shaded with brownish on inner surface and on sides. Penis small, with apices curved ventrally, with a pair of small ventral spines. Caudal filaments pale whitish with contrasting blackish articulations of segments.

Body proportions as in Table 1.

Female imago. General colour of terga yellowish brown, darker than in male; sterna pale. Thoracic terga with patterns as in male. Femora yellowish, with wide brown bands in the middle, at apex, and sometimes at base. Tibiae entirely brown, tarsi lighter. Wings shaded with brownish, more intensely in costal field and in proximal part of subcostal field; veins brown; cross veins in anterior half of wing with narrow brown cloud around them. Hind wing

brownish, of the same form as in male. Abdominal terga with dark blackish band on hind margin, with a pair of longitudinal brown stripes along lateral margins, and with a pair of large indistinct dark brown maculae close to anterior margin (these maculae being smaller, roundish and widely separated on anterior segments, and larger on segments VII-IX). Ovipositor long, pale.

Subimago. On mesonotal cuticle dark macula along medioparapsidal suture very narrow, anterolateral scutal costa pale, and posterior scutal protuberances with light band along their medial and anterior margins. Cuticle of legs, wings, abdomen, and caudal filaments brownish. Penis with a pair of ventral spines similar to those of imago.

Egg. Similar to that of *H. (H.) caligatus.*

Measurements. Length of fore wing 6-7 mm.

Comparison. Nymphs of the new species clearly differ from those of the Puerto Rican species *H. (B.) carmenticus* Trav. and *H. (B.) contradicens* Trav. in bifurcate tergaliae. Male and female imagos and subimagos of the new species can be distinguished from those of the Puerto Rican species by the form of hind wing: in the new species its hind part is distinctly larger than in *H. (B.) carmenticus*, but distinctly smaller than in *H. (B.) contradicens.*

Subgenus **Turquinophlebia** subgen. n.

Type species *Hagenulus (Turquinophlebia) grandis* sp. n.

Etymology. "Turquino-" – from the mountains Cordillera del Turquino and the highest mountain peak of Cuba – Pico Turquino below which the type species was collected; "-phlebia" – the second part of the generic name *Leptophlebia* (from Greek "phlebos" – vein).

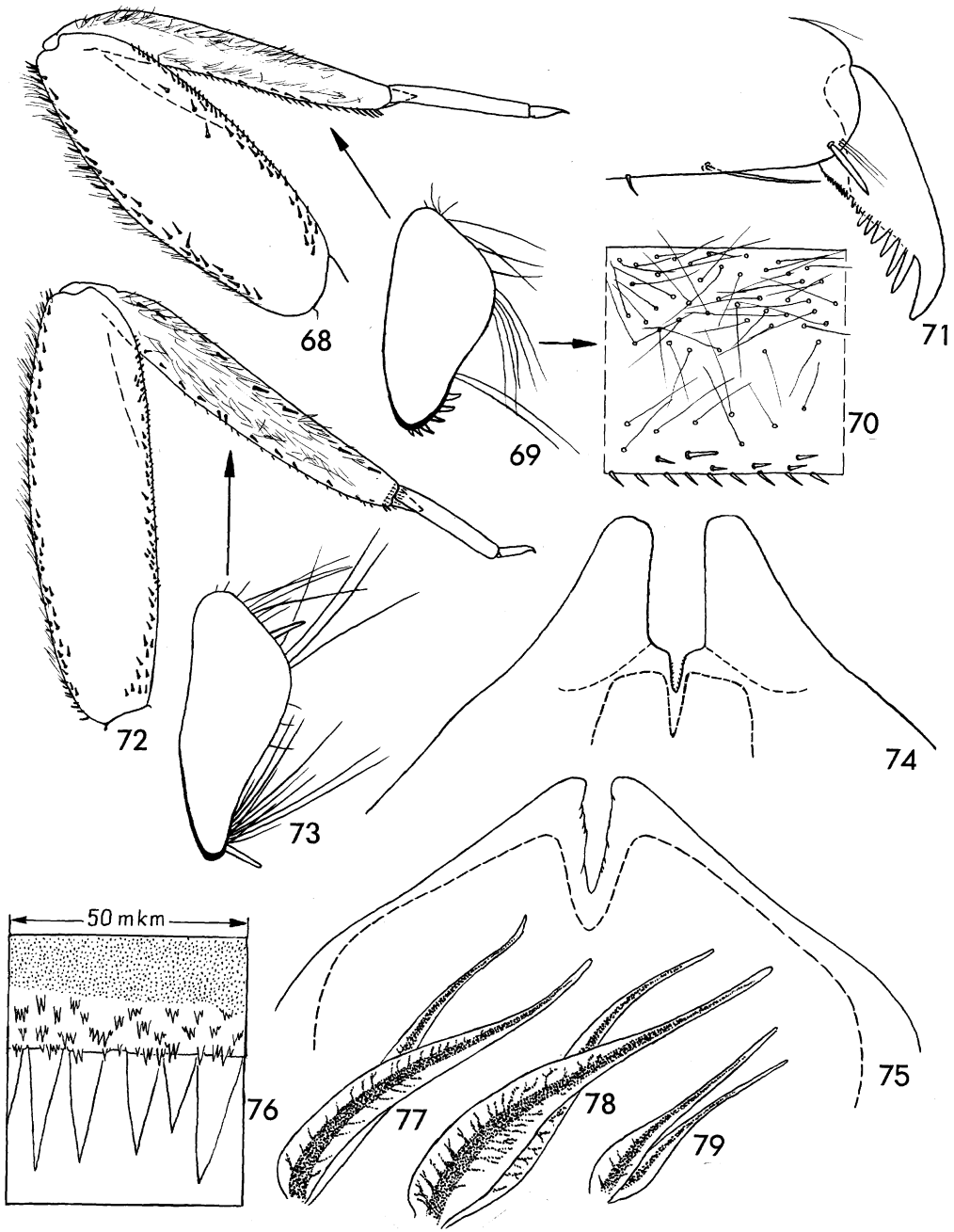
The only species placed in this subgenus can be distinguished from all other representatives of the genus *Hagenulus* s. l. by the following characters of nymph: (1) anteromedian emargination of labrum narrow, without denticles (Fig. 81); (2) segment 3 of labial palp about 0.45 length of segment 2 (Fig. 83) (shorter than in *Borinquena*, but distinctly longer than in all other subgenera); (3) paraglossae wide (Fig. 83) (as wide as in subgenus *Hagenulus* s. str., but wider than in all other subgenera); (4) tibiae with flattened ventral surface (Figs 69, 73), (5) emargination of hind margin of abdominal sternum IX very deep and narrow (Figs 74, 75). Other characters as in Table 2.

Hagenulus (Turquinophlebia) grandis sp. n. (Figs 68-97)

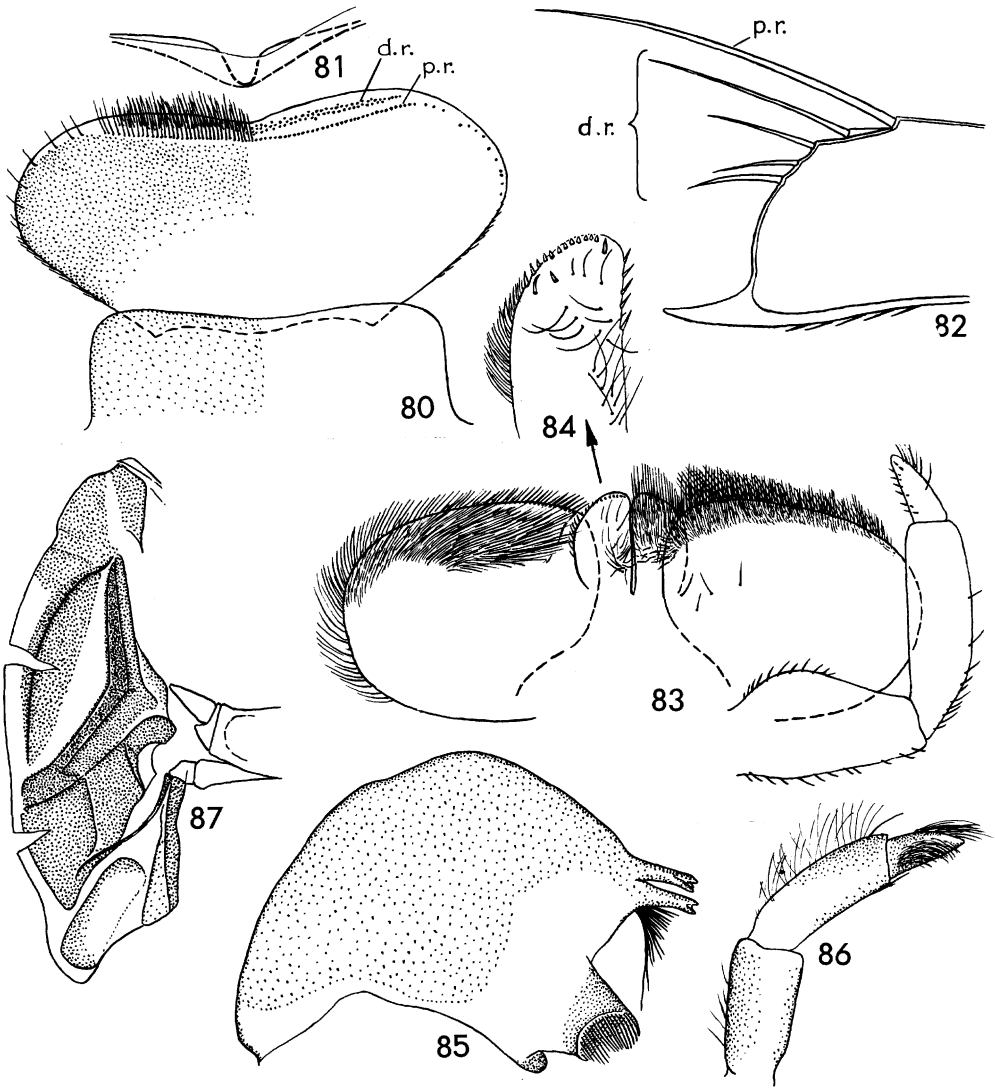
Holotype. ♂ imago (reared from nymph), Eastern Cuba: *prov. Santiago de Cuba*: arroyo Paco (tributary of Palma Mocha River near Pico Turquino), 21.II.1989 (N. Kluge).

Paratypes. 1 ♀ imago (reared from nymph), 42 nymphs, the same locality as holotype, 18-24.II.1989 (N. Kluge).

Nymph. Labrum strongly widened distally, darkened in its distal part, its distal row of bristles irregular; anterior emargination very narrow, not bearing denticles, only with a pair of obtuse flat projections at sides. Mandibles with strongly convex outer margin, darkened laterally. Maxilla with 10-13 bristles in lateral portion of subapical ventral row of comb-like bristles, with 9-10 bristles in medial portion of this row. Distal segment of maxillary palp relatively long. Form of hypopharynx as in most Atalophlebiinae (as in Peters, 1971: Figs 157-160). Paraglossae wide. Glossae and paraglossae with very dense long slender bristles on their ventral side; these fields of bristles reaching distal margins of glossae and paraglossae. Distal segment of labial palp relatively long. Pronotum with cuticle lighter than that of mesonotum. Through cuticle dark hypodermal patterns are visible: dark sublateral stripe at pro- and mesonotum, dark maculation at pronotum, and dark lines at pronotum corresponding to anterolateral scutal costa, lateral scutal suture, and posterior notal wing process. Legs with cuticle nearly colourless. Through cuticle dark hypodermal maculae are visible: a large longitudinal macula parallel to inner margin and a small apical macula. All tibiae flattened, with flat ventral surface and inner margin convex, widest in their middle, narrowed apically. Stout bristles on tibiae as follows: inner-dorsal row sparse, consisting of small bristles; inner bristles not numerous and very small on all tibiae, including fore tibiae; outer row of hind tibia sparse all over its length, spaced on dorsal surface of tibia at some distance from its outer margin. Dorsal surface of tibiae with numerous irregular long thin hairs not forming regular row along outer margin. Claws with distal denticle not enlarged, apices of denticles forming a straight line. Abdomen with cuticle of terga indistinctly pigmented, sometimes with lighter median line and sides, and other patterns.



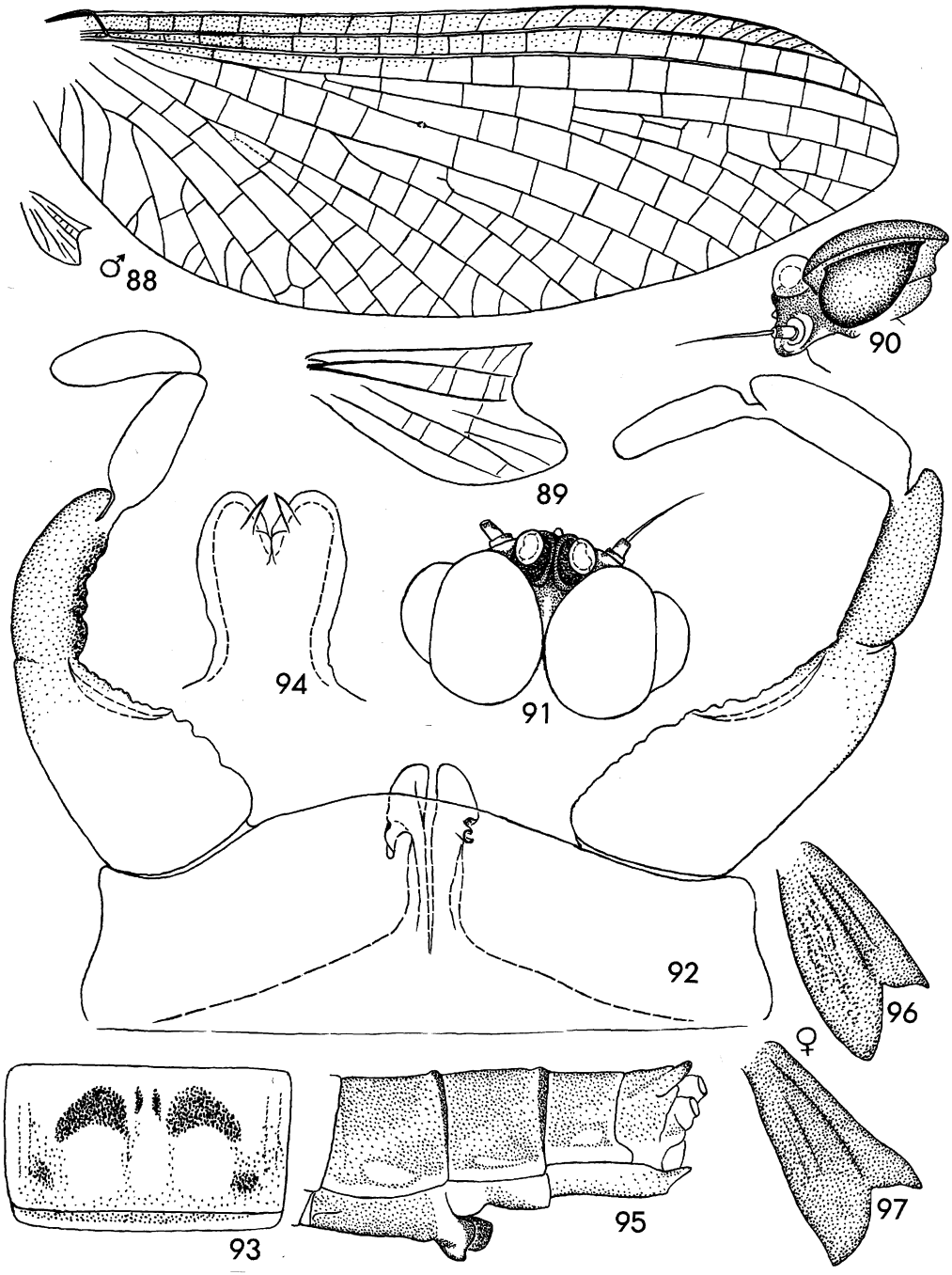
Figs 68-79. *Hagenulus (Turquinophlebia) grandis* sp. n., nymph. **68-70**, fore leg; **68**, dorsal view; **69**, transverse section of tibia; **70**, part of tibia, dorsal view. **71**, claw. **72-73**, hind leg: **72**, dorsal view; **73**, transverse section of tibia. **74**, posterior part of sternum IX (subanal plate) of mature male nymph (ventral view, nymphal penis shown by interrupted line). **75**, the same of mature female nymph (ventral view, subimaginal postgenital plate shown by interrupted line). **76**, hind margin of tergum VI in the middle. **77-79**, tergaliae I, III, and VII.



Figs 80-87. *Hagenulus (Turquinophlebia) grandis* sp. n. **80-86**, nymph: **80**, labrum; **81**, anteromedian emargination of labrum (dorsal view); **82**, the same in longitudinal section; **83**, labium (in left half – dorsal view, in right half – ventral view); **84**, glossa (dorsal view); **85**, left mandible; **86**, maxillary palp. **87**, subimago, exuvia of right half of mesonotum. Figs 80, 83, 85, 86 – the same magnification. *d.r.* – distal row, *p.r.* – proximal row of bristles on labrum.

Through cuticle dark hypodermal patterns are visible (in male nymph as in Fig. 93, in female nymph with longer dark maculae). Terga with long denticles on hind margin, at fore segments these denticles developed only on medial part of hind margin, at hind terga – nearly on all hind margin. Subanal plate of male and female nymph with very narrow median incisor, minute spines inside incisor, no spines on its dorsal (inner) side. 7 pairs of tergaliae with somewhat widened lamellae.

Male imago. Head blackish. Upper eyes low, mesally contiguous, facet surface grey. Paired ocelli strongly brought together. Thorax with intensive blackish maculation on pleura and sides of notum, pronotum entirely with dark



Figs 88-97. *Hagenulus (Turquinophlebia) grandis* sp. n. 88-93, male imago: 88, fore and hind wings; 89, hind wing; 90, head (lateral view); 91, head (dorsal view); 92, genitalia; 93, abdominal tergum V (spread on slide). 94, subimago (dissected from nymph): penis, ventral view; 95-97, female imago: 95, apex of abdomen (lateral view); 96-97, hind wings.

maculation. Fore femur dark brown with base pale yellowish; fore tibia dark brown with extreme base pale yellowish. Middle and hind legs paler, with longitudinal brown lines at femur and tibia, apex of tibia brown; tarsus contrastingly pale whitish. Fore wings slightly yellowish, costal and subcostal fields shaded with pale brown. Veins pale brown. Hind wing narrow, costal process wide. Abdomen generally whitish, with greyish maculation on terga II-VII as in Fig. 93; terga VIII-IX nearly entirely greyish; sterna I-IX with greyish maculae along median line (near the corresponding nerve ganglia). Styliger short, bases of forceps widely separated. Forceps pale, distal part of longest segment shaded with brown. Penis small, without spines, but with a pair of tube-like processes directed ventrally.

Body proportions see in Table 1.

Female imago. Thorax and leg colour as in male, abdomen nearly entirely brownish. Hind wing narrower than in male. Caudal filaments uniformly pale. Ovipositor short.

Subimago. Mesonotal cuticle with dark macula along medioparapsidal suture large, anterolateral scutal costa dark, posterior scutal protuberances entirely dark. Cuticle of legs with brown outer margin of femur. Wings brownish. Cuticle of abdomen pale, colourless. Penis of male with a pair of ventral spines, absent in imago.

Egg. Oval, 160 x 110 μm covered with thick (2 μm) jacket consisting of thin basal membrane, numerous discs (each about 6 μm in diameter) lying on this membrane, and dense fibrillae rising from the basal membrane perpendicular to the egg surface and filling all spaces between the discs. This structure can be transformed into a high (6-8 μm) brush of fibrillae directed perpendicularly to the egg surface.

Measurements. Length of fore wing 10 mm.

Habitat. All nymphs were collected in the upper reaches of a small stream in the highest part of Cuban mountains only in February, 1989. Earlier (in 1985-1986) extensive material was collected from the same stream by C. Naranjo (including also the specimens collected in February) but no representatives of *H. (T.) grandis* were found in that period. Nymphs of *H. (T.) grandis* are the largest among Cuban Leptophlebiidae and hence easely recognizable, their absence in C. Naranjo's collection meaning that in 1985-1986 this species was absent in the stream.

Subgenus **Poecilophlebia** subgen. n.

Type species *Hagenulus (Poecilophlebia) pacoi* sp. n.

Etymology. "Poecilo-" – from Greek poecilos – variegated; "-phlebia" – from Greek phlebos – vein.

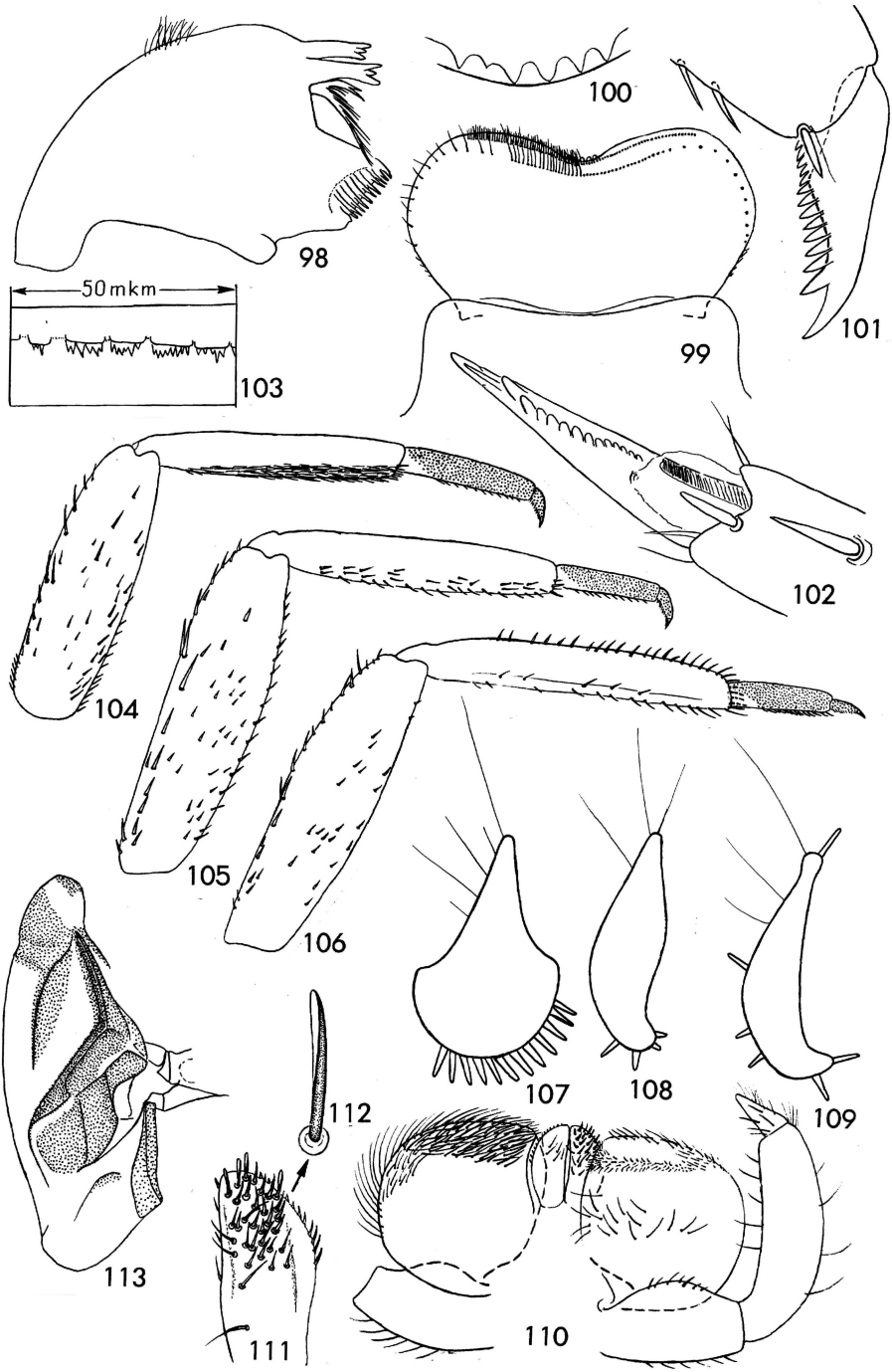
The only species placed in this subgenus can be distinguished from all other representatives of the genus *Hagenulus* by structure of nymphal tibiae: all tibiae with strongly flattened outer margin, hind tibiae extreamly flattened, with concave dorsal surface (Figs 107-109). This species has also unique structure of imaginal penis with a latero-ventral pair of processes (Fig. 115). Other characters as in Table 2.

Hagenulus (Poecilophlebia) pacoi sp. n. (Figs 98-129)

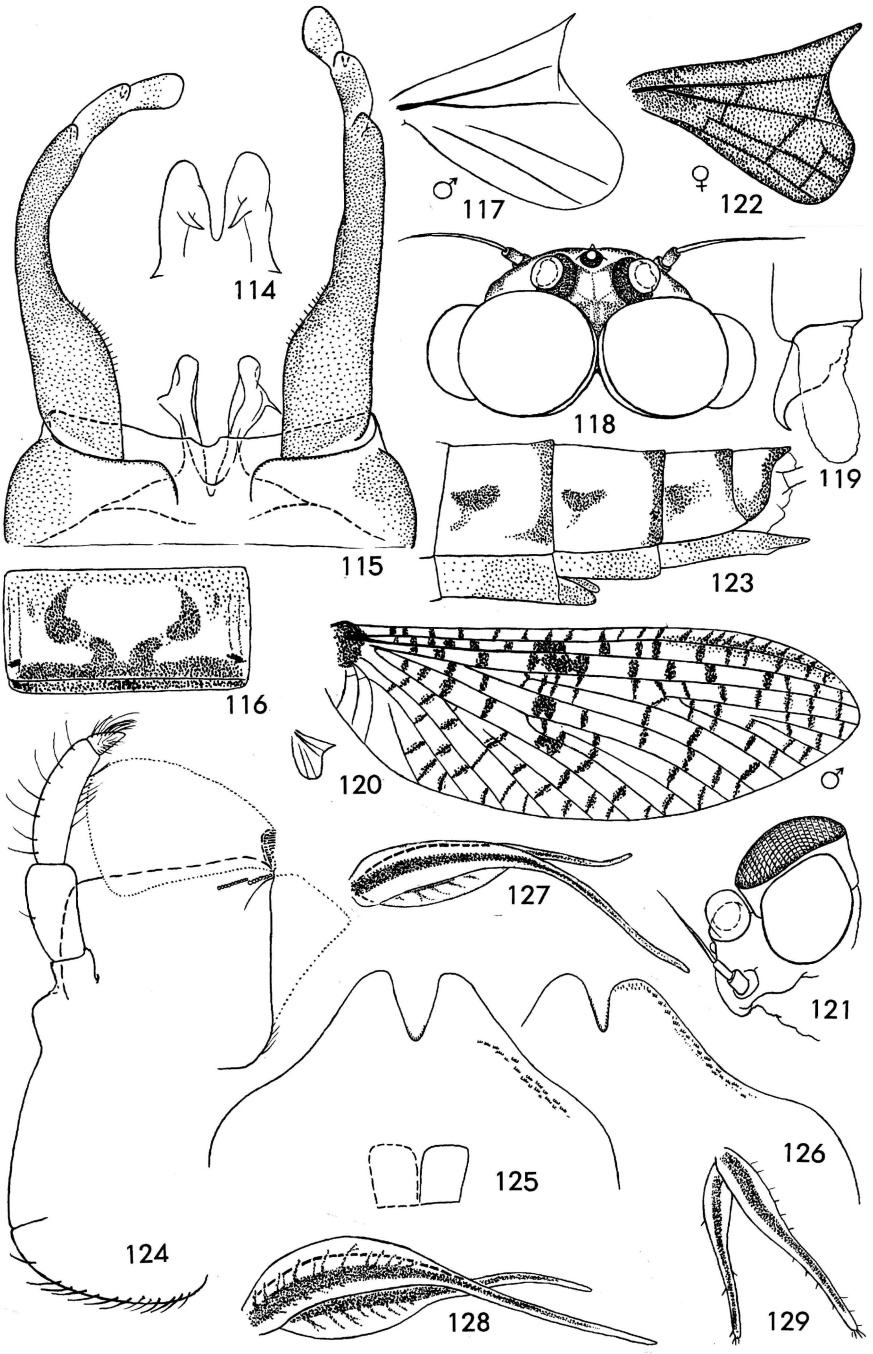
Holotype. ♂ imago (reared from nymph), Eastern Cuba: *prov. Santiago de Cuba*: arroyo Paco (tributary of Palma Mocha River near Pico Turquino), 22.II.1989 (N. Kluge).

Paratypes (all from the same locality as holotype). 1 ♀ imago (reared from nymph), 1 nymph, 18-24.II.1989 (N. Kluge); 1 nymph, 6.II.1989 (C. Naranjo).

Nymph. Cuticle of head and thorax pale, with maculation indistinct. Distal row of bristles on labrum regular, except for its median part above anteromedian denticles. Maxilla with 10-13 bristles in lateral portion of subapical ventral row of comb-like bristles, with 8-9 bristles in median portion of this row. Distal segment of maxillary palp short. Form of hypopharynx as in majority of Atalophlebiinae (as in Peters, 1971: Figs 157-160). Glossae ventrally with stout bristles. Paraglossae ventrally with a narrow subapical stripe of slender bristles, a bare space present between this stripe and apical margin of paraglossa. Distal segment of labial palp short. Through cuticle of thorax hypodermal colour patterns are visible: dark sublateral stripe and a pair of dark longitudinal maculae on pronotum, two pairs of dark oblique maculae on mesonotum (on the places corresponding to anterolateral scutal costa and to posterior notal wing process). Legs with colourless cuticle on femur and tibia, cuticle of tarsus intensely darkened with yellowish brown. Through cuticle of femur dark brown hypodermal mark is visible on apical inner corner of femur; this mark is well developed on fore and, especially, on hind femur, but indistinct on middle femur. Tibiae unusually strongly flattened: fore tibiae



Figs 98-113. *Hagenulus (Poecilophlebia) pacoi* sp. n. **98-112**, nymph: **98**, left mandible; **99**, labrum; **100**, anteromedian emargination of labrum; **101**, claw (dorsal view); **102**, claw (view from inner side); **103**, hind margin of tergum VI in the middle; **104-106**, fore, middle, and hind legs (dorsal view); **107-109**, transverse sections of fore, middle, and hind tibiae; **110**, labium (in left half – dorsal view, in right half – ventral view); **111**, glossa (ventral view); **112**, bristle on ventral side of glossa. **113**, subimago, exuvia of right half of mesonotum. Figs 89, 99, 110 – the same magnification.



Figs 114-129. *Hagenulus (Poecilophlebia) pacoi* **sp. n. 114,** subimago: penis (ventral view); **115-121,** male imago: **115,** genitalia; **116,** abdominal tergum V (spread on slide); **117,** hind wing; **118,** head (dorsal view); **119,** fore claw; **120,** fore and hind wings; **121,** head (lateral view). **122-123,** female imago: **122,** hind wing; **123,** apex of abdomen (lateral view). **124-129,** nymph: **124,** maxilla, ventral view (in the same scale as Figs 98, 99, 110); **125,** posterior part of sternum IX (subanal plate) of mature male nymph (in right half – dorsal view, in left half – ventral view); **126,** the same, female mature nymph (dorsal view); **127-129,** tergaliae I, IV, and VII.

flattened only in their outer margin and with thick inner side; middle and hind tibiae strongly flattened, hind tibia with concave dorsal surface. Stout bristles on tibiae as follows: inner-dorsal row on fore tibia indistinct, on middle tibia consisting of relatively small bristles, on hind tibia of larger bristles; inner bristles on fore tibia very numerous, on middle tibia less numerous (1-3 in transverse section) and larger, on hind tibia sparse (1-2 in transverse section) and small; outer row of hind tibia dense, becoming very dense at apex. Long thin hairs forming regular row along outer margin of middle tibia. Claws with distal denticle slightly thicker than the remaining ones, apices of denticles forming nearly straight line. Abdomen light, with hypodermal dark patterns as in Fig. 116: wide dark band on hind margin and a pair of longitudinal dark maculae. Posterolateral spines on segments VI-VIII obtuse, on segment IX sharp. No distinct denticles on hind margins of abdominal terga, only very small denticles present in their median portions. Median incision of sternum IX deep, with a row of minute acute spines; spines on dorsal (inner) side of subanal plate very small. 7 pairs of tergaliae with lamellae wide and deeply separated.

Male imago. Head yellowish brown with dark brown margins of face and borders around bases of antennae and ocelli. Upper eyes not large, their stems contiguous, yellowish brown, facet surfaces with brown marginal ring. Pronotum yellowish brown with dark brown lateral and front borders and with a pair of dark brown oblique stripes. Meso- and metanotum light brown with dark brown and yellowish patterns. Fore femur brown; fore tibia pale yellowish in proximal part, becoming darker toward apex, and blackish at apex; segments II-V of fore tarsus colourless in their proximal parts, brownish in their distal parts; segment I (rudimentary) and claws pale. Middle and hind legs pale yellowish with dark brown maculae on inner-apical corner of femur and on apex of tibiae; tarsal segments II-V darkened distally. Fore wing translucent with dark brown veins and wide dark brown maculae around cross veins; base proximad to humeral vein dark brown. Hind wing pale, basally darkened with brown. Abdomen pale brownish, each of terga II-IX with a pair of comma-like dark brown spots, terga II-VIII with dark brown stripe on hind margin. Forceps brown. Penis pale, with a pair of weak pointed processi directed latero-ventrally. Caudal filaments pale with contrasting blackish pattern: long dark sections alternate with short ones.

Body proportions as in Table 1.

Female imago. Colour of body as in male, with the same patterns on abdominal terga. Fore femur brown; fore tibia brown, paler at base, blackish at apex; tarsal segment I pale, segments II-V dark. Middle and hind legs intensely yellowish brown, with dark brown maculae on apices of femur and tibia; tarsal segment I pale, segments II-V darkened. Wings somewhat darker than in male, especially costal field of both wings. Hind wing shorter than in male. Ovipositor short.

Subimago. Mesonotal cuticle with dark macula along medioparapsidal suture relatively short, anterolateral scutal costa dark, and posterior scutal protuberances with light band along their medial and anterior margins. Cuticle of wings, legs, and abdomen brownish; cuticle of legs with dark brown apical 1/4 of femur and base of tibia. Penis with a pair of ventral spines.

Egg. Similar to that of *H. (H.) caligatus.*

Measurements. Length of fore wing 6.5-7.5 mm.

Subgenus **Careospina** Peters, 1971

Careospina Peters, 1971: 11 (pro gen.: imago, nymph). Type species *Careospina hespera* Peters & Alayo, 1971 (Cuba).

This subgenus can be separated from other subgenera of the genus *Hagenulus* s. l. by the structure of male genitalia: penis lobes of imago and subimago deeply divided, very long, slender, without spines or denticles. It is interesting to note, that while imagos and subimagos of three Cuban species have similar form of penis (Figs 136, 163, 176), the form of penis rudiments of their nymphs is quite different (Figs 150, 175, 188).

The examined species of *Careospina* have following common characters.

Nymph. Mandibles with outer margin moderately convex (Peters, 1971: Fig. 169) (as in *Farrodes, Borinquena, Poecilophlebia, Traverina*, and majority of other Atalophlebiinae, but in contrast to *Hagenulus* s. str. and *Turquinophlebia*). Maxilla of usual form (as in all other Hagenulini except *Hagenulus* s. str.), with segment 3 of maxillary palp small (Peters, 1971: Fig. 150); subapical ventral row of comb-like bristles with 9-11 bristles in its lateral portion, with 8-9 bristles in its medial

portion. Form of hypopharynx as in majority of Atalophlebiinae (Peters, 1971: Fig. 159) (as in all other Hagenulini except *Hagenulus* s. str). Glossae ventrally with stout bristles; paraglossae not wide, ventrally with a narrow subapical stripe of thin bristles separated by bare space from apical margin of paraglossa; distal segment of labial palp short (Peters, 1971: Fig. 141; the same in *Poecilophlebia*, Figs 110-111, and in *Traverina*). Stout bristles of femora and tibiae long and slender, outer row of hind tibia consisting of very long and very small bristles (Figs 158, 160). Long fine hairs form a regular row on outer margin of tibiae (Figs 153-160).

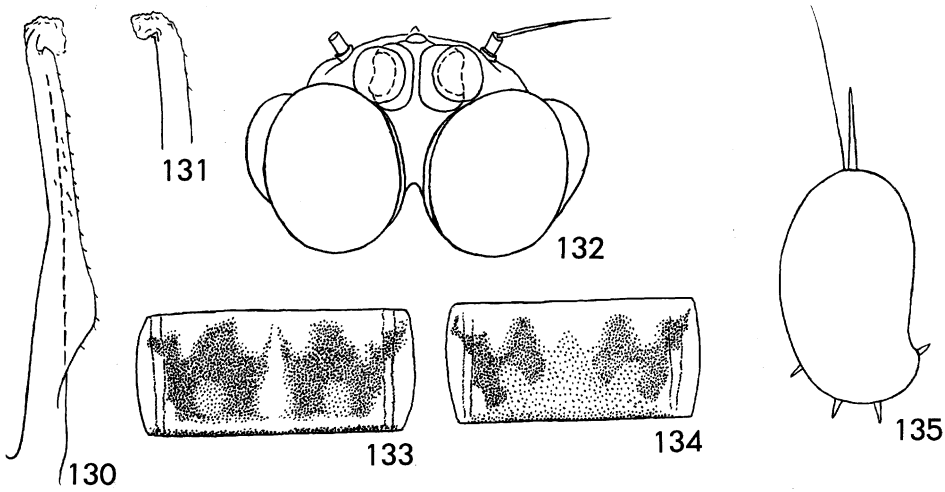
Female imago. Ovipositor short (Peters, 1971: Fig. 112) (as in *Turquinophlebia, Poecilophlebia*, and *Traverina*, but in contrast to *Hagenulus* s. str. and *Borinquena*).

Subimago. Mesonotal cuticle with anterolateral scutal costa dark, posterior scutal protuberances with narrow light wedge on anterior margin and light band along medial margin (as in *Traverina* – Figs 201, 222). Penis without denticles (Figs 150, 171, 188).

Egg. Oval or of irregular form. Surface consisting of very low wide convexities close to each other, each containing irregularly spiralling fibrillae (similar to *Ulmeritus carbonelli* Trav.: Dominguez, 1991: Figs 30-31, but convexities smaller in diameter); diameter of these convexities (or shortest distance between their centres) about 15 μm. Under each such convexity formed by fibrillae, egg chorion forms a shallow wide concavity. In unrolled condition [found in *H. (C.) evanescens*] fibrillae form a brush about 10 μm height.

Discussion. In the original description of *Careospina* it is said that in imago "terminal filament greatly reduced, with 6-7 segments, basal 3 segments short and remainder apical segments long (Fig. 121)" (Peters, 1971: 11). Actually all species of *Careospina*, including the type species, have well developed terminal filament (paracercus), longer than cerci (as in all other Hagenulini and in majority of Leptophlebiidae). Among reared specimens I have several ones with broken caudal filaments (cercus or paracercus) in the nymphal stage and short regenerated caudal filaments in subimago and imago. Such a specimen with regenerated paracercus is described and figured in the paper by Peters.

Beside the species described here, two other species were placed into *Careospina* – *C. minuta* Peters, 1971 [described from imagos from Cuba, very similar to *H. (C.) hespera*] and *C. annulata* Peters, 1971 [described from imagos from Haiti]. The systematic position of the latter species is not quite clear while its nymphs are unknown.



Figs 130-135. *Hagenulus (Careospina) hespera hespera* (Peters & Alayo). **130-134**, male imago: **130**, left penis lobe (lateral view); **131**, the same, another specimen; **132**, head (dorsal view); **133-134**, abdominal tergum V (spread on slide), different specimens. **135**, nymph: transverse section of hind tibia.

Hagenulus (Careospina) hespera (Peters & Alayo, 1971) (Figs 130-151)

Careospina hespera Peters & Alayo in Peters, 1971: 13 (male, imago, nymph).

Nymph. Labrum unicolorous; distal row of bristles regular except its median part; in anteromedian emargination usually 5 subequal denticles (one specimen has all denticles fused into integral plate). Other mouthparts – see characteristics of the subgenus. Pro- and mesonotum with indistinct maculation on cuticle, pronotum with lighter fore and lateral margins. Through cuticle dark hypodermal patterns are visible, usually including dark sublateral stripe on pro- and mesonotum, a pair of maculae on pronotum, and two pairs of maculae on mesonotum, corresponding to anterolateral scutal costa and to lateral scutal suture. Legs with colourless cuticle on femur and tibia, colour of tarsal cuticle differing in the two subspecies. Through cuticle hypodermal patterns are visible: dark maculae at middle and apex of femur and at apex of fore tibia. Fore tibia cylindrical, middle tibia slightly flattened, hind tibia more strongly flattened, different in the two subspecies. Stout bristles on tibiae as follows: inner-dorsal row on fore tibia indistinct, on middle tibia consisting of relatively small bristles, on hind tibia of larger bristles; inner bristles on fore tibia very numerous, on middle tibia sparse (1-2 in transverse section), on hind tibia longer and numerous (3-4 in transverse section); outer row of hind tibia not dense, denser at apex, consisting of very long and very short bristles. Claws with distal denticle not enlarged, apices of denticles forming nearly straight line. Abdomen with dark hypodermal patterns as in Figs 133, 134, 140, 141 (similar in males and females). All abdominal terga with long denticles on hind margin. Hind margin of subanal plate with minute spines, smaller on its dorsal (inner) side. Penis rudiments straight, contiguous, and very long, being often projected far behind styliger. 7 pairs of tergaliae with narrow lamellae separated nearly up to base.

Male imago. Adequately described by Peters (1971) with the exception of caudal filaments: actually paracercus longer than cerci, cerci and paracercus brownish, with dark articulations of segments.

Body proportions as in Table 1.

Female imago. Colour of legs and caudal filaments as in male. Thorax lighter than in male, abdominal terga with the same patterns as in male, or darker. In contrast to male, fore wings coloured: all surface entirely very slightly shaded with brownish, costal field shaded with more intensive light brown. Hind wings narrower than in male. Ovipositor short.

Subimago. Cuticle of mesonotum with dark brown colour patterns typical for the subgenus. Cuticle of legs and abdomen very light brownish, cuticle of penis intensely brown with apices colourless.

Egg. 150-190 μm long and 80-120 μm wide, structure typical for the subgenus.

Measurements. Length of fore wing 5.5-7 mm.

Hagenulus (Careospina) hespera hespera (Peters & Alayo, 1971). (Figs 130-135)

Material. Western Cuba: *prov. Pinar del Rio*: 9 ♂, 13 ♀ imagos, 1 ♂, 2 ♀ subimagos (all reared from nymphs), 9 nymphs, Soroa, 1-10.IV.1989 (N. Kluge).

Nymph. Hind tibia only slightly flattened (Fig. 135). Tarsi as pale as tibiae.

Male imago. Upper eyes distinctly separated (Fig. 132).

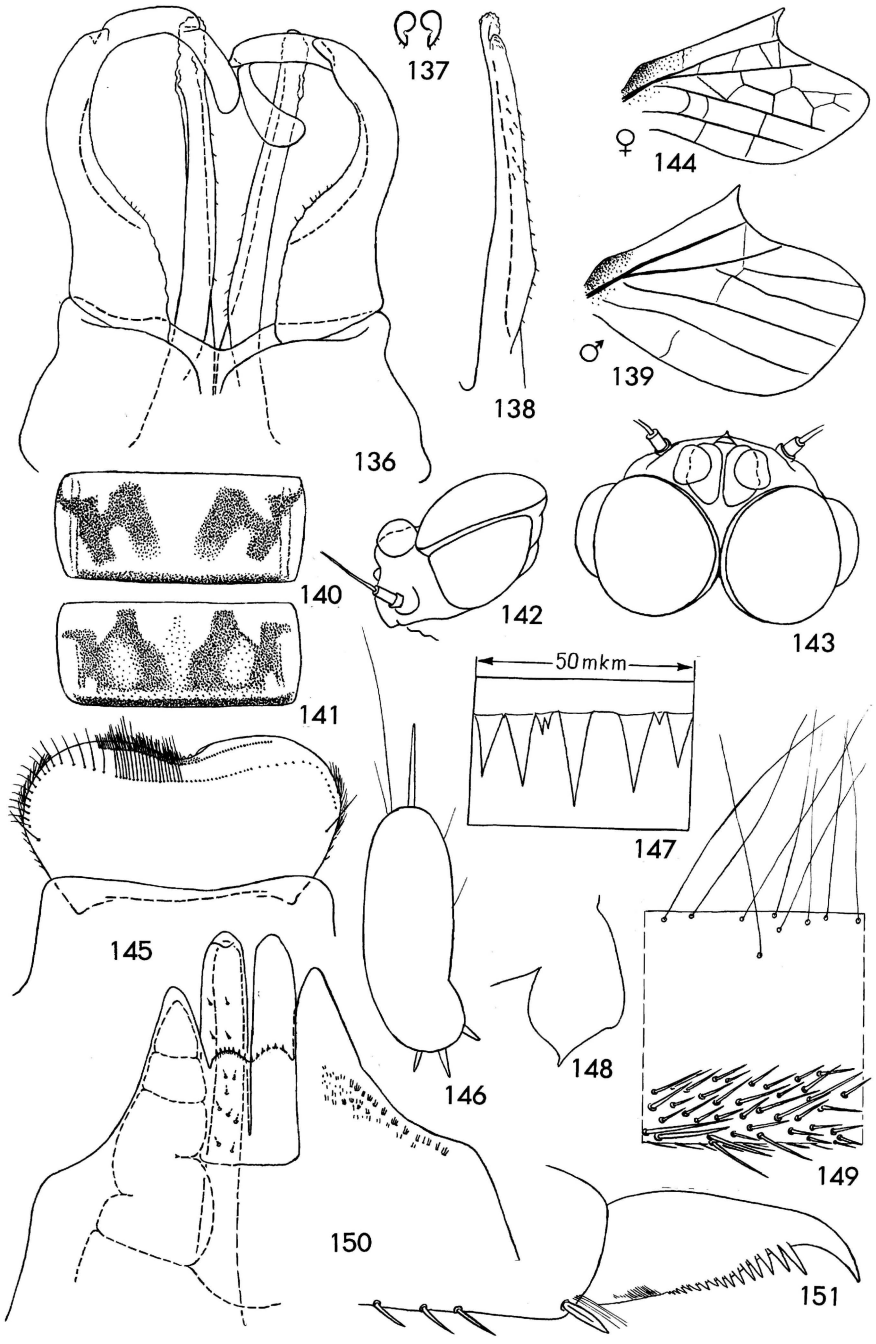
Habitat. All material was collected in a small stream, in the place where water level was the lowest (about 1 cm). Nymphs were found on the lower surface of small stones, upper surface of which was above water.

Hagenulus (Careospina) hespera sierramaestrae subsp. n. (Figs 136-151)

Holotype. ♂ imago (reared from nymph), Eastern Cuba: *prov. Santiago de Cuba*: arroyo Paco (tributary of Palma Mocha River near Pico Turquino), 25.II.1989 (N. Kluge).

Paratypes. The same locality as holotype: 10 ♂, 9 ♀ imagos, 3 ♀ subimagos (all reared from nymphs), 28 nymphs, 1 ♀ imago, 18-25.II.1989 (N. Kluge); 36 nymphs, 6.II.1986 (C. Naranjo); 10 nymphs, 9.I.1984 (C. Naranjo); 1 nymph, 15.V.1985 (C. Naranjo); Gran Piedra (to the east of Santiago de Cuba): 15 nymphs, 25.IX.1983 (C. Naranjo); 1 nymph, 13.XI.1983 (C. Naranjo); 2 nymphs, 2.II.1984 (C. Naranjo); 6 nymphs, 24.V.1985 (C. Naranjo); Cruce de los Baños, 4 nymphs, 11.VI.1985 (C. Naranjo); El Tartaro, 1 nymph, 13.VI.1985 (C. Naranjo).

Nymph. Hind tibia distinctly flattened (Fig. 146), with somewhat convex inner margin. Tarsi with cuticle pigmented, darker than tibiae.



Figs 136-151. *Hagenulus (Careospina) hespera sierramaestrae* subsp. n. **136-143**, male imago: **136**, genitalia; **137**, transverse section of penis; **138**, left penis lobe (lateral view); **139**, hind wing; **140-141**, abdominal tergum V (spread on slide), different specimens; **142**, head (lateral view); **143**, head (dorsal view). **144**, female imago, hind wing. **145-151**, nymph: **145**, labrum; **146**, transverse section of hind tibia; **147**, hind margin of abdominal tergum VI; **148**, hind wing pad; **149**, part of fore tibia (dorsal view); **150**, posterior part of abdominal sternum IX (subanal plate) of mature male nymph (in right half – dorsal view, in left half – ventral view with subimaginal genitalia shown); **151**, claw. Figs 139, 144, 148 – the same magnification.

Male imago. Upper eyes contiguous by their bases (Fig. 143).

Hagenulus (Careospina) baconaoi sp. n. (Figs 152-175)

Holotype. ♂ imago (reared from nymph), Eastern Cuba: *prov. Santiago de Cuba*: Baconao River in Las Yaguas, 12.II.1989 (N. Kluge).

Paratypes. The same locality as holotype: 8 ♂, 6 ♀ imagos, 13 ♂, 2 ♀ subimagos (all reared from nymphs), 4 nymphs, 17 ♂, 1 ♀ imagos, 12.II.1989 (N. Kluge); 5 ♂, 6 ♀ imagos, 38 nymphs, 23. I.1986 (C. Naranjo); 5 nymphs, 22.I.1985 (C. Naranjo); 1 nymph, 23.XII. 1983 (C. Naranjo); 1 nymph, 22.VIII.1985 (C. Naranjo); 1 nymph, 18.III.1985 (C. Naranjo). *Prov. Santiago de Cuba*: 2 nymphs, Baconao River near Baconao, 4.III.1989 (N. Kluge); 2 nymphs, Sto. Domingo, 22. VIII.1983 (C. Naranjo). *Prov. Guantanamo*: 2 ♂, 1 ♀ imagos (all reared from nymphs), Toa River near Paso de Toa and Naranjal, 15.III.1989 (N. Kluge). Western Cuba: *prov. Pinar del Rio*: 1 nymph, Soroa, 1-7.VI. 1989 (N. Kluge).

Nymph. Labrum unicolorous, anteromedian emargination very deep, with 5 (rarely 4) subequal denticles; distal row of bristles regular except its median part. Other mouthparts – see characteristics of subgenus. Pro- and mesonotum with indistinct maculation on cuticle, pronotum with light lateral margins. Through cuticle dark hypodermal patterns are visible, usually including dark sublateral stripes and fine patterns medially (these patterns may be absent). Legs pale with colourless cuticle and weakly developed hypodermal patterns: usually only small apical dark macula present on femora, sometimes also a median dark macula present on fore femur. Fore tibia cylindrical, middle tibia slightly flattened, hind tibia more strongly flattened. Stout bristles on tibiae as follows: inner-dorsal row on fore tibia indistinct, on middle tibia consisting of relatively small bristles, with larger bristles on hind tibia; inner bristles on fore tibia moderately numerous (3-4 in transverse section), sparse on middle tibia (1-2 in transverse section), sparse, but more widely distributed on hind tibia (2-4 in transverse section); outer row of hind tibia not dense, not becoming denser at apex, consisting of very long and very small bristles. Claws with all denticles subequal, their apices forming a curved line. Abdomen with dark hypodermal patterns as in Fig. 168 (similar in males and females). All abdominal terga with long slender denticles on hind margin. Hind margin of subanal plate with minute spines, spines on its dorsal (inner) side distinct. Rudiments of penis short, strongly curved outwards. 7 pairs of tergaliae with narrow lamellae separated nearly up to base.

Male imago. Head brown. Upper eyes low, mesally contiguous, their facet surfaces grey with marginal ring. Thorax brownish. Legs pale, with more or less developed dark maculae at middle and at apex of femur and sometimes at apex of fore tibia; sometimes these maculae not developed, and legs entirely pale. Fore wing hyaline, with base more or less shaded with brown (but with costal brace light). Veins pale, whitish or yellowish. Hind wings narrow. Abdominal terga dark with median light patterns, especially developed in hind part of each tergum. Sterna pale. Styliger with sharp median emargination. Forceps brownish in proximal part, apical segments lighter. Penis lobes curved laterodorsally, with groove on lateral side. Caudal filaments pale with dark articulations of segments.

Body proportions as in Table 1.

Female imago. Colour of legs and caudal filaments as in male. Thorax lighter than in male. Abdominal terga with the same patterns as in male, or darker. Fore wings hyaline, but in contrast to male with costal field shaded with brown. Hind wings narrower than in male. Ovipositor short.

Subimago. Cuticle colourless, with the only exception of mesonotum having light brownish patterns typical for the subgenus.

Egg. 150-170 μm length and 80-100 μm width, structure typical for the subgenus.

Measurements. Length of fore wing 5-5.5 mm.

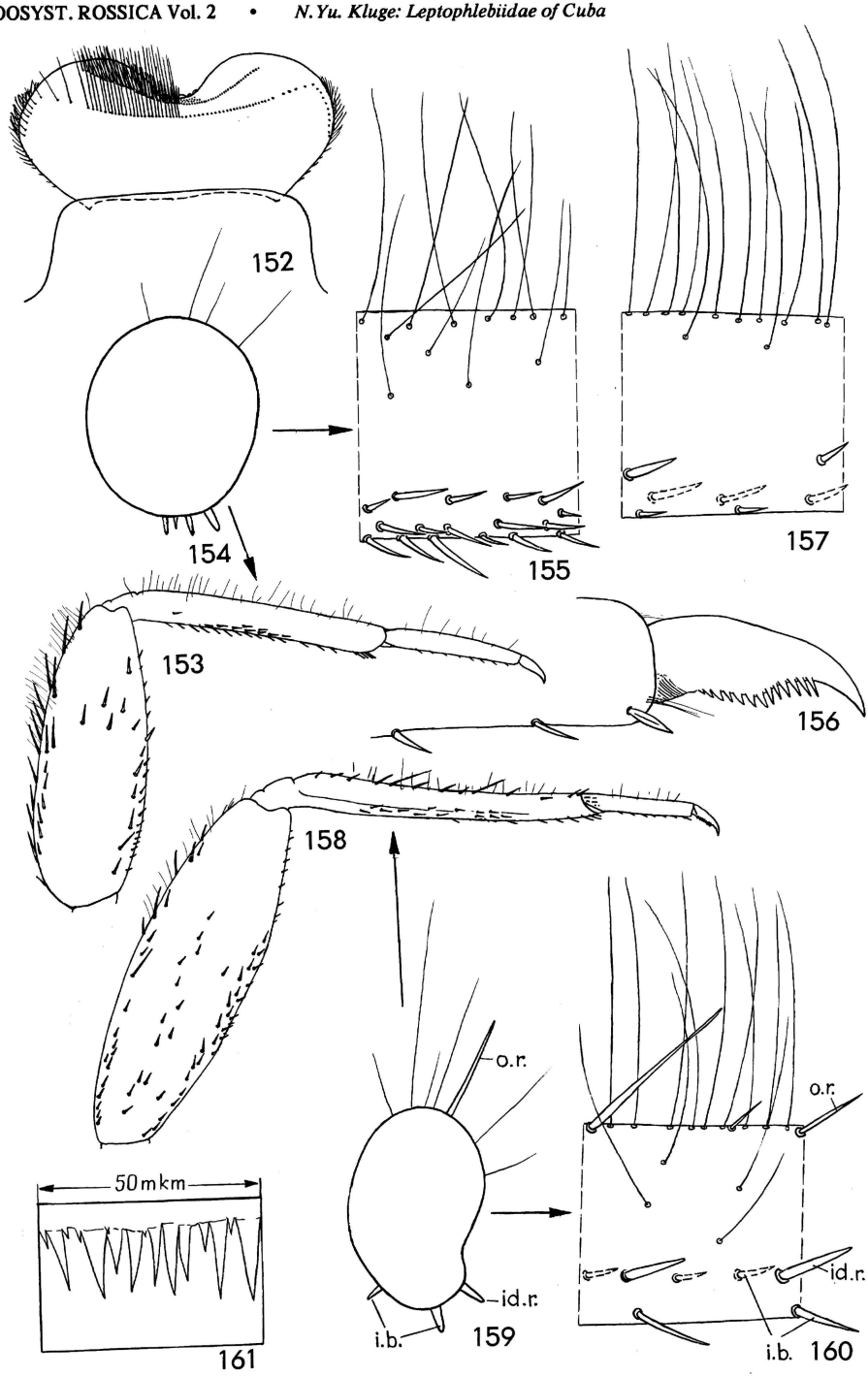
Comparison. The new species clearly differs from *H. (C.) hespera* in narrower hind wing, form of styliger, and fine structure of penis; in nymph form of penis rudiment and other characters are different.

Hagenulus (Careospina) evanescens sp. n. (Figs 176-193)

Holotype. ♂ imago, Eastern Cuba: *prov. Santiago de Cuba*, arroyo Paco (tributary of Palma Mocha River near Pico Turquino), 15.V.1985 (C. Naranjo).

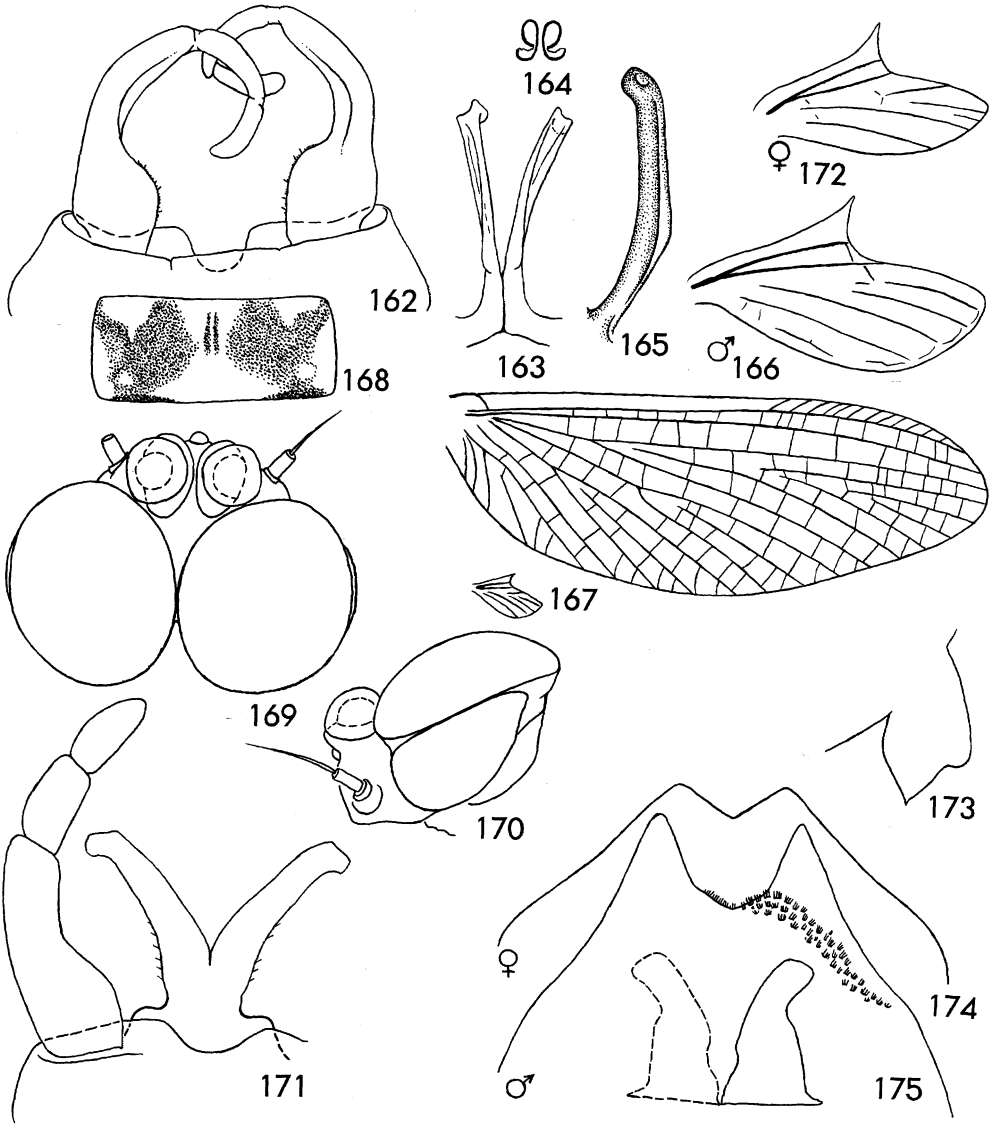
Paratypes (all from the same locality as holotype). 14 ♂, 9 ♀ imagos, 12 nymphs, 15-16.V.1985 (C. Naranjo); 3 nymphs, 2.VI.1985 (C. Naranjo); 4 ♂ imagos, 23.VI. 1985 (C. Naranjo).

Nymph. Labrum unicolorous; distal row of bristles irregular in most part; in anteromedian



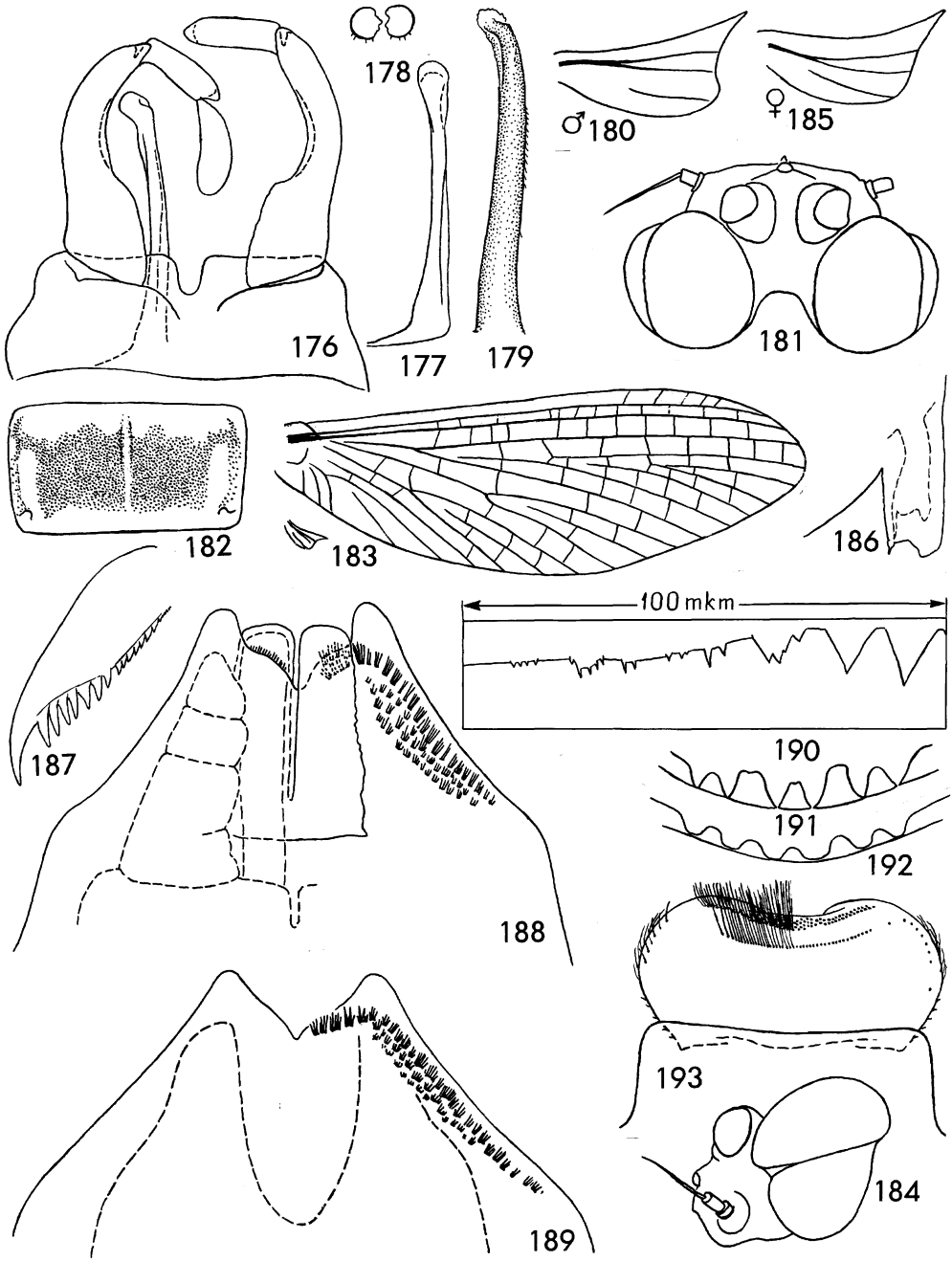
Figs 152-161. *Hagenulus (Careospina) baconaoi* sp. n., nymph. **152**, labrum; **153-155**, fore leg: **153**, dorsal view; **154**, transverse section of tibia; **155**, part of tibia, dorsal view. **156**, claw; **157**, middle leg (part of tibia, dorsal view); **158-160**, hind leg: **158**, dorsal view; **159**, transverse section of tibia; **160**, part of tibia, dorsal view. **161**, hind margin of abdominal tergum VI.

id.r. – inner-dorsal row of bristles, *i.b.* – inner bristles, *o.r.* – outer row of bristles of tibia.



Figs 162-175. *Hagenulus (Careospina) baconaoi* sp. n. **162-170**, male imago: **162-163**, genitalia (ventral view); **164**, transverse section of penis; **165**, left penis lobe (lateral view); **166**, hind wing; **167**, fore and hind wings; **168**, abdominal tergum V (spread on slide); **169-170**, head (dorsal and lateral views). **171**, male subimago, genitalia; **172**, female imago, hind wing; **173-175**, nymph: **173**, hind wing pad; **174**, posterior part of abdominal sternum IX (subanal plate) of mature female nymph, ventral view; **175**, the same of mature male nymph (in the right half – dorsal view, in the left half – ventral view). Figs 166, 172, 173 – the same magnification.

emargination 5 denticles, all subequal or two of them slightly enlarged. Other mouthparts – see characteristics of the subgenus. Pro- and mesonotum with indistinct maculation on cuticle and dark hypodermal patterns. In mature nymphs hind wing pads with hind portion rudimentary, spine-like. Legs with cuticle of femur and tibia colourless, tarsus slightly pigmented. Through cuticle dark hypodermal maculae at middle and at apex of femur are visible. Fore tibia cylindrical, middle tibia slightly flattened, hind tibia flattened as in *H. (C.) hespera sier-*



Figs 176-193. *Hagenulus (Careospina) evanescens* sp. n. **176-184**, male imago: **176-177**, genitalia; **178**, transverse section of penis; **179**, left penis lobe (lateral view); **180**, hind wing; **181**, head (dorsal view); **182**, abdominal tergum V (spread on slide); **183**, fore and hind wings; **184**, head (lateral view). **185**, female imago, hind wing; **186-193**, nymph: **186**, hind wing pad; **187**, claw; **188**, posterior part of abdominal sternum IX (subanal plate) of male mature nymph (in right half – dorsal view, in left half – ventral view with subimaginal genitalia shown); **189**, the same of mature female nymph (ventral view with subimaginal postgenital plate shown); **190**, right side of hind part of VII abdominal tergum; **191-192**, anteromedian emargination of labrum, different specimens; **193**, labrum.

ramaestrae (Fig. 146). Bristles on tibiae similar to those of *H. (C.) hespera*. Claws with distal denticle not enlarged, apices of denticles forming nearly straight line. Anterior abdominal terga with cuticle pale, posterior ones with cuticle uniformly darkened. Through cuticle hypodermal patterns are visible: on dark background a narrow median light line, more or less wide light bordering on posterior and anterior margin, and sometimes more or less large paired light maculae; the most part of tergum dark (as in Fig. 182) or light. Posterior margins of terga without denticles, or with very small irregular spines; only in lateral parts of terga VII and VIII and on terga IX and X well developed denticles present. Posterior margin of subanal plate with minute denticles, those on its dorsal (inner) side very long. Rudiments of penis straight and parallel, not so long as in *H. (C.) hespera*. 7 pairs of tergaliae with narrow lamellae separated nearly up to base.

Male imago. Head brown. Upper eyes small, widely separated, their facet surfaces very dark grey. Prothorax yellowish brown, with dark brown lateral margins and median part of posterior margin. Mesothorax relatively small (Table 1). Mesonotum dark yellowish brown, terga and anterior part of sternum darker than pleura and posterior part of sternum; membranous areas of pleura with dark brown maculation. Legs with tibiae relatively long (Table 1). All femora yellowish brown, with large indistinct longitudinal brown macula at middle (occupying about 1/3 length of femur) and brown apex. All tibiae brownish, proximally lighter. Segments 1-4 of all tarsi brownish yellow, contrastingly lighter than tibiae, segment 5 brownish. Fore wing entirely slightly shaded with brown, veins light brown. Hind wing very small, with hind part (portion behind costal projection) rudimentary. Abdominal terga III-IX in the most part dark, only with light anterior and posterior margins and with narrow light median line; terga I-II pale. Abdominal sterna pale. Styliger with sharp median emargination. Forceps unicolorous, very light brownish. Penis lobes slightly curved dorsally at apex, cylindrical, with membranous median side. Caudal filaments brownish, with articulations narrowly darkened.

Body proportions as in Table 1.

Female imago. Colour of thorax, legs, wings, and caudal filaments as in male. Hind wing with more strongly reduced hind portion than in male. Abdominal terga as in male or darker. Ovipositor short.

Subimago. Subimaginal thorax dissected from mature nymph has coloured cuticular patterns typical of the subgenus.

Egg. 120-150 μm length, 80-100 μm width, structure typical for the subgenus.

Measurements. Length of fore wing 5.5-6.5 mm.

Remarks. Imagos have not been reared from nymphs. Association of imagos and nymphs collected in the same locality is based on the unique form of hind wing (dissected from mature nymphs and smoothed out by boiling in alkali) and on hypodermal abdominal colour patterns differing from those of other Cuban species.

Comparison. The new species differs from all others in the form of hind wing and other characters.

Habitat. All specimens were collected in the same place in May-June of 1985 by C. Naranjo. Despite careful collecting in the same place in February of 1989 the author failed to find any additional specimens. It may mean that *H. (C.) evanescens* had disappeared from that stream, or it has seasonal cycle.

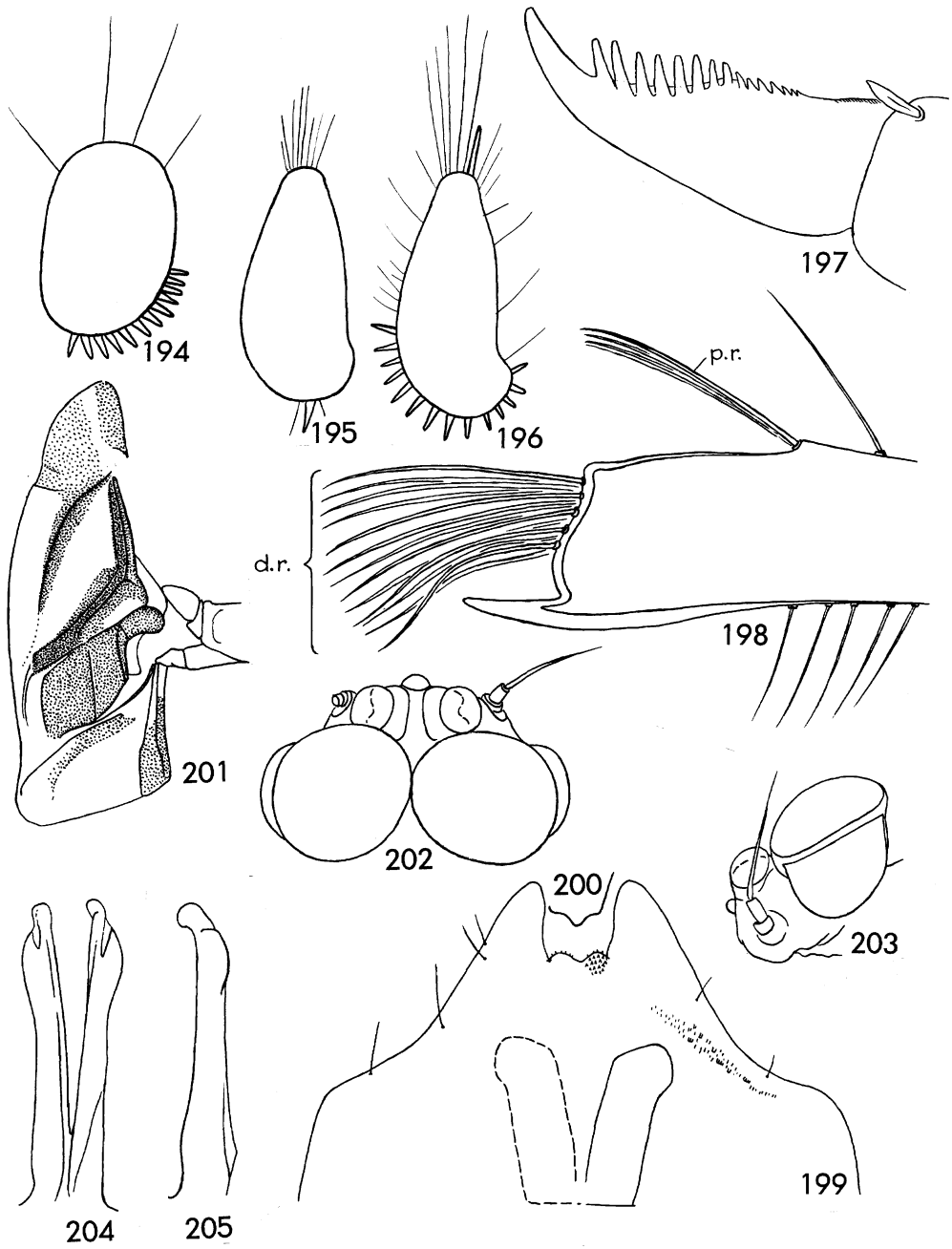
Subgenus Traverina Peters, 1971

Traverina Peters, 1971: 9 (pro gen.: imago, nymph). Type species *Traverina cubensis* Peters & Alayo, 1971.

This subgenus can be separated from other subgenera of the genus *Hagenulus* s. l. by structure of nymphal tergaliae: each lamella with proximal portion widened, two additional short terminal processi on each side of median long terminal process (Figs 215-217). The same form of tergaliae occurs in the South American genus *Miroculis*; nymphs of *Traverina* differ from those of *Miroculis* in the characters common for the genus *Hagenulus* s. l.: glossae not expanded ventrally, subapical ventral row of comb-like bristles of maxilla shorter than in *Miroculis*.

Both examined Cuban species of *Traverina* have the following characters in common.

Nymph. Labrum unicolorous; distal row of bristles regular except in its median part; in anteromedian emargination usually 5 subequal denticles, two of them sometimes enlarged (as in Fig. 191); sometimes only 4 denticles present (Figs 213, 214). Mandibles with outer margin moderately convex (Fig. 219). Maxilla of ordinary form (as in all other Hagenulini except *Hagenulus* s. str.), with segment 3 of maxillary palp small (Peters, 1971: Fig. 149);



Figs 194-205. *Hagenulus (Traverina) cubensis* (Peters & Alayo). **194-200**, nymph: **194-196**, transverse section of fore, middle, and hind tibia; **197**, claw; **198**, longitudinal section of anteromedian emargination of labrum; **199**, posterior part of abdominal sternum IX (subanal plate) of mature male nymph (in right half – dorsal view, in left half – ventral view); **200**, outline of median emargination of the same, another specimen. **201**, subimago, exuvia of right half of mesonotum; **202-205**, male imago: **202-203**, head (dorsal and lateral views); **204**, penis (ventral view); **205**, left penis lobe (lateral view).
d.r. – distal row, *p.r.* – proximal row of bristles on labrum.

subapical ventral row of comb-like bristles with 10-13 bristles in its lateral and 8-9 bristles in its medial portion. Form of hypopharynx as in majority of Atalophlebiinae and as in all other Hagenulini except *Hagenulus* s. str. (Peters, 1971: Fig. 158). Glossae ventrally with stout bristles; paraglossae not wide, ventrally with a narrow subapical stripe of slender bristles separated by a bare space from apical margin of paraglossa; distal segment of labial palp short (Peters, 1971: Fig. 140; the same in *Poecilophlebia* as in Figs 110-112, and in *Careospina*). Fore tibiae slightly flattened, middle and hind tibiae distinctly flattened, thinner at outer side (Figs 194-196). Stout bristles on tibiae as follows: inner-dorsal row on fore tibia indistinct, consisting of relatively small bristles on middle tibia, of longer bristles on hind tibia; inner bristles very numerous on fore tibia, not numerous on middle tibia (1-2 in transverse section), very numerous on hind tibia (5-6 in transverse section), but sparser than on fore tibia; bristles in the outer row of hind tibia not dense, becoming denser at apex. Long fine hairs form a regular row on outer margin of tibiae. Posterior margins of abdominal terga from I or II to X with long denticles (Fig. 218). Hind margin of subanal plate with minute spines, spines of its dorsal (inner) side very small (Figs 199, 221).

Male imago. Styliger with hind margin medially straight (sometimes very slightly concave or very slightly convex), forceps with long straight first segment and short distal segments (Fig. 207; Peters, 1971: Fig. 79). Penis lobes long and straight, deeply divided, fused only by their bases (Figs 204, 205, 207).

Female imago. Ovipositor short.

Subimago. Mesonotal cuticle with anterolateral scutal costa darkened, posterior scutal protuberances with narrow light wedge on anterior margin and light band along medial margin (Figs 201, 222) (the same in *Careospina*). Both Cuban species have dark mesonotal cuticular patterns very light brownish, the remaining mesonotal cuticle colourless. Penis without denticles, the same as in imago.

Discussion. In the original description among the generic characters of *Traverina* the following was stated: "the denticles on the claws are progressively larger apically" (Peters, 1971: 10). Actually it is true only for the type species (Fig. 197), but the new species described here has the apical denticle much larger than the others (Fig. 212).

Beside the type species, Peters (1971) placed in *Traverina* undescribed nymphs from the Trinidad Mountains of Cuba.

Hagenulus (Traverina) cubensis (Peters & Alayo in Peters, 1971)
(Figs 194-205)

Traverina cubensis Peters, 1971: 10 (male and female imago, nymph).

Material. Western Cuba: *prov. Pinar del Rio*: 2 ♂, 2 ♀ imagos, 4 ♂, 4 ♀ subimagos (all reared from nymphs), Soroa, 1-10.IV.1989 (N. Kluge).

Nymphs, male and female imagos and *subimagos* are described by Peters (1971) and in the characteristics of the subgenus (see above). Body proportions of male imago as in Table 1.

Egg. Oval or of irregular form, 140-170 μm length, 80-100 μm width. Surface only with small (not more than 3 μm) sculptural elements.

Measurements. Length of fore wing 6-8 mm.

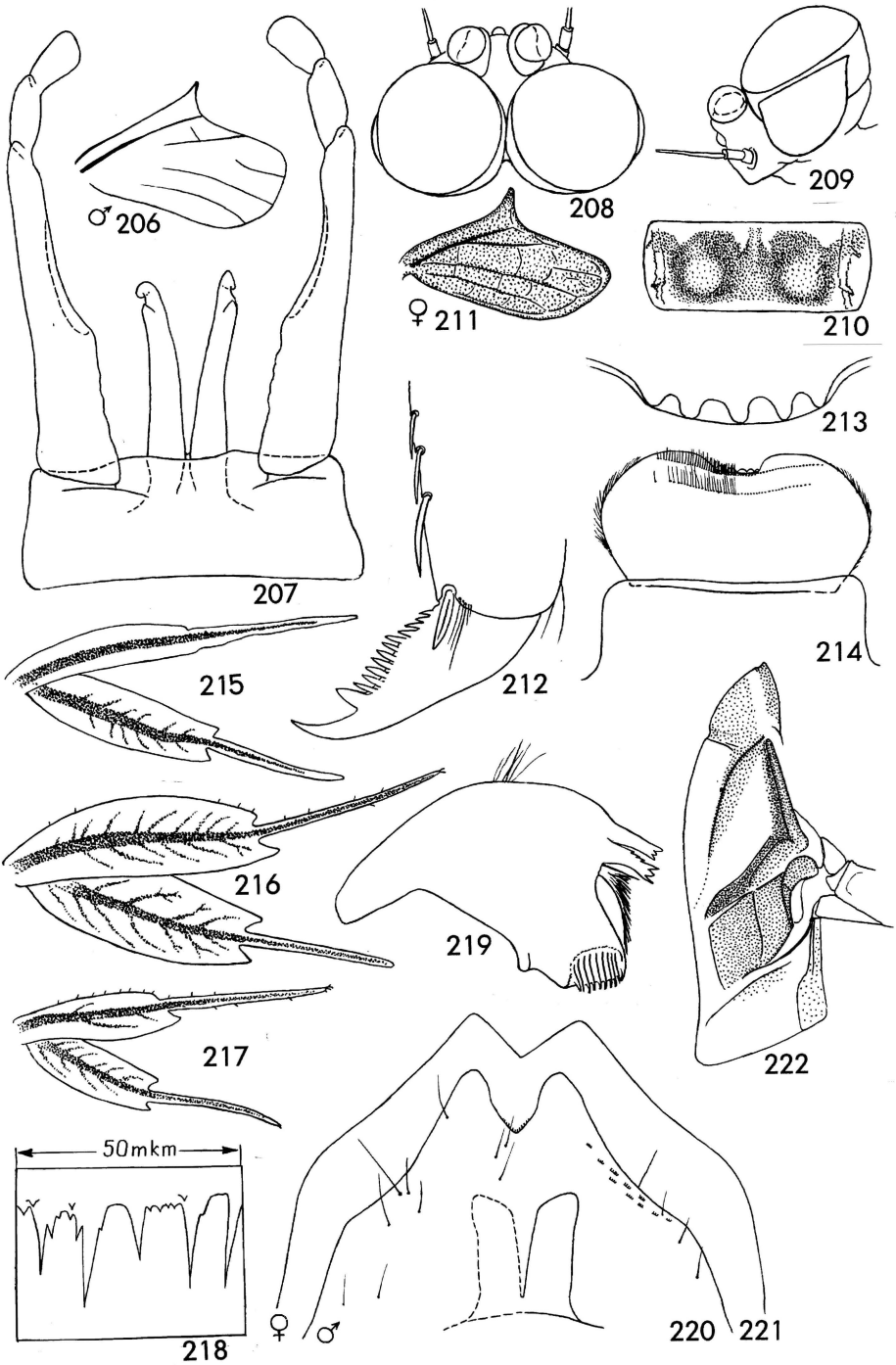
Hagenulus (Traverina) oriente sp. n.
(Figs 206-222)

Holotype. ♂ imago (reared from nymph), Eastern Cuba: *prov. Guantanamo*: Naranjal (8 km NW of Baracoa), small stream – tributary of Toa River, 15.III.1989 (N. Kluge).

Paratypes. 1 ♂, 1 ♀ imagos, 1 ♂ subimago (all reared from nymphs), 19 nymphs, the same locality as holotype, 13-15.III.1989 (N. Kluge). *Prov. Santiago de Cuba*: 1 nymph, Las Yaguas, 24.V.1985 (C. Naranjo).

Nymph. Pro- and mesonotum with indistinct cuticular maculation and indistinct dark hypodermal patterns. Legs with cuticle colourless on femur and tibia, cuticle of tarsus slightly more pigmented. Through the cuticle dark hypodermal middle and apical maculae of femur are visible; usually only middle macula on ventral side of hind femur and apical macula on dorsal side of hind and middle femora are developed, in youngest nymphs these maculae absent, in nymphs of the last instar all femora with middle and apical maculae on both sides. Claws with apical denticle enlarged. Abdomen with colourless cuticle and indistinct dark hypodermal patterns. 7 pairs of tergaliae with lamellae narrower than those of *H. (C.) cubensis*.

Male imago. Head yellowish brown, with brown margins of face and borders around bases of antennae and ocelli. Upper eyes brownish yellow, facet surfaces with brown marginal ring. Pronotum with brown and brownish yellow patterns. Meso- and metathorax light brown.



Figs 206-222. *Hagenulus (Traverina) oriente* sp. n. **206-210**, male imago: **206**, hind wing; **207**, genitalia; **208-209**, head (dorsal and lateral views); **210**, abdominal tergum V (spread on slide). **211**, female imago, hind wing; **212-221**, nymph: **212**, claw; **213**, anteromedian emargination of labrum; **214**, labrum; **215-217**, tergaliae I, IV, VII; **218**, hind margin of abdominal tergum VI; **219**, left mandible; **220**, posterior part of abdominal sternum IX (subanal plate) of mature male nymph (in right half – dorsal view, in left half – ventral view); **221**, the same of mature female nymph; **222**, subimago, exuvia of right half of mesonotum.

Fore femur brownish, with indistinct dark macula at middle and with dark apex. Fore tibia and tarsus pale yellowish, base and apex of tibia brown. Middle and hind legs pale yellowish, with contrasting dark brown apex of femur; middle femur with very small brown macula at middle, hind femur with distinct roundish dark brown macula at middle. Fore wings hyaline, with bases shaded with brown (but with costal brace light); veins pale, *C*, *Sc*, and *R* brownish, remaining veins whitish. Abdominal terga and sterna yellowish brown, patterns on terga not contrasting. Penis and proximal half of forceps light brownish, distal half of forceps pale. Caudal filaments pale brownish yellow, with dark brown articulations of segments.

Body proportions as in Table 1.

Female imago. Colour of body and legs as in male. Wings very slightly shaded with brownish, costal field shaded with more intensive light brown; veins brown.

Egg. Similar to that of *H. (H.) caligatus.*

Measurements. Length of fore wing *5-5.5* mm.

Comparison. The new species differs from *H. (T.) cubensis* in smaller size, enlarged distal denticle of nymphal claw, and other characters.

Phylogeny

A preliminary phylogenetic tree of Hagenulini, based on Cuban species, is shown on the Fig. 223.

The numbers denote the following apomorphies:

(1) *MP* of fore wing symmetrical (in general more or less asymmetrical in majority of Leptophlebiidae and Ephemeroptera including the most primitive and ancient groups). (2) Hind wing with acute costal projection and *Sc* terminating close to its base. (3) Absence of median bare stripe on subimaginal mesonotum (connected with reduction of ancestral mesonotal suture; in other Leptophlebiidae mesonotal suture is longitudinal and separates pigmented and covered with microtrichia area of mesoscutum from narrow bare and colourless area along median suture). (4) Medioparapsidal suture distinct up to its connection with median suture, colour patterns of subimaginal mesonotal cuticle disappeared (Fig. 13) (connected with subsequent reduction of ancestral mesonotal suture; the same appearance of medioparapsidal suture as in *Traverina*: Tsui & Peters, 1972: Fig. 29). (5) Lateroscutum of subimago connected with parascutellum (Fig. 13) (not connected in the outer group – at least in Leptophlebiinae, *Choroterpes, Deleatidium*). (6) Unique structure of genitalia. (7) *ICu* of fore wing basally attached to *CuP*. (8) On subimaginal cuticle pigmented area occupies the most part of mesonotal posterior scutal protuberances (Figs 20, 50, 87, 113, 201, 222) (probably this character is not an autapomorphy of *Hagenulus* s. l., but apomorphy of Hagenulini). (9) Nymphal abdominal sternum IX with median concavity on posterior margin of subanal plate. (10) Distal row of bristles on labrum irregular at least in middle (Figs 82, 198). (11) Subapical ventral row of comb-like bristles on maxilla with two portions disjunct. (12) Ovipositor of female imago long (probably a plesiomorphy or parallelism with some other Atalophlebiinae). (13) Filtering bristles on nymphal fore legs. (14) Filtering specialization of nymphal mouthparts (convergence with *Hermanella-Traverella* complex). (15) Secondary enlargement of nymphal segment 3 of labial palp. (16) Elongation of first segment of forceps. (17) Reduction of ventral spines on penis both in imago and subimago. (18) Eggs with spiral fibrillous structures in shallow con-

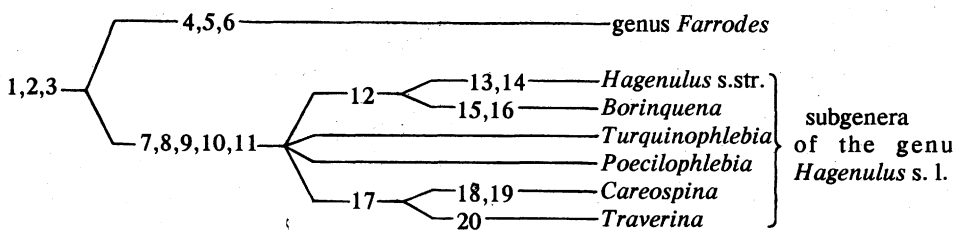


Fig. 223. Phylogeny of the Cuban Hagenulini.

cavities of chorion, diameter of these structures the same in all three examined species. (19) Stout bristles on outer margin of nymphal hind tibia strongly dissimilar (Fig. 160). (20) Leaves of nymphal tergaliae with three apical projections (convergence with *Miroculis*; to some extent similar to the state present in *Hermanella, Choroterpes, Choroterpides*, some of *Leptophlebia*).

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