

NOTES ON THE VELIIDAE (HETEROPTERA) OF BORNEO: 2. *POLHEMOVELIA* N.GEN., WITH DESCRIPTION OF THREE NEW SPECIES

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Abstract.—*Polhemovelina* n.gen. and three new species, *P. septuaginta* n.sp. (type species), *P. johnpolhemi* n.sp., and *P. setosa* n.sp., are described from Northern Borneo (Malaysia, Sabah). This new genus of Microveliini is compared with other similar genera which are distributed in the tropics of the Old World. Two of the three species were found to be hygropetric. Adaptations to (semi-)terrestrial habits in Microveliinae are discussed.

Key words: Heteroptera, Veliidae, Microveliinae, Microveliini, *Polhemovelina*, new genus, new species, key, phylogeny, hygropetric, Borneo.

Material collected by the senior author during a research study in Sabah in 1997 and additional specimens deposited in the National Natural History Museum (NNM, Leiden), the John T. Polhemus Collection (JTPC, Englewood), and the Natural History Museum Vienna (NHMW) belong to a new genus of Microveliini sensu Štys, 1976 (excluding the Microveliinae genera *Hebrovelia* Lundblad, 1939, and *Velohebria* Štys, 1976, both with subterminal claws). Although there is presently no phylogenetic analysis of Microveliinae available (see Andersen, 1982, 1989; Polhemus and Polhemus, 1994; Zettel, 1998), the three new species clearly form a separate clade of Microveliini, which is closely related to the Oriental genera *Baptista* Distant, 1903, *Neoalardus* Distant, 1912, and *Lathriovelina* Andersen, 1989, and similar to the New Guinean genera *Tanyvelia* Polhemus and Polhemus, 1994, and *Aegilipsicola* Polhemus and Polhemus, 1994. The Oriental fauna is very rich in different clades of Microveliini, partly of generic rank, and partly still included in *Microvelia* s.l. Several studies on these clades have to be done in preparation for a cladistic analysis of the microveliine genera.

In the key to the Veliidae genera of Thailand and adjacent countries by the junior author (Hecher 1998), *Polhemovelina* gen.n. would key out together with *Baptista*, from which it is easy to distinguish by the lack of modifications on the male forelegs and male abdomen, by the very long antennae, and by the short, club-shaped parameres.

All specimens studied are macropterous.

Repositories.

JTPC Coll. J.T. Polhemus, Englewood, Colorado, U.S.A.
NHMW Naturhistorisches Museum in Wien, Vienna, Austria
NNM National Museum of Natural History, Leiden, The Netherlands
UMS Universiti Malaysia Sabah, Kota Kinabalu, Malaysia

Polhemovelina, new genus

Type species. *Polhemovelina septuaginta* n.sp.

Diagnosis. Medium to large sized, slender, elongate Microveliinae; male slightly

smaller than female; head directed anteriad, posteriorly produced, inserted in an emargination of the anterior margin of the pronotum; eyes very close to anterior margin of pronotum (Fig. 1); antenna very long and slender, total length 78–106% of body length, with segment 1 as long as or longer than head width (1.0–1.2 times), with segments 3 and 4 subequal in length, very long and filiform (Figs. 1, 7); rostrum surpassing anterior margin of mesosternum; propleura anteriorly produced; legs very long and slender (Figs. 1, 8–11); protibia of male with relatively short (one fifth to one fourth of protibial length), but elongate grasping comb (Figs. 9–11); legs of male without further modifications; segments of meso- and metatarsi subequal in length; claws preterminal, simple; only macropterous morph known; forewing with four closed cells, distal cells large, the posterior cells larger than the corresponding anterior cells (Figs. 4–6); abdomen of both sexes elongate, relatively flat, otherwise unmodified; male segment 8 small, strongly depressed, with shallow ventral impression (Figs. 18–20); pygophore and proctiger of male small, proctiger posteriorly pointed (indistinct in *P. johnpolhemi* n.sp.; Figs. 21–23); left and right paramere of same shape, small, clubshaped (Figs. 24–26); gonocoxa of female uncovered, directed posteriad; tergite 8 and proctiger of female directed posteriad (Figs. 15–17); female proctiger terminating in an acute spine (indistinct in *P. johnpolhemi* n.sp.).

Discussion. Andersen (1989: tab. 1) presented a comparison of thirteen Microveliinae genera based on a set of twelve diagnostic characters. Some characters of *Polhemovelinae*, like the modifications of the head insertion and anterior part of the pronotum (presently regarded as an important character for a differentiation of genera; see Andersen 1982, 1989), the elongate body shape, and relatively long antennae and legs are typical for the Microveliini genera *Aegilipsicola*, *Baptista*, *Gracilovelina* Poisson, 1948, *Lathriovelina*, *Neoalardus*, *Tanyvelina*, and *Tenagovelina* Kirkaldy, 1908. These genera differ from *Polhemovelina* gen.n. as follows:

Aegilipsicola (one species; New Guinea): hemelytron of macropterous morph with five closed cells, and with bluish pruinose streaks, but without white spots; claws extremely long; male profemur with modifications (thickened, hair tuft); male protibia with very long grasping comb ($\frac{3}{4}$ of protibial length); parameres small, lobe-shaped (Polhemus and Polhemus, 1994).

Baptista (four species; India and Southeast Asian mainland): antenna not very long; foreleg of male usually with obvious additional modifications (but not in an undescribed species from Burma; Dan A. Polhemus, pers. comm.); male abdominal segments 6 and/or 7 with distinct modifications; parameres falciform (Andersen, 1989).

Gracilovelina (one species; West Africa): male much larger than female; antenna much shorter than body length; protibial grasping comb very short (about $\frac{1}{10}$ of protibial length); parameres falciform (Poisson, 1955).

Lathriovelina (two species; Malaysia): eyes distinctly removed from the anterior margin of pronotum; antenna relatively short; profemur of male modified; segment 8 of male with one pair of tubercles; parameres falciform (Andersen, 1989).

Neoalardus (one species; from India to Sumatra): male without grasping comb; parameres medium-sized, with dorsal process (Zettel, 1998).

Tanyvelina (one species; New Guinea): legs long, but relatively stout; male grasping comb extremely long ($\frac{3}{4}$ of protibial length); only brachypterous morph known; paramere acuminate; female gonocoxa small, barely exposed (Polhemus and Polhemus, 1994).

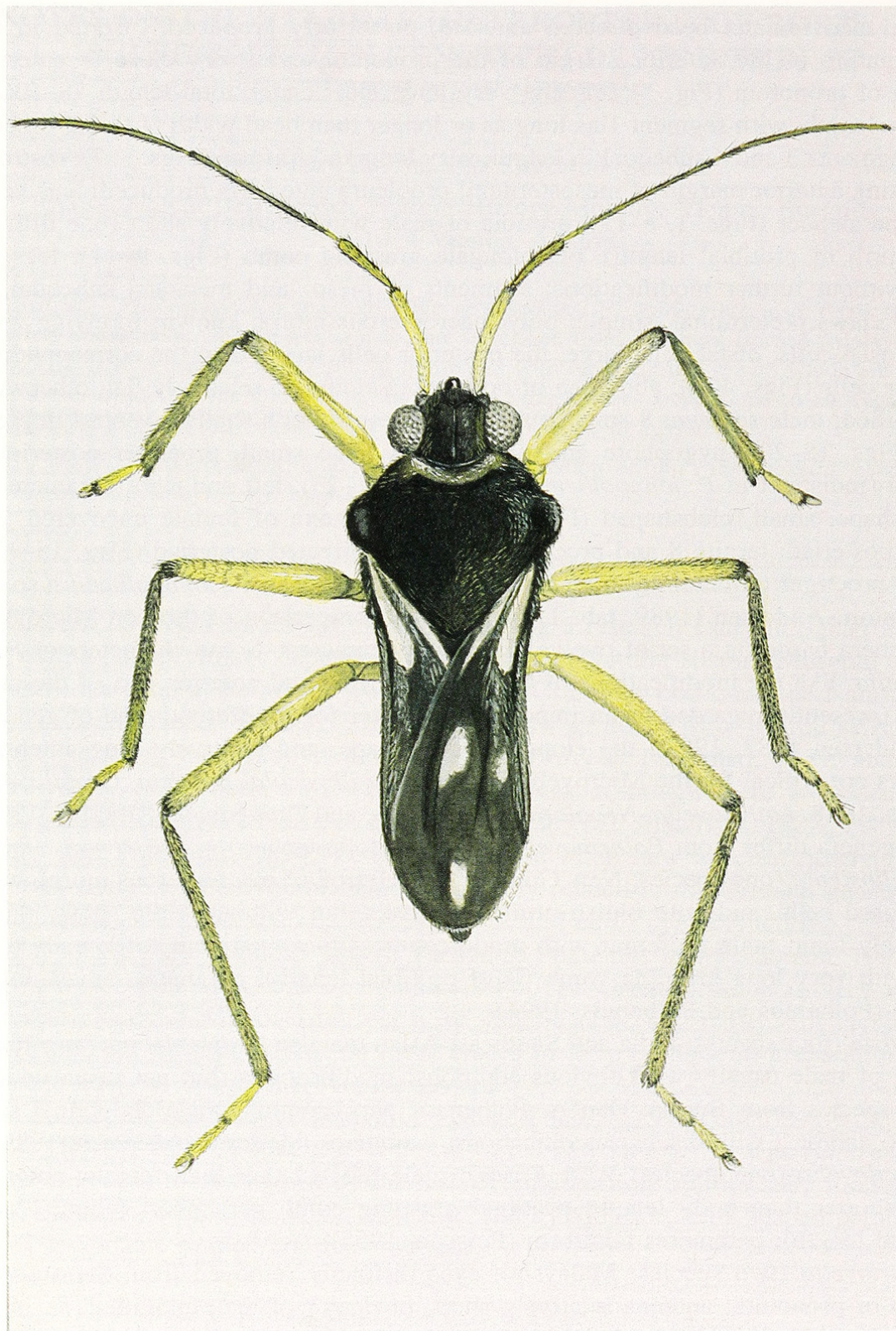
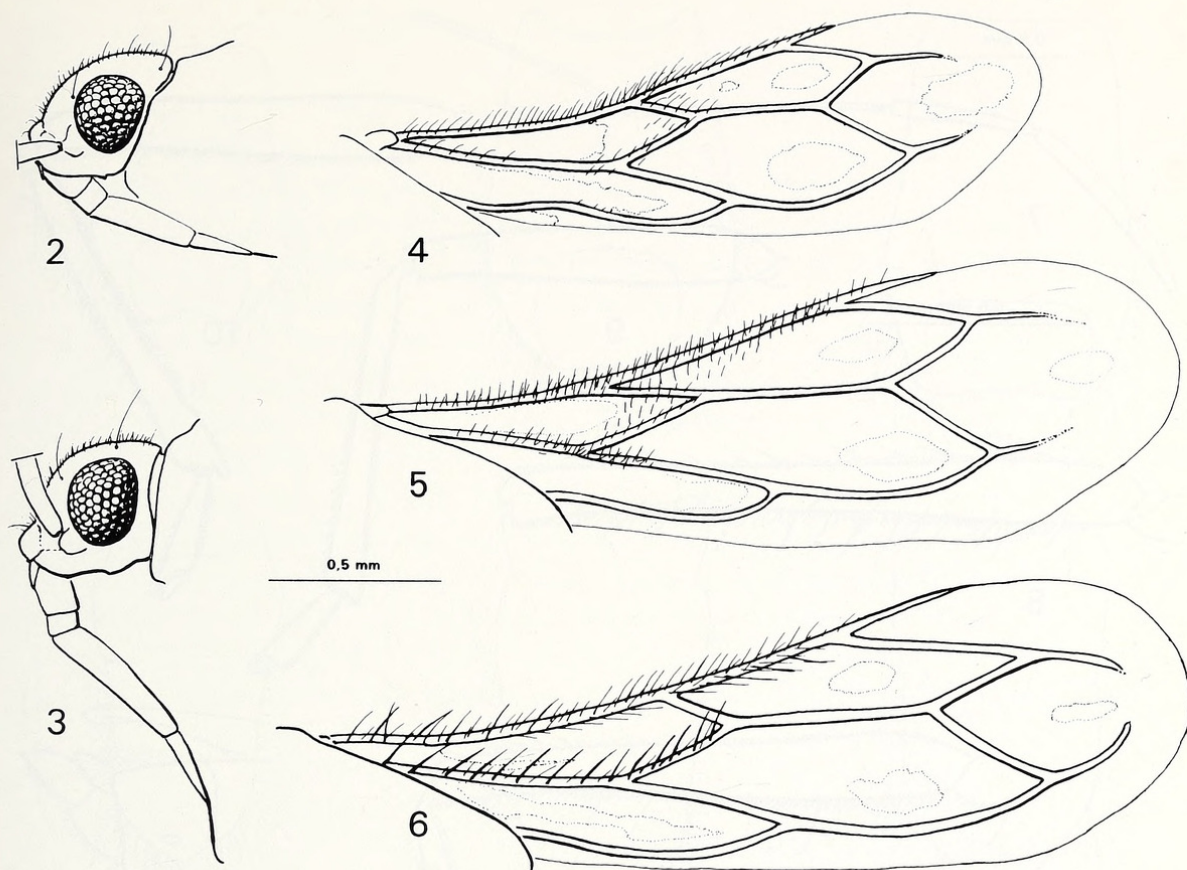


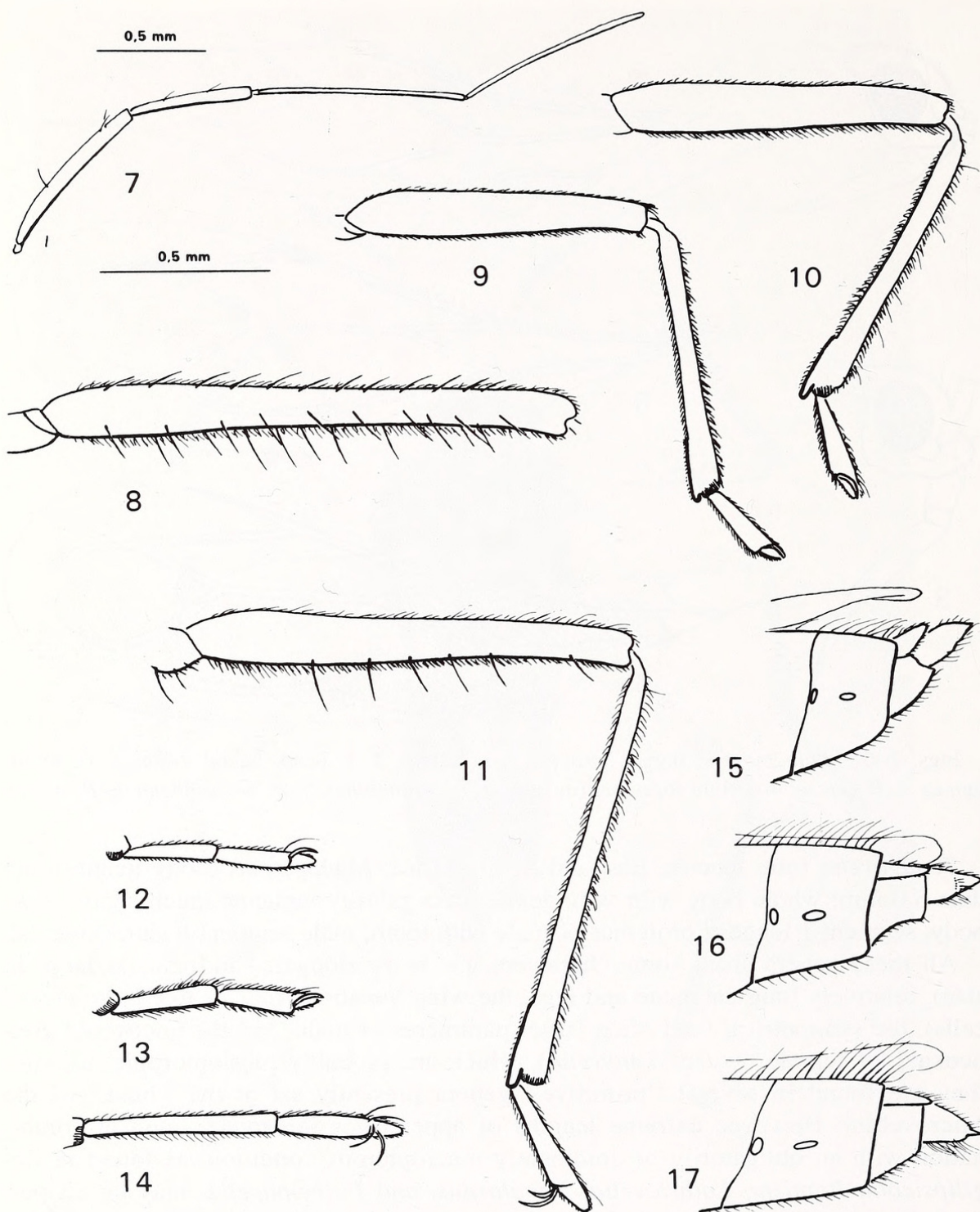
Fig. 1. *Polhemovelis septuaginta* n.gen., n.sp., male, dorsal habitus.



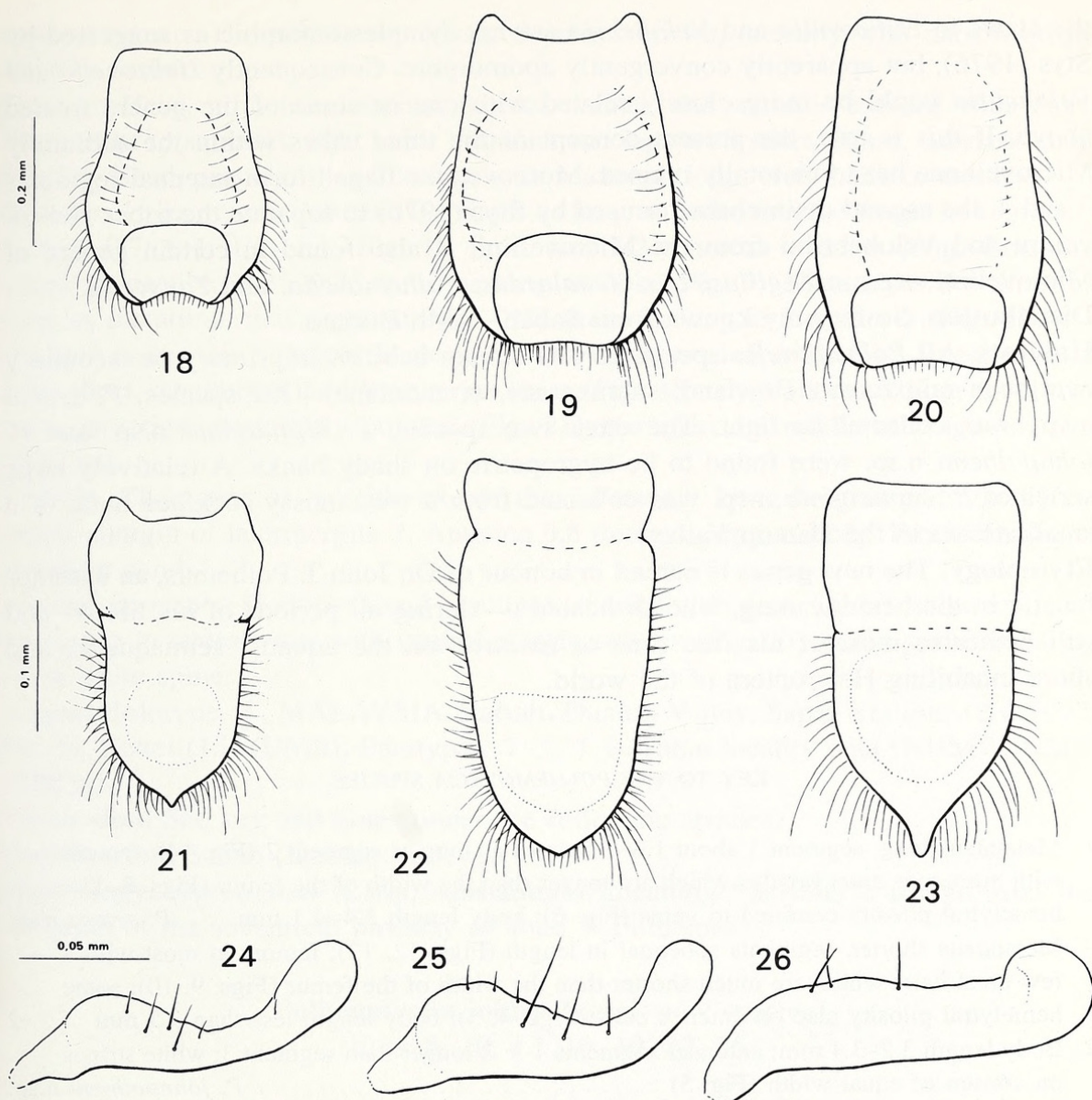
Figs. 2–6. *Polhemovelina* n.gen., structural characters. 2, 3, head, lateral view; 2. *P. septuaginta*, 3. *P. setosa*. 4–6, right forewing (in situ); 4. *P. septuaginta*, 5. *P. johnpolhemi*, 6. *P. setosa*.

Tenagovelina (one species; East and South Africa, Madagascar): body length more than 5.0 mm; whole body with very dense, erect pilosity; antenna much shorter than body, segment 1 longest; profemur of male with tooth; male segment 8 subcylindrical.

All these genera share some characters, i.e. body elongate (and usually large in size), relatively long antennae and legs, the wing venation (four or five large closed cells), the symmetrical (and often large) parameres of male, and the uncovered gonocoxa 1 of female (except *Tanyvelia*), which are probably plesiomorphic, because they are found in several “primitive” genera presently set at the “base” of the Microveliini. However, extreme lengths of appendages (antennae, legs) in combination with an obligatorily or dominantly macropterous condition, as found in *Aegilipsicola*, *Baptista*, *Lathriovelina*, *Neoalardus*, and *Polhemovelina*, may be adaptations to specialized, semiterrestrial or terrestrial life habits (for antenna see Štys, 1976), as convergently (also within Microveliinae?; see below) developed in Hebroveliini, Velohebrini, Mesoveliidae, and Gerridae-Eotrechinae. In fact, *Baptista* species are said to live in terrestrial (Linnavuori, 1977), semiterrestrial or small aquatic habitats (Andersen, 1989; Yang and Kovac, 1995); *Lathriovelina* “in the hollow interior of bamboo internodes of *Gigantochloa latifolia*” (Andersen, 1989; Yang and Kovac, 1995); *Neoalardus* “on moist sand and mud along a small stream” (Andersen, 1982); *Aegilipsicola* “apparently obligate to hygropetric habitats” (Dan A. Polhemus, pers. comm.); and *Polhemovelina* hygropetric (see below). The question as to whether these adaptations are apomorphic characters of a very old (see wide



Figs. 7-17. *Polhemovelina* n.gen., structural details. 7. *P. setosa*, antenna; 8. *P. setosa*, right mesofemur. 9-11, right foreleg; 9. *P. septuaginta*, 10. *P. johnpolhemi*, 11. *P. setosa*. 12-14, male metatarsus; 12. *P. septuaginta*, 13. *P. johnpolhemi*, 14. *P. setosa*. 15-17, Female terminalia, lateral view; 15. *P. septuaginta*, 16. *P. johnpolhemi*, 17. *P. setosa*.



Figs. 18–26. *Polhemovelina* n.gen., male genitalia. 18–20, segment 8, ventral view; 18. *P. septuaginta*, 19. *P. johnpolhemi*, 20. *P. setosa*. 21–23, proctiger, dorsal view; 21. *P. septuaginta*, 22. *P. johnpolhemi*, 23. *P. setosa*. 24–26, left paramere, external view; 24. *P. septuaginta*, 25. *P. johnpolhemi*, 26. *P. setosa*. Pilosity in Figs. 18–23 half-schematic, only along contours and characteristic mediad directed hairs of segment 8.

distribution!) clade of Microveliinae or have developed convergently several times, cannot be answered at present. Convergences of hygropetric life and body adaptations have also been observed in an undescribed *Microvelia* species (with very long middle and hind legs, but short antenna) from Australia, Northern Territories (H. Gross, pers. comm.), which seems to be otherwise closely related to other Australian *Microvelia* species.

It should be also considered that *Hebrovelia* and *Velohebria* may have perfected their adaptations to terrestrial habits by secondarily subterminal claws, as this is indicated in the gerrid genus *Eotrechus* Kirkaldy, 1902. In this case the positions of

the claws in *Hebrovelia* and *Velohebria* are not symplesiomorphic as suggested by Štys (1976), but apparently convergently apomorphic. Consequently *Hebrovelia* and *Velohebria* could be more closely related with one or some of the genera treated above. If this is true, the present concept of the three tribes within the subfamily Microveliinae has to be totally revised. Moreover, the flagelliform antennal segments 3 and 4, the second main character used by Štys (1976) to separate the tribes Hebroveliini and Velohebrini from the Microveliini, is also found in certain genera of Microveliini, e.g., in *Aegilipsicola*, *Neoalardus*, *Polhemovelina*, and *Tanyvelia*.

Distribution. So far only known from Sabah, North Borneo.

Habitats. All *Polhemovelina* species live in stream habitats in primary or secondary evergreen rain forests (lowland, submontane, or montane). One species, *P. setosa* n.sp., was collected at light. The other two species, *P. septuaginta* n.sp. and *P. johnpolhemi* n.sp. were found to be hygropetric on shady banks. A relatively large series of *P. septuaginta* n.sp. was collected from a wet, mossy rockface bank of a small stream in the Danum Valley.

Etymology. The new genus is named in honour of Dr. John T. Polhemus, an entomofanatic in the best meaning, who dedicated — during all periods of his life — and still dedicates most of his free time to research on the aquatic, semiaquatic, and shore inhabiting Heteroptera of the world.

KEY TO THE *POLHEMOVELIA* SPECIES

1. Metatarsus long, segment 1 about 1.3–1.5 times as long as segment 2 (Fig. 14); femora with numerous erect bristles which are longer than the width of the femur (Figs. 8, 11); hemelytral pilosity confined to veins (Fig. 6); body length 3.4–4.1 mm . . . *P. setosa* n.sp.
- Metatarsus shorter, segments subequal in length (Figs. 12, 13); femora at most with a few erect hairs which are much shorter than the width of the femur (Figs. 9, 10); some hemelytral pilosity also on anterior cells (Figs. 4, 5); body length less than 3.5 mm . . . 2
2. Body length 3.2–3.4 mm; antennal segments 1 + 2 longer than segment 3; white stripes on corium of equal width (Fig. 5) *P. johnpolhemi* n.sp.
- Body length 2.4–2.9 mm; antennal segments 1 + 2 of subequal length as segment 3 (Fig. 1); posterior white stripe on corium more slender than the anterior one (Fig. 4) *P. septuaginta* n.sp.

***Polhemovelina septuaginta*, new species**

Figs. 1, 2, 4, 9, 12, 15, 18, 21, 24

Description. Length: 2.4–2.6 mm (♂), 2.8–2.9 mm (♀); width of head: 0.6–0.7 mm (♂, ♀); width of pronotum: 0.9–1.1 mm (♂, ♀); habitus see Fig. 1.

Male. Color: Head dark brown, antenna brown, with basal part of segment 1 slightly lighter. Rostrum yellow, with apical segment shiny dark brown. Pronotum dark brown, with a narrow transverse stripe near anterior margin light brown. Legs brown, with coxae, trochanters, and basal part of femora yellow. Forewing dark brown with white patches: corium with one long and very slender stripe and with one broader and shorter stripe, membrane with two larger and one smaller spots (Fig. 4). Tergites and laterotergites covered by wings, lateral margin of laterotergites light brown to

reddish brown. Thoracic venter black. Sternites brown, laterally with narrow stripe slightly darker.

Pilosity: Head, pronotum, corium, thoracic venter, and sternites covered with short, decumbent to suberect, light hairs. Antenna and legs with short, dense, suberect, dark bristles. Head, pronotum, and corium with scattered, long, erect hairs or bristles.

Structural characters: Antenna 0.9 times as long as body, relative length of segments 1–4 as 0.7: 0.4: 1.0: 1.1 (Fig. 1). Pronotum 1.2 times as wide as long. Grasping comb on protibia 0.21–0.25 times as long as tibia (Fig. 9). Metatarsus 0.4 times as long as metatibia, first segment 0.83–0.92 times as long as segment 2 (Fig. 12).

Genital segments: Segment 8 slender, ventral impression indistinct, apical portion with short, decumbent and long, erect hairs (Fig. 18); pygophore without modifications; proctiger posteriorly pointed (Fig. 21); paramere in middle of length slender (Fig. 24).

Female. Characters as in male except the following: Long bristles additionally on lateral margin of laterotergite 7. Antenna 0.8 times as long as body. Protibia without grasping comb.

Genital segments: Gonocoxa and proctiger covered with dense, short, suberect hairs; gonocoxa in lateral view with ventral margin convex (Fig. 15); proctiger terminating in an acute spine.

Types. Holotype, ♂, MALAYSIA, **Sabah**, Danum Valley, Sapat Kalisan, 12.ii.1997, leg. H. Zettel (15) (UMS); Paratypes: 7 ♂, 7 ♀, same locality data (NHMW, UMS, JTPC).

Discussion. See key and notes under the following species.

Distribution. Sabah (Danum Valley).

Etymology. *septuaginta* (Latin, substantive), meaning “seventy”, named after the occasion of the seventieth birthday of John T. Polhemus.

***Polhemovelio johnpolhemi*, new species**

Figs. 5, 10, 13, 16, 19, 22, 25

Description. Length: 3.2 mm (♂), 3.4 mm (♀); width of head: 0.6–0.7 mm (♂, ♀); width of pronotum: 1.1–1.2 mm (♂, ♀).

Male. *Color*: Head dark brown, antennae brown, with basal part of segment 1 slightly lighter. Pronotum dark brown, with transverse, narrow stripe near anterior margin lighter brown. Legs brown, with coxae, trochanters, and basal part of femora yellow. Forewing dark brown with white patches: corium with two stripes of equal width, inner stripe longer, membrane with three spots (Fig. 5). Tergites and laterotergites covered by wings. Thoracic venter black. Sternites brown, laterally with narrow stripe slightly darker, lateral margin of sternites and distal margin of sternite 7 light brown.

Pilosity: Head, pronotum, corium, thoracic venter, and sternites covered with short, decumbent to suberect, light hairs. Antenna and legs with short, dense, suberect, dark bristles, femora with slightly longer, scattered, erect hairs, tibiae with slightly longer, scattered, erect bristles. Head, pronotum, corium, lateral margin of laterotergite 7, and distal margin of sternite 7 with long, erect hairs, especially dense on lateral margin of corium.

Structural characters: Antenna 0.8 times as long as body, relative length of segments

1-4 as 0.8: 0.5: 1.0: 1.0. Pronotum 1.2 times as wide as long. Grasping comb on protibia 0.21 times as long as tibia (Fig. 10). Metatarsus 0.4 times as long as metatibia, first segment as long as segment 2 (Fig. 13).

Genital segments: Segment 8 broad, ventral impression shallow and large, apical portion with short, decumbent and long, erect hairs (Fig. 19); pygophore without modifications; proctiger posteriorly weakly pointed (Fig. 22); paramere constricted in middle of length (Fig. 25).

Female. Characters as in male except the following: White stripes on corium rather indistinct. Long hairs on veins of corium and on lateral margin of laterotergite 7 more bristle-like; length of antenna as in male, relative length of segments 1-4 as 0.9: 0.5: 1: 1.1. Pronotum 1.3 times as wide as long. Protibia without grasping comb. Metatarsus 0.4 times as long as metatibia, first segment 0.85 times as long as segment 2.

Genital segments: Gonocoxa and proctiger covered with dense, short, suberect hairs; gonocoxa in lateral view with ventral margin concave (Fig. 16); proctiger terminating in an acute spine.

Types. Holotype, ♂, MALAYSIA, **Sabah**, Mt. Kinabalu, Liwagu River, 1,500 m, 18.ii.1997, leg. H. Zettel (20) (UMS). Paratype: 1 ♀ MALAYSIA, **Sabah**, Crocker Range, near Tenom, Kalang Waterfall, 16.-18.v.1998, leg. J. Kodada & F. Ciampor (NHMW).

Discussion. *Polhemovelina johnpolhemi* n.sp. is closely related to *P. septuaginta* n.sp., from which it can be distinguished in larger size, more flattened abdomen (comp. Figs. 15 and 16), more extended pruinose coloration of the pronotum, shorter antenna, and less acute tip of proctiger in both sexes. The male differs further in a ventrally more weakly impressed segment 8 (comp. Figs. 18 and 19), the female in the gonocoxa 1, which has the ventral margin slightly concave in lateral view (Fig. 16).

Distribution. Sabah (Mt. Kinabalu and Crocker Range).

***Polhemovelina setosa*, new species**

Figs. 3, 7, 8, 11, 14, 17, 20, 23, 26

Description. Length: 3.4-3.8 mm (♂), 3.9-4.1 mm (♀); width of head: 0.6-0.7 mm (♂, ♀); width of pronotum: 1.1-1.2 mm (♂), 1.3 mm (♀).

Male: Color: Head dark brown to dark reddish brown, antennae brown, with basal part of segment 1 slightly lighter. Pronotum dark brown, with transverse, narrow stripe on anterior margin yellow to light brown and with pronotal humeri sometimes pruinose. Legs brown, with coxae, trochanters, and basal part of femora yellow to light brown. Forewing dark brown with white patches: corium with one long and very slender stripe and with one broader and shorter stripe, both stripes sometimes rather indistinct, membrane with three spots, distal one smaller and sometimes indistinct (Fig. 6). Tergites and laterotergites covered by wings. Thoracic venter dark brown to black. Sternites light brown, laterally with narrow stripe slightly darker.

Pilosity: Head, pronotum, anterior margin of corium, thoracic venter, and sternites covered with short, decumbent to suberect, light hairs. Antenna and legs with short, dense, suberect, dark bristles, femora additionally with numerous long, erect bristles. Head, pronotum, veins of corium, lateral margin of laterotergite 7, and distal margin of sternite 7 with long, erect bristles.

Structural characters: Antenna 0.9-1.1 times as long as body, relative length of

segments 1–4 as 0.9: 0.5–0.6: 1.0: 0.9–1.0 (Fig. 7). Pronotum 1.1–1.2 times as wide as long. Grasping comb on protibia 0.21–0.23 times as long as tibia (Fig. 11). Metatarsus 0.4 times as long as metatibia, first segment 1.36–1.50 times as long as segment 2 (Fig. 14).

Genital segments: Segment 8 broad, ventral impression shallow and large, apical portion with short, decumbent and long, erect hairs (Fig. 20); pygophore without modifications; proctiger posteriorly strongly pointed (Fig. 23); paramere in middle of length weakly constricted (Fig. 26).

Female: Characters as in males except the following: Antenna 0.9 times as long as body, relative length of segments 1–4 as 0.8: 0.5: 1.0: 1.0. Pronotum 1.1–1.2 times as wide as long. Protibia without grasping comb. First metatarsal segment 0.50–0.53 times as long as segment 2.

Genital segments: Gonocoxa and proctiger covered with dense, short, suberect hairs; gonocoxa in lateral view with ventral margin straight (Fig. 17); proctiger ending in spine.

Types. Holotype, ♂, MALAYSIA, NW, **Sabah**, Kinabalu Park, W slope of Kinabalu, between Kg. Kiau Satu and Marai Parai, at light along Sg. Tahuban, 1030 m, untouched submontane evergreen rain forest, 6°04'N 116°30'E, 11.iii.1987, leg. Van Tol & Huisman (NNM); Paratypes: 6 ♂, 9 ♀, same locality data (NNM, NHMW); 3 ♂, 2 ♀, MALAYSIA, **Sabah**, Borneo, Mesilau River, 8 km. N. of Kundessan, 2,100 m, CL 2020, 1.viii.1985, leg. J.T. & D.A. Polhemus (JTPC, 1 ♂ NHMW).

Discussion. *Polhemovelina setosa* sp.n. differs from both congeners in larger size, more elongate shape of the abdomen (more conspicuous in females), strong pilosity of the legs (Figs. 8, 11), long segment 1 of metatarsus (Fig. 14), a differently shaped paramere (comp. Figs. 24, 25 and 26) and a posteriorly more pointed proctiger, especially in the male (Fig. 23).

Distribution. Sabah (Mt. Kinabalu).

Etymology. *setosus*, -a, -um (Latin, adjective) meaning “bristly”; named after the numerous diagnostic bristles of this species, especially those on the femora.

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