

# A new genus of marine water striders (Hemiptera, Veliidae) with five new species from Malesia

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Ent. scand.



Andersen, N. M.: A new genus of marine water striders (Hemiptera, Veliidae) with five new species from Malesia. *Ent.scand.* 22: 389–404. Copenhagen, Denmark January 1992. ISSN 0013–8711.

The generic classification of water striders belonging to the veliid subfamily Haloveliinae is discussed and revised and a key to the genera provided. A new genus of marine haloveliines, *Haloveloides* gen. n., is described. The type species of the new genus, *H. papuensis* (Esaki) comb. n., is redescribed and recorded from Papua New Guinea, the Bismarck Archipelago, and the Solomons. *H. browni* (Lansbury) comb. n. is redescribed and recorded from the same areas as the type species. Five new species are described in the genus: *H. brevicornis* sp. n. (the Moluccas, Sulawesi, Palawan), *sundaensis* sp. n. (Sunda shelf areas), *danpolhemi* sp. n. (Palawan), *cornuta* sp. n. (Luzon), and *femoratis* sp. n. (Palawan). The cladistic relationships and biogeography of the species are discussed.

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## Introduction

Marine water striders of the subfamily Haloveliinae (Gerromorpha, Veliidae) have radiated extensively in habitats of intertidal coral, rocky, and mangrove coasts in the Indo-Pacific region. I have earlier (Andersen 1989a, 1989b) revised the coral bugs, genus *Halovelina* Bergroth (1893), with 30 species chiefly inhabiting the intertidal zone of coral reefs. In this work (Andersen 1989a), a new concept of the genus *Halovelina* was introduced and a few species originally placed in this genus were transferred to the genus *Xenobates* Esaki (1927) which will be treated in a forthcoming paper (Andersen *in prep.*). *Halovelina papuensis* Esaki (1926) does not fit in either of these genera and it is therefore necessary to erect a new genus to hold this species together with some recently described species of *Halovelina* (Lansbury 1989) and five undescribed species from Malesia.

The subfamily Haloveliinae contains at present the genera *Halovelina* Bergroth (1893), *Strongyloveia* Esaki (1924), *Xenobates* Esaki (1927), and *Entomovelina* Esaki (1930). In the context of describing the new genus, the generic classification of the Haloveliinae is reviewed and a revised key to genera presented.

## Material and methods

The present study was based on material belonging to the institutions and collections listed as repositories below. Type material of all species belonging to the new genus but formerly placed in *Halovelina* have been studied. Much material has been gathered by the author during the past twenty years and is now deposited in the Zoological Museum, University of Copenhagen. On expeditions sponsored by the National Geographic Society, Drs John T. Polhemus, Englewood, Colorado, and Dan A. Polhemus, Honolulu, have collected many specimens belonging to the new genus from a number of localities throughout the Indo-Malayan archipelago.

The methods used to preserve, store, and examine marine haloveliines have been described earlier (Andersen 1989a). Colouration and vestiture are important characters in distinguishing the new genus (and some species) from other haloveliines. Specimens stored in 70% ethyl alcohol may not show all of these characters. It is therefore advisable to dry mount synoptic series of specimens as done during the present study. The morphological terminology follows Andersen (1982, 1989a). As a rule, absolute measurements (total length and maximum

width of body) are given to show the range of variation of each species. Relative measurements are only given for one specimen of each sex, usually the holotype and a paratype of the opposite sex. Except as noted, all relative measurements are given in micrometer units, 10 units equal 0.125 mm.

### List of repositories

(with abbreviations used in the lists of material examined)

JTPC - John T. Polhemus Collection, Englewood, Colorado

NHML - Natural History Museum (formerly British Museum, Natural History), London

TMB - Termesztudományi Múzeum (Hungarian National Museum), Budapest

UMO - University Museum, Oxford University, Oxford

USNM - U.S. National Museum of Natural History, Washington, D.C.

ZMUC - Zoological Museum, University of Copenhagen

### Generic classification

The shifting position of the subfamily Haloveliinae (Hale 1926; Esaki 1926, 1930; China & Usinger 1949; Poisson 1956) has been thoroughly discussed earlier (Andersen 1982, 1989a) where it was confirmed that the haloveliines belong to the family Veliidae. However, the generic classification of the Haloveliinae needs further attention, especially after the discovery of several marine species that violate the current generic concepts within the subfamily (Esaki 1930; China & Usinger 1949; Andersen 1982).

The genus *Halovelina* Bergroth (1893) was delimited by Andersen (1989a) to include marine haloveliines with relatively small eyes (eye width less than 0.3x interocular width of head), a definite grasping comb (a row of densely set spines) on the fore tibia of male, genital segments of male withdrawn into pregenital abdomen, etc. When describing *Halovelina papuensis*, Esaki (1926) noticed that this species is much different from the other species of *Halovelina* in its relatively much longer legs, less swollen mesonotum, etc. Esaki overlooked, however, that his new species also was unique in lacking the grasping comb present in all *Halovelina* species (first shown by Hale 1926).

In the same paper, Esaki (1926) described a new genus, *Microbates* (preoccupied name, replaced by *Xenobates* Esaki, 1927), based upon a single species, *X. seminulum* (Esaki 1926). Apart from the minute size of the type species (male 1.2 mm, female

1.3 mm long), this genus was characterized by the relatively long head, the broad female abdomen, and especially by a fringe of long, stout hairs on the exterior margin of the intermediate legs. *X. seminulum* was collected in a river with brackish water, while most subsequent records of *Xenobates* spp. (Lansbury 1989; Polhemus, unpublished; Andersen, unpublished) are from marine habitats, chiefly mangroves.

Polhemus (1982) described *Halovelina* (*Colpovelina*) *angulana* (Northern Territory, Australia). The diagnostic characters of the new subgenus were the absence of a fore tibial comb and presence of yellowish and silvery pubescent markings. Polhemus (l.c.) included *Halovelina loyaltiensis* China (1957) and *H. malaya* Dover [sic!]. I have examined specimens of the latter identified by J.T. Polhemus. They belong to *Haloveloides sundaensis* sp. n. described below.

Most recently, Lansbury (1989), while describing new marine haloveliines from Australia and the Solomon Islands, placed the species of *Halovelina* known to him in four groups: (1) *Halovelina* (*Halovelina*): male with a fore tibial comb; (2) *Halovelina* (*Colpovelina*): male without a fore tibial comb, fore trochanter not spinose and sternum keeled; (3) *Halovelina* (species group): male without a fore tibial comb, fore trochanter spinose and sternum keeled; and (4) *Halovelina* (species group): male without a fore tibial comb, fore trochanter not spinose and sternum not keeled. Most previously described *Halovelina* species were placed in the first group. The second group contained *H. angulana* (but not *H. loyaltiensis*). In the third group Lansbury (l.c.) placed his new species *H. carinata* and *browni*, apparently overlooking that the former is the same as *H. papuensis* Esaki (1926). The fourth group contained a new species from Queensland, *H. myorensis* Lansbury. While there is no doubt about the taxonomic distinctness of *Halovelina* (sensu stricto; as defined by Andersen 1989a), the rest of the marine haloveliines are much more heterogeneous. Lansbury (1989) also used the mesofemoral hair fringe to separate *Xenobates* (with *X. seminulum* and a new species, *X. solomonensis*) from *Halovelina*. This character is quite variable, however. I have seen several undescribed species which show all grades of development of the mesofemoral hair fringe. In some of these, the male has a carinate abdominal venter. The subgenus *Colpovelina* (Polhemus 1982) does not belong to *Halovelina* (male grasping comb lacking), but more

likely to *Xenobates*, and its status as a separate taxon is questionable (pale pronotal markings and silvery pubescence on dorsum are found in many species).

The spinose fore trochanter of the male seems to be diagnostic for a group of species comprising *Halovelina papuensis* (Esaki 1926), *H. carinata*, and *browni* also recognized by Lansbury (1989). In my opinion, this species group is sufficiently distinct from other marine haloveliines to deserved the status of a separate genus which is described below.

The following key will assist in the identification of haloveliine water striders to genus. The key also includes the two freshwater genera, *Strongylovelia* Esaki (1924) and *Entomovelina* Esaki (1930). While marine haloveliines are always apterous (wingless), macropterous (long-winged) forms are known to exist in freshwater species (Esaki 1926; Andersen 1982, and unpublished).

### Key to the genera of Haloveliinae (Veliidae)

1. Head strongly deflected anteriorly. Eyes very large, more than half as wide as interocular width of head. First antennal segment shorter than third segment. Male fore tibia without grasping comb. Freshwater species ..... 2
- Head moderately deflected anteriorly. Eyes less than half as wide as interocular width of head. First antennal segment usually longer than third segment. Male fore tibia with (*Halovelina*) or without grasping comb (*Xenobates*, *Haloveloides*). Marine species ..... 3
2. Second antennal segment longer than first segment. Hind tarsal segments subequal in length ..... *Strongylovelia* Esaki
- Second antennal segment shorter than first segment. First hind tarsal segment about one half of second segment ..... *Entomovelina* Esaki
3. Pronotum usually totally dark. Eye width less than 0.3x interocular width of head. Fore tibia of male with grasping comb. Abdominal venter of male rarely modified. Male genital segments withdrawn into pregenital abdomen and only slightly protruding from abdominal end ..... *Halovelina* Bergroth
- Pronotum with pale marking or spots. Eye width more than 0.4x interocular width of head. Fore tibia of male without grasping comb. Abdominal venter of male usually with basal tumescence and/or median keel. Male genital segments distinctly protruding from pregenital abdomen ..... 4
4. Usually dark and pale coloured; thoracic dorsum with definite spots of silvery hairs. Fore trochanter of male not modified. Middle femur less than 0.9x total length, with or without a row of long, bristle-like hairs along anterior margin; ratio of middle tarsus and tibia less than 0.7:1 ..... *Xenobates* Esaki

- Chiefly dark coloured; thoracic dorsum at most with scattered silvery hairs. Fore trochanter of male with a tubercle or spine before apex (except *H. femoralis* sp. n.). Middle femur more than 0.9x total length, with short pubescence along anterior margin; ratio of middle tarsus and tibia about 0.8:1 ..... *Haloveloides* gen. n.

### Taxonomy

#### Genus *Haloveloides* gen. n.

Type species: *Halovelina papuensis* Esaki, 1926; here designated.

#### Description

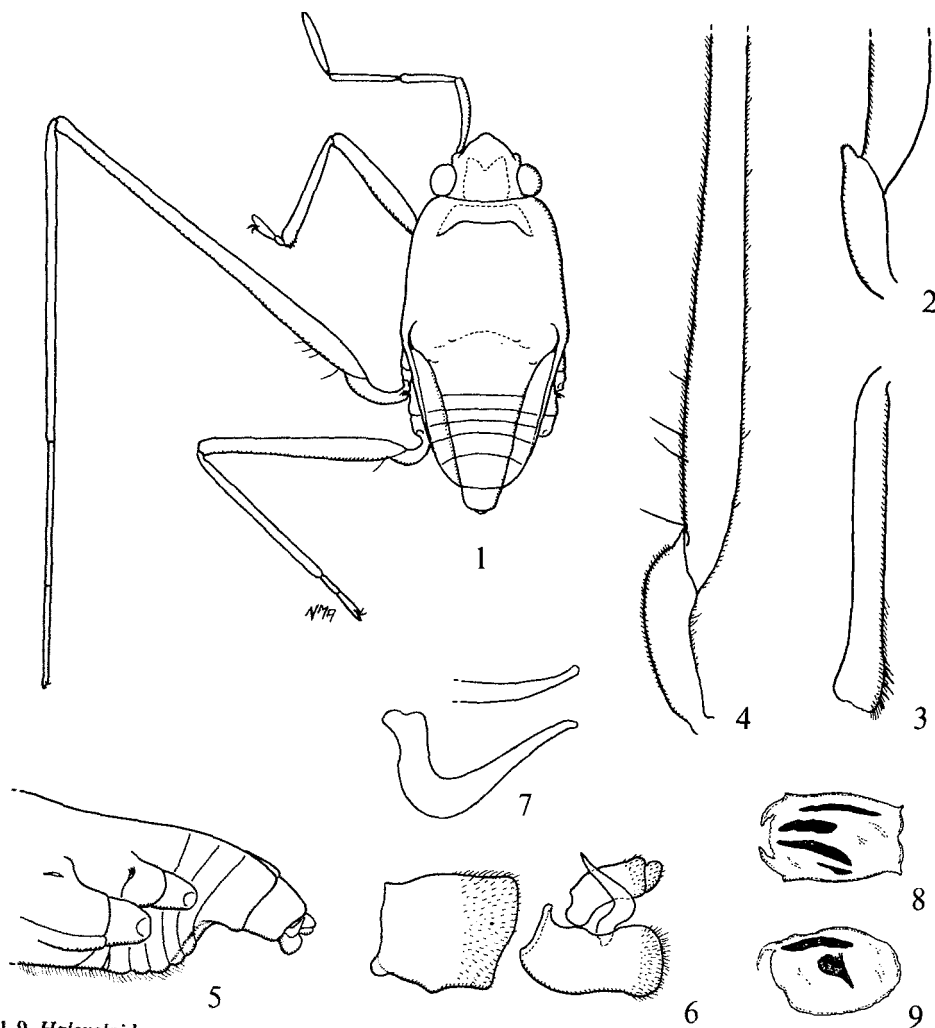
Small or very small insects, always apterous (wingless). Body chiefly dark coloured, covered by a thick, usually greyish pubescence. Head largely pale between eyes; pronotum with transverse pale marking. Thoracic dorsum usually without definite spots of silvery hairs.

Body fusiform, length 2.1–2.3x greatest width (♂) or rhomboid, length about 2.0x (♀) greatest width. Head shorter than wide, moderately deflected in front of eyes (Fig. 11). Eyes globular and relatively large, width of each eye more than 0.4x interocular width of head. Antennae long and slender, 0.5–0.8x total length; segment 1 subequal to or slightly longer than head.

Pronotum very short (Figs 1 and 10),  $\frac{1}{4}$ – $\frac{1}{3}$  of head length in middle; dorsal suture between pro- and mesothorax distinct, turned obliquely backwards laterally, terminating far from lateral margins of thorax; sutures between pro- and mesopleura lost. Ventral sutures of thorax and abdomen distinct; scent channels extending laterally and obliquely backwards, distinctly separated from hind margin of metasternum.

Fore trochanter of male usually with a tubercle (Fig. 2) or spine (Fig. 19). Fore tibia of male without definite grasping comb, but usually with scattered, spinous hairs along inner surface just before apex (Fig. 3). Middle femur very long, usually more than 0.8x total length, distinctly thickened proximally, especially in male; femur with short pubescence along anterior margin (Fig. 4); tibia and tarsus prolonged, tarsus 0.7–0.9x length of tibia; second tarsal segment 1.3–1.6x first segment; claws short, falcate, and subterminal. Hind femur relatively short, more or less incrassate in male; second tarsal segment much longer than first segment.

Abdomen relatively short and tapering in both



Figs 1-9. *Haloveloides papuensis* (Esaki), male: 1. Dorsal view, appendages of right side removed; pale markings indicated by stippled lines. 2. Right fore trochanter. 3. Right fore tibia. 4. Basal half of left middle femur; only marginal hairs shown. 5. Posterior thorax and abdomen, lateral view. 6. Genital segments, lateral view. 7. Left paramere, lateral view; dorsal aspect of blade above. 8. Vesica, dorsal view. 9. Same, lateral view.

sexes; connexiva broad and obliquely inclined throughout in male, vertically raised or posteriorly inflexed upon abdominal dorsum in female; abdominal terga 3-7 distinctly separated by intersegmental sutures. Abdominal venter of male usually with basal tumescence and median keel (Fig. 5); female abdomen with hind margin of sternum 7 produced in middle. Male genital segments distinct-

ly protruding from abdominal end (Figs 1 and 5); segment 8 simple; pygophore usually modified distally; parameres large, symmetrically developed, usually falciform. Vesica (Figs 8-9) with four dark sclerites, dorsal sclerite divided into two. Female genital segments more or less deflected, proctiger usually covering gonocoxae. Gynatrial complex as in *Halovelina* (Andersen 1989a).

**Key to the species of *Haloveloides* gen. n.**

1. Third antennal segment more than 1.5x second segment. Abdominal venter of male with narrow, basal tumescence but without a median keel on sterna 5–6 ..... 2
- Third antennal segment less than 1.5x second segment. Abdominal venter of male with large, basal tumescence and median keel on sterna 5–6 (Fig. 5) ..... 5
2. Fourth antennal segment fusiform (Figs 23–24), distinctly thicker than first segment. Fore trochanter of male with a spine (Fig. 25). Sunda Shelf areas ..... 4. *sunduensis* sp. n.
- Fourth antennal segment not fusiform (Figs 1 and 10), only as thick as first segment. Fore trochanter of male with a tubercle or spine ..... 3
3. Fore trochanter of male with a distinct spine (Fig. 19). Pygophore of male distinctly expanded posteriorly (Fig. 21). Female mesonotum with a round, shallow impressions on each side of midline. Papuaasia ..... 3. *browni* (Lansbury)
- Fore trochanter of male with a tubercle (Fig. 2). Pygophore of male not modified as above. Female mesonotum not as above ..... 4
4. Antennae short, 0.65x (♂) or 0.5x (♀) total length of insect. Posterior surface of each eye with a white, felt-like pad (Fig. 14). Female mesonotum simple. Palawan, Sulawesi, Moluccas ..... 2. *brevicornis* sp. n.
- Antennae long, 0.75x (♂) or 0.6x (♀) total length of insect. Eyes without felt-like pad posteriorly. Female mesonotum with a large, shallow impression posteriorly. Papuaasia ..... 1. *papuensis* (Esaki)
5. Fore trochanter of male with a tubercle (Fig. 29). Hind femora of male thickened but not incrassate ..... 6
- Fore trochanter of male without a tubercle. Hind femora of male distinctly incrassate (Fig. 38). Palawan ..... 7. *femoralis* sp. n.
6. Male pygophore with lateral tufts of curved hairs (Fig. 36). Fore tibia of male with a row of 8–10 spinous hairs distally (Fig. 35). Luzon ..... 6. *cornuta* sp. n.
- Male pygophore not modified as above. Fore tibia of male with a group of densely set spinous hairs (Fig. 30). Palawan ..... 5. *danzpolhemi* sp. n.

**1. *Haloveloides papuensis* (Esaki) comb. n.**

(Figs 1–11)

*Halovelia papuensis* Esaki, 1926: 160, figs 12a–b (description; type locality: Dregerhafen, New Guinea); Esaki 1930: 24 (list); China 1957: 355–356 (descriptive notes, key).

*Halovelia carinata* Lansbury, 1989: 100–101 (description; type locality: Solomon Is., New Georgia), **syn. n.**

**Type material.** – PAPUA NEW GUINEA: Lectotype ♂ (*papuensis*, here designated), labelled 'N. Guinea, Biro 1898', 'Dregerhafen' and 'Halovelia papuensis Esaki, det. T. Esaki' (TMB). Paralectotypes: 48♂ 393♀ (4♂ 3♀ examined), same data as lectotype (NHML, TMB).

SOLOMON ISLANDS: Holotype ♂ (*carinata*), New Georgia, Vip Is., sheltered rocky beach, 4.ii.1979, W.D. Williams (UMO). Paratypes: 5♂ 14♀ (1♂ 1♀ examined), same data as holotype (UMO, ZMUC).

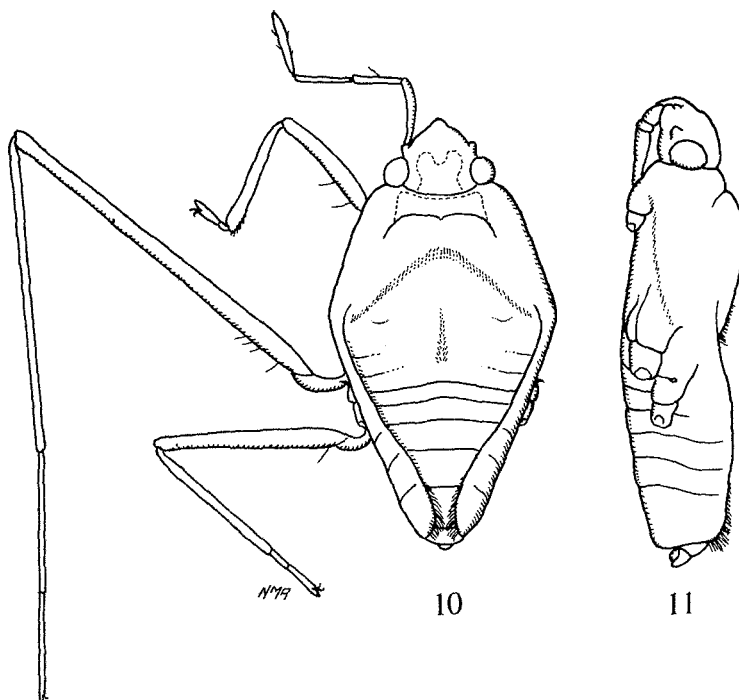
**Other material examined.** – BISMARCK ARCHIPELAGO: 93♂ 31♀ + numerous nymphs, Mussau, Malakate, freshwater spring near the sea, 12.vi.1962, Noona Dan Expedition 1961–62 (ZMUC). PAPUA NEW GUINEA: 13♂ 1♀, Madang P., Nagada Harbour, C.R.I., jetty, 6 p.m., 17.ii.1990, I. Lansbury (UMO); 9♂ 2♀, same locality, 5 p.m., 22.ii.1990, I. Lansbury (UMO); 22♂ 18♀, same locality, 5.30 p.m., 23.ii.1990, I. Lansbury (UMO); 3♀, same locality, m.v.l.t., 24.ii.1990, I. Lansbury (UMO); 10♂ 4♀, same locality, 4 p.m., 27.ii.1990, I. Lansbury (UMO); 4♂ 3♀, same locality, 7.iii.1990, I. Lansbury (UMO); 5♂ 5♀, same locality, m.v.l.t. 8.30–9.30, 14.iii.1990, I. Lansbury (UMO). SOLOMON ISLANDS: 1♂ 1♀, Malaita, Buma, 12.ix.1954, E.S. Brown (NHML); 1♀, New Georgia, Hawthorn Sound, Noro, Cheng 5, 25.iii.1983, Lanna Cheng (ZMUC); 1♂ 1♀, New Georgia, 3 km off Munda, in lagoon, 3.iv.1983, Lanna Cheng (ZMUC); 1♂, New Georgia, Munda, Cheng 10, lagoon, 7.iv.1983, Lanna Cheng (ZMUC); 1♂, Russell I., Fai Ami, 9.ix.1955, E.S. Brown (NHML); 1♂ 1♀, Ulawa, 27.iv.1955, E.S. Brown (NHML).

**Diagnosis.** – Recognized by the chiefly dark coloured body with distinct, yellowish brown markings on head and along pronotal hind margin, the presence of a tubercle on male fore trochanter, the basal tumescence on male abdominal venter, and the tufts of hairs on female metanotum and abdominal end.

**Redescription.** – Size: ♂, length 1.58–1.82 mm, width 0.72–0.85 mm; ♀, length 1.85–2.08 mm, width 0.90–1.10 mm.

Colour: Black or dark brown with greyish pubescence. A large, V-shaped spot at base of head and middle area of pronotum except anterior margin, yellowish brown. Antennae and legs dark brown or blackish; basal part of antennal segment 1, fore trochanter and basal part of fore femur, and basal parts of middle and hind trochanters, light brown to yellowish brown. Ventral surface dark brown.

Structural characters: Male (Fig. 1) fusiform, length about 2.3x greatest width across thorax (142:63). Head length about 0.7x head width across eyes (27:41); eye width almost 0.4x width of head between eyes (9:23). Antennae about 0.75x total length of insect (105:142); relative lengths of antennal segments (1–4): 30:22:25:28; segment 2 slightly shorter than segment 3; segment 4 only slightly thicker than segment 1 (5:4). Relative lengths of leg segments (femur:tibia:tarsus): fore leg: 53:47:17; middle leg: 150:115:91; and hind leg: 81:65:22. Fore trochanter with an apical tubercle (Fig. 2) furnished with some minute, black denticles; fore tibia distal-



Figs 10–11. *Haloveloides papuensis* (Esaki), female: 10. Dorsal view, appendages of right side removed; pale markings indicated by stippled lines. 11. Lateral view of body, appendages removed.

ly with 4–5 spinous hairs (Fig. 3); middle femur 1.05x total length of insect (150:142); relative lengths of middle tarsal segments (1–2): 52:39; hind femur as thick as middle femur (9:9). Abdominal venter with a broad, basal tumescence which continues as a median keel on sterna 5–6 (Fig. 5); basal tumescence with long, erect pubescence. Genital segments (Fig. 6) small, segment 8 ventrally flattened, pygophore slightly widened posteriorly; parameres relatively short, falciform (Fig. 7); blade of each paramere slender and almost straight, distally curved mesad, apex blunt; vesical sclerites (Figs 8–9).

Female (Figs 10–11) rhomboid in outline, length about 2.0x greatest width across thorax (164:83). Head structure as in male; antennae 0.6x total length of insect (101:164); length of antennal segments (1–4): 28:21:24:28. Thorax dorso-ventrally flattened, in lateral view (Fig. 11) only slightly convex dorsally; mesonotum usually with a large, shallow impression in posterior part; metanotum and basal abdominal terga with a median tuft of hairs. Relative lengths of leg segments (femur:tibia:tar-

sus): fore leg: 57:46:19; middle leg: 151:126:102; hind leg: 78:61:22. Fore trochanter without tubercle; middle femur about 0.9x total length. Abdomen broad at base, distinctly tapering in width posteriorly; connexiva vertically raised in anterior parts, slightly inflexed upon abdominal dorsum posteriorly; connexiva of segment 7 and genital segments with long, suberect pubescence; sternum 7 not produced in middle. Tergum 8 and proctiger slightly deflected; gonocoxa exposed.

*Distribution and habitats.* – See map (Fig. 42). Described by Esaki (1926) from Dregerhafen, northeastern Papua New Guinea. Now also recorded from Madang Province, Papua New Guinea, the Solomon Islands (New Georgia, Malaita, Russell, Ulawa) and Bismarck Archipelago (Mussau). Numerous adults and nymphs were collected in a freshwater spring near the sea on the island of Mussau, Bismarck Archipelago. In Papua New Guinea and the Solomons, however, adult specimens have been collected on the sea surface.

**Discussion.** – Lansbury (1989) described *Halovelina carinata* from New Georgia, Solomon Is., without comparing it with Esaki's (1926) *H. papuensis*. I have seen type material of both and find that they belong to the same species.

Specimens from the Solomon Islands and Bismarck Archipelago (Mussau) are generally smaller ( $\sigma$ : length 1.55–1.7 mm;  $\phi$ : length 1.85–1.95 mm) than those from Papua New Guinea ( $\sigma$ : length 1.7–1.8 mm;  $\phi$ : length 2.05–2.1 mm). Other characters, e.g., the relative length of antennae, the modification of male fore trochanter and abdominal venter, are the same.

## 2. *Haloveloides brevicornis* sp. n.

(Figs 12–15)

**Type area.** – Cape Dadebo, Sulawesi Utara Prov., Celebes.

**Type material.** – SULAWESI: Holotype  $\sigma$ , Sulawesi Utara Province, Cape Dadebo, 8 km W of Malibago, CL 2112, mangroves behind reef, 8.ix.1985, J.T. & D.A. Polhemus (JTPC); deposited in the Natural History Museum, London, property of Museum Zoologicum Bogoriense, Bogor. Paratypes: 13 $\sigma$  16 $\phi$ , same data as holotype (JTPC, ZMUC). MOLUCCAS: 31 $\sigma$  30 $\phi$ , Bacan, Maluku Province, Babang, calm sea offshore, CL 2135, 24.ix.1985, J.T. & D.A. Polhemus (JTPC, ZMUC). PHILIPPINES: 4 $\sigma$  3 $\phi$ , Palawan, Sabang, N of Mt St Paul, 11–13.vii.1977, M. Sato (JTPC).

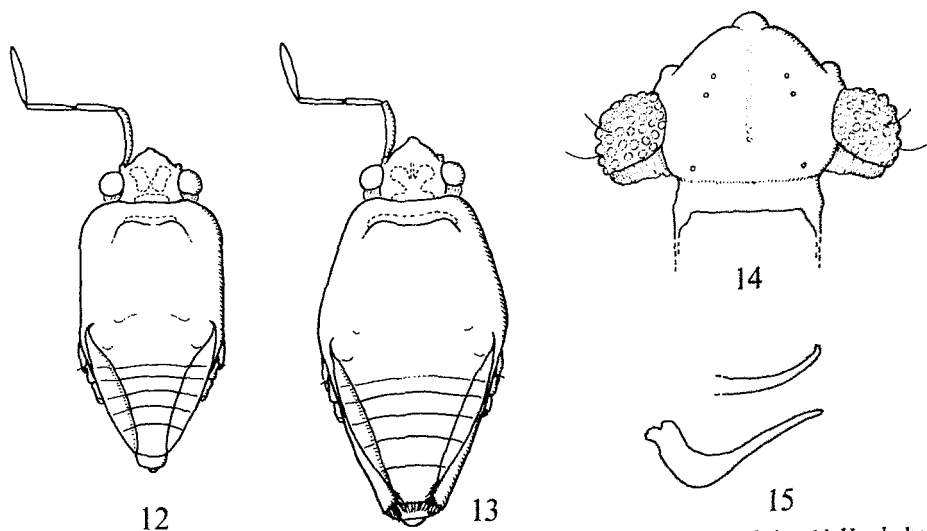
**Etymology.** – Named to describe the relatively short antennae.

**Diagnosis.** – Separated from *papuensis* by the relatively shorter antennae, the presence of a whitish, felt-like pad on posterior surface of each eye, and the scattered pubescence of female thoracic dorsum.

**Description.** – Size:  $\sigma$ , length 1.52–1.78 mm, width 0.68–0.82 mm;  $\phi$ , length 1.78–2.12 mm, width 0.85–1.04 mm.

**Colour:** Black with thick greyish pubescence. A V-shaped spot in middle of head, basal part of head, and pronotum along posterior margin, yellowish brown. Antennae and legs dark brown or black. Ventral surface dark brown.

**Structural characters:** Male (Fig. 12) fusiform, length about 2.3x greatest width across thorax (126:54). Head length about 0.6x head width across eyes (23:39); eye width slightly more than 0.4x width of head between eyes (9:21); posterior surface of each eye covered with a whitish, felt-like pad (Fig. 14). Antennae relatively short, about 0.65x total length of insect (80:126); relative lengths of antennal segments (1–4): 23:17:19:21; segment 2 slightly shorter than segment 3; segment 4 only slightly thicker than segment 1 (5:4). Relative lengths of leg segments (femur:tibia:tarsus): fore leg: 44:38:15; middle leg: 126:98:86; and hind leg: 65:52:18. Fore trochanter distally with a small tubercle (as Fig. 2); fore tibia before apex with 6–7 spinous hairs; middle femur 1.0x total length of insect (126:126); relative lengths of middle tarsal segments (1–2): 49:37;



Figs 12–15. *Haloveloides brevicornis* sp. n.: 12. Male body, dorsal view. 13. Female body, dorsal view. 14. Head, showing felt-like pads on posterior surface of eyes. 15. Left clasper of male, lateral view; dorsal aspect of blade above.

hind femur not as thick as middle femur (7:8). Abdominal venter with a narrow, basal tumescence which continues as a low, median keel on sterna 5–6; tumescence with long, erect pubescence. Genital segments, segment 8 ventrally flattened, pygophore slightly widened posteriorly; parameres relatively short, falciform (Fig. 15); blade of each paramere slender and almost straight, distally curved mesad, apex blunt.

Female (Fig. 13) rhomboid in outline, length about 2.0x greatest width across thorax (146:72). Head structure as in male; antennae 0.5x total length of insect (74:146); length of antennal segments (1–4): 23:15:17:19. Thorax only slightly convex dorsally, with scattered, suberect pubescence; mesonotum not impressed. Relative lengths of leg segments (femur:tibia:tarsus): fore leg: 45:39:16; middle leg: 128:105:96; hind leg: 61:50:21. Fore trochanter without tubercle; middle femur almost 0.9x total length. Abdomen broad at base, distinctly tapering in width posteriorly; connexiva obliquely raised in anterior parts, vertically raised or slightly inflexed upon abdominal dorsum posteriorly; connexiva and genital segments with scattered, suberect pubescence; sternum 7 slightly produced in middle. Tergum 8 and proctiger deflected, covering gonocoxa.

**Distribution and habitats.** – See map (Fig. 42). Described from Cape Dadebo, Sulawesi Utara Province, Celebes. Further material known from Bacan in the Moluccas, and from Palawan, Philippines. In Sulawesi, specimens (adults only) were collected amongst coral blocks and mangroves inside coral reef. In Bacan, adult specimens were taken by trolling with nets from a small boat, a mile or more from shore (Polhemus, field notes).

**Discussion.** – The white felt-like pad on the posterior surface of eyes has not been observed in any other species of Haloveliinae. Specimens from Palawan are generally larger ( $\sigma$ : length 1.75 mm;  $\varphi$ : length 2.05–2.1 mm) than those from Bacan and Celebes ( $\sigma$ : length 1.5–1.65 mm;  $\varphi$ : length 1.8–1.9 mm). Other characters, e.g., the eye structure, the relative length of antennae, the modification of male fore trochanter and abdominal venter are the same.

### 3. *Haloveloides browni* (Lansbury) comb. n. (Figs 16–22)

*Halovelia maritima* Bergroth; Esaki 1926: 162 (misidentification; records Dregerhafen, New Guinea).

*Halovelia browni* Lansbury, 1989: 102–104 (description; type locality: Solomon Is., Rendova, Kokorana I).

**Type material.** – SOLOMON ISLANDS: Holotype  $\sigma$  (examined), Kokorana Islands, Rendova, taken on the surface of sea in exposed situation, 7.x.1954, E.S. Brown (UMO). Paratype  $\varphi$  (examined), same data as holotype (UMO).

**Other material examined.** – BISMARCK ARCHIPELAGO: 1  $\sigma$ , New Ireland, Kalili Bay, on the sea near ship, 29.iv.1962, Noona Dan Expedition 1961–62 (ZMUC). PAPUA NEW GUINEA: 2  $\varphi$ , N. Guinea, Dregerhafen, Biro 1898, labelled '*Halovelia maritima* Bergr., det. T. Esaki' (TMB); 15  $\sigma$  10  $\varphi$  + nymphs, Bismarck Sea, P-23 Operation Drake, 04°18'S 147°23'E, 17.ix.1970, Lanna Cheng (ZMUC); 9  $\sigma$  3  $\varphi$ , Madang P., Nagada Harbour, C.R.I. jetty, m.v.l.t., 24.ii.1990, I. Lansbury (UMO); 1  $\varphi$ , same locality, 7.iii.1990, I. Lansbury (UMO); 5  $\sigma$ , same locality, m.v.l.t., 8.30–9.30, 14.iii.1990, I. Lansbury (UMO). SOLOMON ISLANDS: 2  $\varphi$ , Rendova, Kokorana I., 7.x.1954, E.S. Brown (NHML); 1  $\varphi$ , Ulawa, 27.iv.1955, E.S. Brown (NHML).

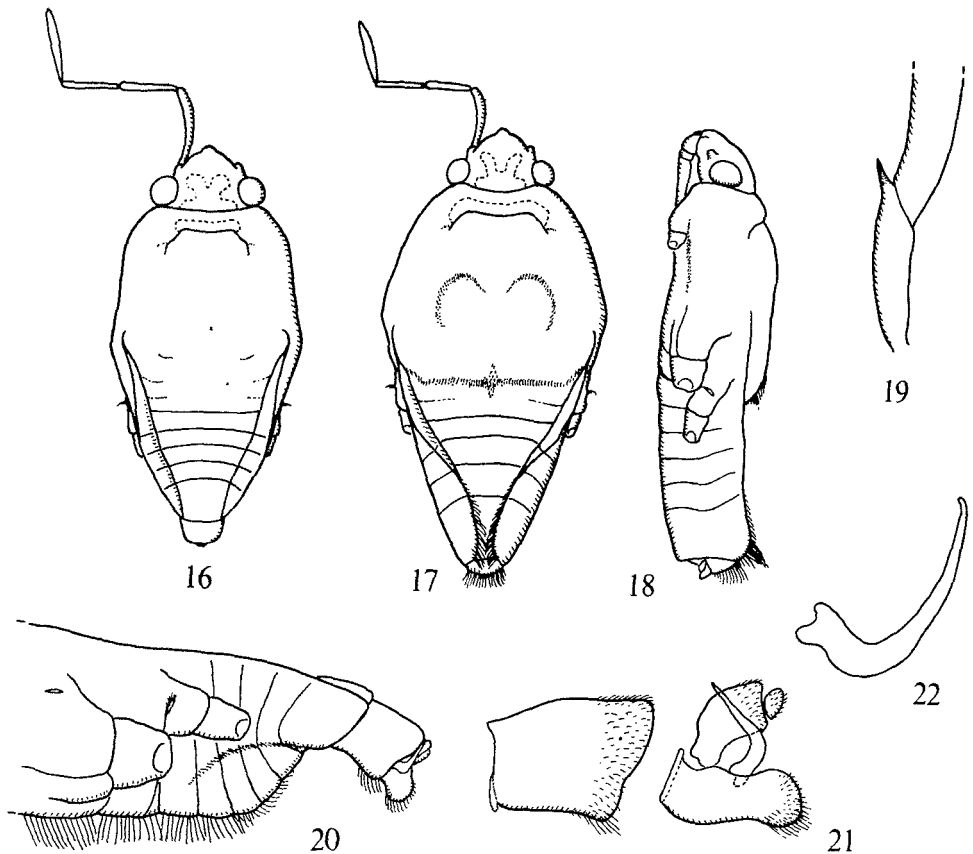
**Diagnosis.** – Separated from *H. papuensis* and *brevicornis* sp. n. by the spine on male fore trochanter, the thickened male hind femora, strongly modified male abdominal venter and genital segments, and the female abdominal structure.

**Redescription.** – Size:  $\sigma$ , length 1.85–1.92 mm, width 0.85–0.90 mm;  $\varphi$ , length 2.05–2.18 mm, width 1.06–1.10 mm.

Colour: Black with greyish pubescence which is longer and more distinctly grey on abdomen. A large, V-shaped spot at base of head and middle area of pronotum except anterior margin, yellowish brown. Antennae and legs including proximal parts, black and shiny. Ventral surface of body dark brown or blackish.

Structural characters: Male (Fig. 16) fusiform, length about 2.1x greatest width across thorax (149:70). Head length about 0.5x head width across eyes (23:42); eye width slightly more than 0.4x width of head between eyes (10:23). Antennae about 0.65x total length of insect (99:149); relative lengths of antennal segments (1–4): 28:21:22:28; segment 2 subequal in length to segment 3; segment 4 only slightly thicker than segment 1 (5:4). Relative lengths of leg segments (femur:tibia:tarsus): fore leg: 50:48:20; middle leg: 171:134:109; and hind leg: 85:73:24. Fore trochanter with a distinct apical spine (Fig. 19); fore tibia distally with 5–6 spinous hairs; middle femur 1.15x total length of insect (171:149); relative lengths of middle tarsal segments (1–2): 64:45; hind femur thicker than middle femur (12:10). Abdominal venter with a broad, basal tumescence which continues as a sharp, median keel on sterna 4–6 (Fig.





Figs 16–22. *Haloveloides browni* (Lansbury): 16. Male body, dorsal view. 17. Female body, dorsal view. 18. Female body, lateral view. 19. Right fore trochanter of male. 20. Posterior thorax and abdomen of male, lateral view. 21. Genital segments, lateral view. 22. Left paramere, lateral view.

20); tumescence and median keel furnished with long, erect pubescence. Genital segments (Fig. 21) prominent, segment 8 ventrally flattened, pygophore distinctly widened posteriorly, forming a hairy tumescence; parameres falciform (Fig. 22); blade of each paramere slender and almost slightly curved both dorsad and mesad, apex blunt.

Female (Figs 17–18) rhomboid in outline, length about 2.0x greatest width across thorax (172:85). Head structure as in male; antennae 0.5x total length of insect (87:172); length of antennal segments (1–4): 25:18:20:24. Thorax dorso-ventrally flattened, in lateral view (Fig. 18) slightly convex dorsally; mesonotum with a round, shallow impression on each side of midline; metanotum and basal abdominal terga with a median tuft of hairs. Relative lengths of leg segments (femur: tibia:tarsus):

fore leg: 50:45:20; middle leg: 156:123:106; hind leg: 74:62:21. Fore trochanter without spine; middle femur 0.9x total length of insect (156:172). Abdomen broad at base, distinctly tapering in width posteriorly; connexiva vertically raised in anterior parts, usually rather abruptly turned over and inflexed upon dorsum posteriorly; hind corners of connexival segment 7 and genital segments with tufts of long hairs; sternum 7 not produced in middle. Tergum 8 and proctiger slightly deflected; gonocoxa exposed.

*Distribution and habitats.* – See map (Fig. 42). Described by Lansbury (1989) from Rendova, Solomon Islands. Further recorded from Ulawa, Solomon Islands; Dregerhafen, Papua New Guinea (Esaki 1926; as *Halovelia maritima* Bergroth),

Madang Province, and the Bismarck Sea; and from New Ireland, Bismarck Archipelago. Both adults and large nymphs have been collected from the sea surface, far from shore.

#### 4. *Haloveloides sundaensis* sp. n.

(Figs 23–26)

*Halovelia malaya* Dover [sic!]; Polhemus 1982: 8 (mis-identification).

*Type area.* – Phang Nga, Phang Nga Province, Thailand.

*Type material examined.* – THAILAND: Holotype ♂, Phang Nga Province, Phang Nga, 6.iii.1982, Claus Nielsen (ZMUC). Paratypes: 25♂ 5♀, same locality and date as holotype (ZMUC); 2♂, Koh Chang, Strait at Koh Chang, 3–5 fathoms, muddy bottom, 1900, Th. Mortensen (ZMUC); 2♂, Phuket Island, P.M.B.C. reef–flat pools at low tides, 26–28.i.1987, N.M. Andersen (ZMUC). BORNEO: 33♂ 92♀, Sarawak, Bako National Park, 27.ix.1966, J.F.G. & Thelma M. Clarke (JTPC, USNM). JAVA: 37♂ 74♀, Onrust I., Java Sea, on surface at light, 4.v.1929, Th. Mortensen (ZMUC). WEST MALAYSIA: 145♂ 59♀ + nymphs, Johor, rocky coast at Mersing, CL 2057, 13.viii.1985, J.T. & D.A. Polhemus (JTPC); 1♂ Langkawi Is., 6.iv.1934, R. Birch (JTPC); 2♂ 2♀, Penang, Batu Muang, bay near shore, 23.iv.1965, Univ. Singapore (JTPC).

*Etymology.* – Named for its distribution in areas of the Sunda Shelf.

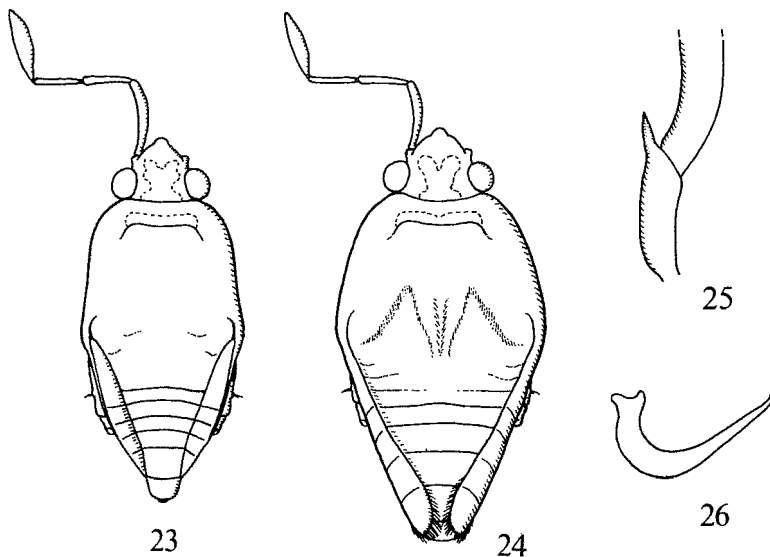
*Diagnosis.* – Separated from other species of the ge-

nus by the distinctly fusiform antennal segment 4 (both sexes), and from *papuensis* and *brevicornis* by the presence of a long spine on male fore trochanter and posteriorly depressed female mesonotum.

*Description.* – Size: ♂, length 1.65–1.75 mm, width 0.80–0.85 mm; ♀, length 1.96–2.20 mm, width 0.98–1.10 mm.

*Colour:* Black or dark brown with a thick greyish or pale brownish pubescence. A large, V-shaped spot at the base of head and median area of pronotum except anterior margin, yellowish brown. Antennae and legs brownish or dark brown. Ventral surface dark brown.

*Structural characters:* Male (Fig. 23) fusiform, length about 2.1x greatest width across thorax (137:64). Head length 0.7x head width across eyes (27:40); eye width about 0.4x width of head between eyes (9:22). Antennae about 0.7x total length of insect (100:137); relative lengths of antennal segments (1–4): 31:20:22:27; segment 2 slightly shorter than segment 3; segment 4 distinctly fusiform, about twice as wide as segment 1 (7.5:4). Relative lengths of leg segments (femur:tibia:tarsus): fore leg: 51:43:17; middle leg: 145:114:95; and hind leg: 77:61:22. Fore trochanter distally with a long spine (Fig. 25); fore tibia before apex with 6–8 stout, erect hairs; middle femur 1.05x total length of insect (145:137); relative lengths of middle tarsal segments



Figs 23–26. *Haloveloides sundaensis* sp. n.: 23. Male body, dorsal view. 24. Female body, dorsal view. 25. Right fore trochanter of male. 26. Left clasper of male, lateral view.

(1–2): 54:41; hind femur not as thick as middle femur (7:9). Abdominal venter with a narrow, basal tumescence which continues as a sharp, median keel on sterna 5–6; tumescence furnished with short, erect pubescence. Genital segments small, segment 8 ventrally flattened, pygophore widened posteriorly; parameres relatively short, falciform (Fig. 26); blade of each paramere slender and almost straight, apex blunt.

Female (Fig. 24) rhomboid in outline, length about 2.0x greatest width across thorax (163:83). Head structure as in male; antennae 0.55x total length of insect (91:163); length of antennal segments (1–4): 27:18:21:25; segment 4 fusiform as in male. Thorax only slightly convex dorsally; mesonotum with a large posterior depression margined by long pubescence and notched on each side of midline. Relative lengths of leg segments (femur:tibia:tarsus): fore leg: 53:43:19; middle leg: 177:115:101; hind leg: 74:57:23. Fore trochanter without spine; middle femur 1.1x total length. Abdomen broad at base, distinctly tapering in width posteriorly; connexiva vertically raised in anterior parts, inflexed upon abdominal dorsum posteriorly; connexiva with scattered, short suberect pubescence, genital segments with long suberect hairs; sternum 7 slightly produced in middle. Tergum 8 and proctiger strongly deflected, covering gonocoxa.

*Distribution and habitats.* – See map (Fig. 42). Recorded from various coastal areas of the Sunda Shelf: Thailand (Phang Nga, Phuket, Koh Chang in the Gulf of Siam); West Malaysia (Langkawi Is., Penang, Johor); Java; and Borneo (Sarawak). Adults and nymphs collected around rocks at low tide (Johor, West Malaysia and Phuket, Thailand) and near mangroves (Phang Nga, Thailand). In Java taken at light together with species of *Haloveloides*, *Halobates*, and *Hermatobates*.

### 5. *Haloveloides danpolhemii* sp. n.

(Figs 27–31)

*Type area.* – Langoban River, Palawan, Philippines.

*Type material examined.* – PHILIPPINES: Holotype ♂, Palawan, Langoban Riv., 84 km NW of Puerto Princesa, CL 2015, 28.vii.1985, J.T. & D.A. Polhemus (JTPC). Paratypes: 7 ♂ 71 ♀, same data as holotype (JTPC, ZMUC).

*Etymology.* – Named for one of the collectors, Dr Dan. A. Polhemus, Honolulu.

*Diagnosis.* – Separated from other species with a

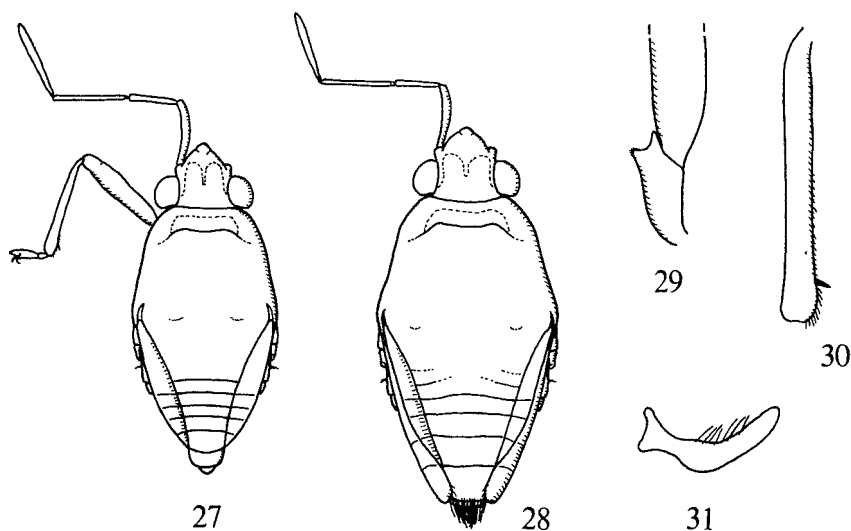
tubercle on fore trochanter of male by the relatively longer antennae, especially in male, the shape of parameres, and the long, dark bristle-like hairs on hind margin of tergum 7 in female.

*Description.* – Size: ♂, length 1.40–1.48 mm, width 0.62–0.66 mm; ♀, length 1.72–1.80 mm, width 0.80–0.88 mm.

Colour: Dark brown with scattered silvery hairs on mesonotum, more extensive silverish pubescence on abdominal dorsum. A large, V-shaped spot in middle of and basal part of head, and posterior half of pronotum, yellowish brown. Antennae and legs brownish, trochanter and basal half of fore femora yellowish. Ventral surface pale brownish.

Structural characters: Male (Fig. 27) fusiform, length about 2.2x greatest width across thorax (114:52). Head length about 0.6x head width across eyes (23:37); eye width slightly less than 0.5x width of head between eyes (9:19). Antennae relatively long, about 0.85x total length of insect (100:114); relative lengths of antennal segments (1–4): 23:17:29:31; segment 2 much shorter than segment 3; segment 4 not thicker than segment 1 (3:3). Relative lengths of leg segments (femur:tibia:tarsus): fore leg: 44:37:15; middle leg: 116:91:66; and hind leg: 59:49:17. Fore trochanter with a small subapical tubercle (Fig. 29); fore femur distinctly thickened beyond middle; fore tibia before apex with a group of densely set, spinous hairs (Fig. 30); middle femur about as long as total length of insect; relative lengths of middle tarsal segments (1–2): 41:25; hind femur as thick as middle femur (7:7). Abdominal venter with a narrow, basal tumescence furnished with long pubescence; sterna 5–6 not keeled. Genital segments small, segment 8 simple, pygophore slightly widened posteriorly; parameres relatively short, falciform (Fig. 31); blade of each paramere widened and setose, apex blunt.

Female (Fig. 28) rhomboid in outline, length about 2.15x greatest width across thorax (138:64). Head structure as in male. Antennae relatively shorter than in male, 0.65x total length of insect (90:138); length of antennal segments (1–4): 23:16:26:25. Thorax only slightly convex dorsally. Relative lengths of leg segments (femur:tibia:tarsus): fore leg: 46:39:15; middle leg: 125:103:80; hind leg: 61:51:17. Fore trochanter without tubercle; middle femur almost 0.9x total length. Abdomen broad at base, distinctly tapering in width posteriorly; connexiva obliquely raised in anterior parts, verti-



Figs 27–31. *Haloveloides danpolhemi* sp. n.: 27. Male body, dorsal view. 28. Female body, dorsal view. 29. Right fore trochanter of male. 30. Right fore tibia of male. 31. Left clasper of male, lateral view.

cally raised posteriorly; connexiva with short, suberect hairs in distal parts; hind margin of tergum 7 with several long, erect bristles; sternum 7 slightly produced in middle. Tergum 8 and proctiger strongly deflected, covering gonocoxa.

**Distribution and habitats.** – See map (Fig. 42). Only known from the type locality in Palawan, Philippines. The specimens (adults only) were collected in shaded side-pools with mangroves near river meeting sea via wide lagoon with narrow, rocky mouth (Polhemus, field notes).

## 6. *Haloveloides cornuta* sp. n.

(Figs 32–37)

**Type area.** – Infanta, Zimabales Province, Luzon, Philippines.

**Type material examined.** – PHILIPPINES: Holotype ♂, Luzon, Zimabales Province, 1 km S of Infanta, CL 1950, 5.vii.1985, J.T. & D.A. Polhemus (JTPC). Paratypes: 13 ♂ 11 ♀ + nymphs, same data as holotype (JTPC, ZMUC).

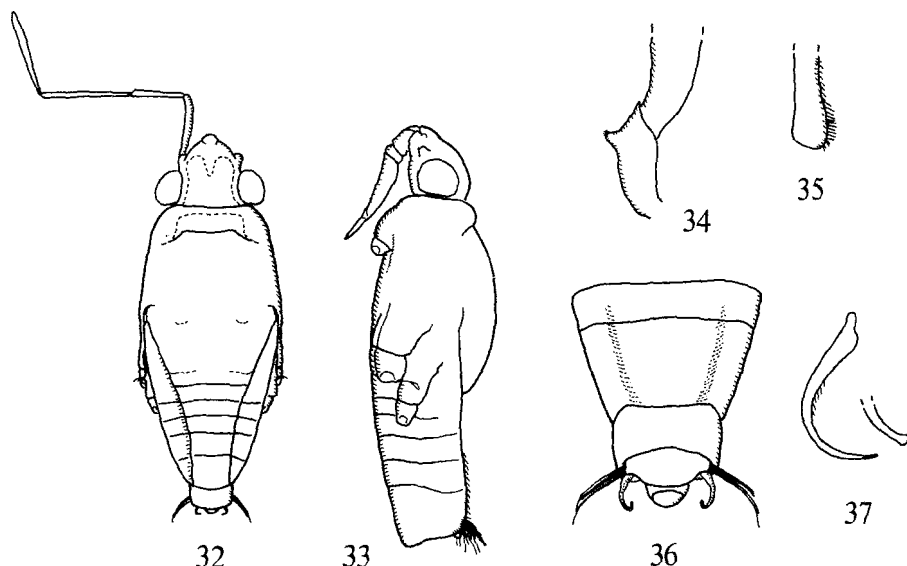
**Etymology.** – Named for the shape of the lateral modifications of the male genitalia.

**Diagnosis.** – Close to *H. danpolhemi* sp. n. but separated from this and other species with a tubercle on fore trochanter of male by the structure of the male genital segments.

**Description.** – Size: ♂, length 1.60–1.68 mm, width 0.65–0.70 mm; ♀, length 1.85–1.95 mm, width 0.85–0.90 mm.

**Colour:** Dark brown with scattered silvery hairs on mesonotum, more extensive silvery pubescence on abdominal dorsum. A large, V-shaped spot in middle and basal parts of head, and pronotum except anterior margin, yellowish brown. Antennae and legs brownish, trochanter and basal half of fore femora yellowish. Ventral surface pale brownish.

**Structural characters:** Male (Fig. 32) fusiform, length about 2.3x greatest width across thorax (131:56). Head length about 0.6x head width across eyes (25:39); eye width about 0.5x width of head between eyes (9.5:20). Antennae relatively long, about 0.8x total length of insect (105:131); relative lengths of antennal segments (1–4): 24:20:31:30; segment 2 much shorter than segment 3; segment 4 not thicker than segment 1 (3:3). Relative lengths of leg segments (femur:tibia:tarsus): fore leg: 49:39:16; middle leg: 116:90:69; and hind leg: 65:50:18. Fore trochanter with a distinct subapical tubercle (Fig. 34); fore femur thickened beyond middle; fore tibia before apex with 8–10 spinous hairs (Fig. 35); middle femur slightly less than 0.9x total length of insect; relative lengths of middle tarsal segments (1–2): 41:28; hind femur slightly thicker than middle femur (9:8). Abdominal venter with a narrow, basal



Figs 32–37. *Haloveloides cornuta* sp. n.: 32. Male body, dorsal view. 33. Female body, lateral view. 34. Right fore trochanter of male. 35. Apex of right fore tibia of male. 36. Abdominal end of male, ventral view. 37. Left clasper of male, lateral view; dorsal aspect of blade above.

tumescence furnished with long pubescence also present on mesosternum; sterna 6–7 medially depressed. Genital segments large, segment 8 depressed ventrally, pygophore slightly widened posteriorly, on each side with a tubercle equipped with a group of long curved bristles; parameres long, falciform (Fig. 37); blade of each paramere slender, semicircular, apex blunt.

Female rhomboid in outline, length about 2.2x greatest width across thorax (151:68). Head structure as in male; antennae relatively shorter than in male, 0.6x total length of insect (92:151); length of antennal segments (1–4): 22:17:27:26. Thorax only slightly convex dorsally. Relative lengths of leg segments (femur:tibia:tarsus): fore leg: 50:41:19; middle leg: 129:107:81; hind leg: 69:55:20. Fore trochanter without tubercle; middle femur almost 0.85x total length. Abdomen broad at base, distinctly tapering in width posteriorly; connexiva obliquely raised in anterior parts, vertically raised posteriorly; connexiva terminating with long hairs (Fig. 33); hind margin of tergum 7 with several long, erect bristles; sternum 7 slightly produced in middle. Tergum 8 and proctiger strongly deflected, covering gonocoxa.

*Distribution and habitats.* – See map (Fig. 42). Only

known from the type locality in the Zimabales Province, Luzon, Philippines. The specimens (adults and nymphs) were collected at the mouth of a wide coastal river with marine influence (Polhemus, field notes).

### 7. *Haloveloides femoralis* sp. n.

(Figs 38–40)

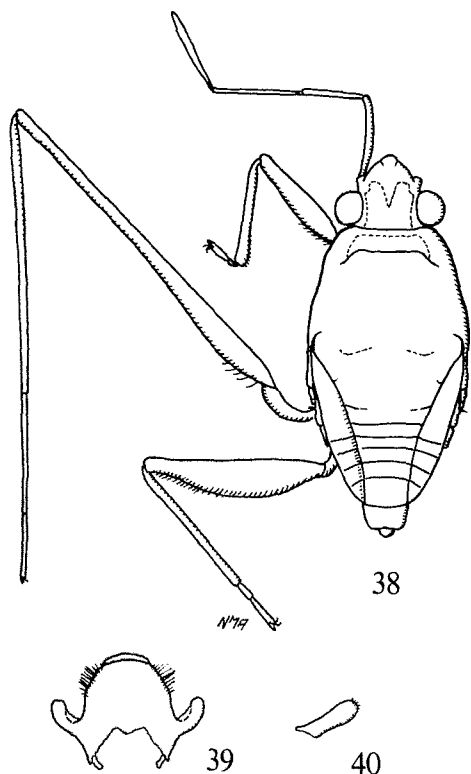
*Type area.* – Pacduan Beach, Palawan, Philippines.

*Type material examined.* – PHILIPPINES: Holotype ♂, Palawan, Pacduan Beach, 40 km S of Puerto Princesa, CL 2004, 25.vii.1985, J.T. & D.A. Polhemus (JTPC). Paratypes: 56♂ 96♀, same data as holotype (JTPC, ZMUC); 24♂ 41♀ + nymphs, Palawan, Togading Riv., 79 km NW of Puerto Princesa, CL 2016, 28.vii.1985, J.T. & D.A. Polhemus (JTPC, ZMUC).

*Etymology.* – Named for the incrassate hind femora of the male sex.

*Diagnosis.* – Separated from other species by the absence of a tubercle on fore trochanters, the incrassate hind femora, and reduced parameres of the male.

*Description.* – Size: ♂, length 1.60–1.75 mm, width 0.70–0.75 mm; ♀, length 1.80–1.95 mm, width 0.85–0.90 mm.



Figs 38-40. *Haloveloides femoralis* sp. n.: 38. Male, dorsal view, appendages of right side removed. 39. Proctiger of male, dorsal view. 40. Left clasper of male, lateral view.

Colour: Dark brown with scattered silvery hairs on mesonotum, basal and distal abdominal tergites. A large, V-shaped spot on head between eyes, and median area of pronotum except anterior margin, yellowish brown. Antennae and legs brownish, trochanter and basal half of fore femora yellowish. Ventral surface pale brownish.

Structural characters: Male (Fig. 38) fusiform, length about 2.3x greatest width across thorax (133:58). Head length 0.7x head width across eyes (28:40); eye width 0.5x width of head between eyes (10:20). Antennae relatively long, about 0.85x total length of insect (116:133); relative lengths of antennal segments (1-4): 29:23:33:31; segment 2 much shorter than segment 3; segment 4 not thicker than segment 1 (3:3). Relative lengths of leg segments (femur:tibia:tarsus): fore leg: 49:42:16; middle leg: 127:100:72; and hind leg: 70:55:21. Fore trochanter

not modified; fore femur moderately thickened in middle; fore tibia before apex with some scattered, spinous hairs; middle femur slightly less than total length of insect, with only short hairs along anterior margin; relative lengths of middle tarsal segments (1-2): 46:26; hind femur distinctly thickened throughout most of its length, thicker than middle femur (11:9.5). Abdominal venter depressed laterally and posteriorly forming a narrow, basal tumescence furnished with long pubescence; sterna 5-6 not keeled, sternum 7 impressed in middle. Genital segments small, segment 8 simple, pygophore broadly ovate, proctiger ovate with an angular projection on each side of base (Fig. 39). Parameres very short, lobate (Fig. 40) and setose, apex rounded.

Female similar to the preceding species, length about 2.1x greatest width across thorax (146:69). Head structure as in male; antennae relatively shorter than in male, about 0.7x total length of insect (98:146); length of antennal segments (1-4): 25:17:27:27. Thorax only slightly convex dorsally. Relative lengths of leg segments (femur:tibia:tarsus): fore leg: 50:43:18; middle leg: 132:113:82; hind leg: 70:54:20. Middle femur 0.9x total length. Abdomen broad at base, distinctly tapering in width posteriorly; connexiva obliquely raised in anterior parts, vertically raised or slightly overturned posteriorly; connexiva with short, suberect hairs in distal parts; hind margin of tergum 7 with several long, erect bristles; sternum 7 slightly produced in middle. Tergum 8 and proctiger strongly deflected, covering gonocoxa.

**Distribution and habitats.** - See map (Fig. 42). Known from two localities in Palawan, Philippines. In one site, adults were collected from still pools out amidst coral rubble exposed at low tide. The locality was close to *Sonneratia* mangroves at boundary of rocky shore and intertidal coral rubble (Polhemus, field notes).

**Discussion.** - The absence of a tubercle or spine on the fore trochanter and reduced parameres of the male seem to exclude this species from the genus *Haloveloides*. However, in other characters, e.g., absence of a male grasping comb, the prolonged middle legs, male abdominal venter with basal tumescence, and structure of female abdomen and genital segments, *H. femoralis* sp. n. is closer to the species described above than to other haloveliines, including *Xenobates*.

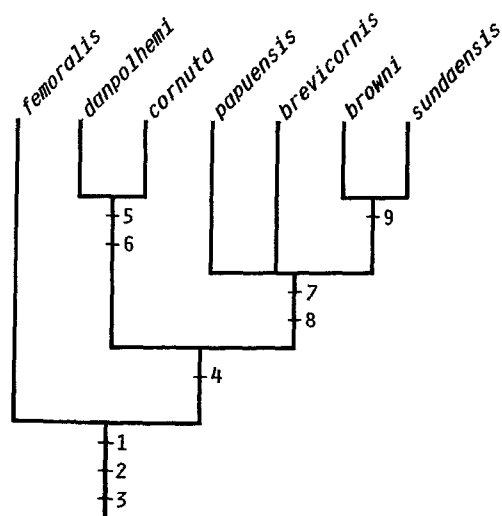


Fig. 41. Cladogram of relationships between the species of *Haloveloides* gen. n. Numbers on cladogram denote characters (synapomorphies only) discussed in the text.

## Phylogeny and biogeography

The relationships between the species of *Haloveloides* are depicted in the cladogram (Fig. 41) with the characters used in its construction indicated. Decisions about plesiomorphy-apomorphy of character states were based upon outgroup comparisons with other haloveliine genera. The position of *H. femoralis* is ambiguous, mainly because the male fore trochanter is simple. This may be either a plesiomorphy or a reversal. The first and most parsimonious alternative is preferred here.

The following characters were used in constructing the cladogram (Fig. 41). Only apomorphic character states are listed.

- (1) Fore tibia of male with a row of spinous hairs before apex.
- (2) Middle femur more than 0.8x total length of insect.
- (3) Female genital segments strongly deflected, proctiger covering gonocoxae.
- (4) Fore trochanter of male with tubercle or spine.
- (5) Fore trochanter of male with subapical tubercle.
- (6) Fore femur of male thickened beyond middle.
- (7) Third antennal segment only slightly longer than second segment.

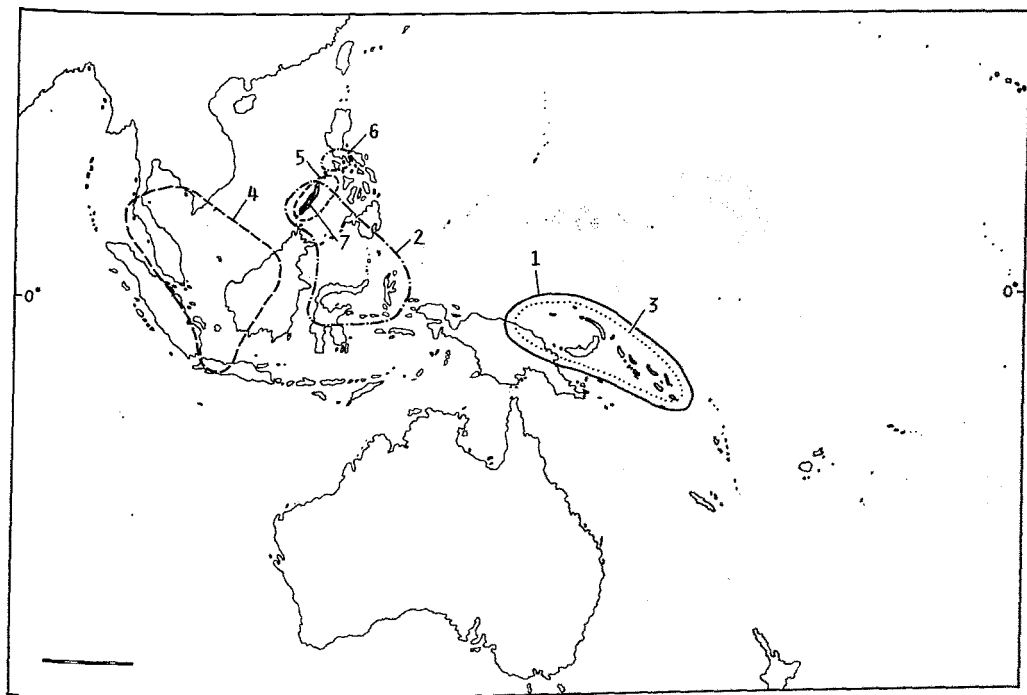


Fig. 42. Distribution of the species of *Haloveloides* gen. n.: 1. *H. papuensis* (Esaki), 2. *H. brevicornis* sp. n. 3. *H. browni* (Lansbury), 4. *H. sundaensis* sp. n. 5. *H. danpolhemi* sp. n. 6. *H. cornuta* sp. n. 7. *H. femoralis* sp. n. Scale of map 1,000 km.

- (8) Male abdominal venter with median keel on sterna 5–6.  
 (9) Fore trochanter of male with apical spine.

The geographical distributions of the seven species of *Haloveloides* are depicted on the map (Fig. 42). Three species are only known from the Philippine Islands, from Palawan (*H. danpolhemi* and *femoralis*) and Luzon (*H. cornuta*). Two species (*H. papuensis* and *browni*) are confined to the north-eastern coast of Papua New Guinea, the Bismarck Archipelago, and the Solomon Islands (collectively known as Papuasia). Finally, two species have wider distributions, *H. brevicornis* in the Moluccas, Sulawesi, and the Philippines (Palawan) and *H. sundaensis* in the Sunda shelf areas. The Philippines are clearly an area of endemism for the genus (with three endemic species). It is also noteworthy that the sister-group relationship between *H. browni* and *sundaensis* indicates area relationships across Wallace's line.

### Acknowledgements

The material upon which this study is based was gratefully borrowed from or donated by the following persons and institutions: Mr W. R. Dolling (NHML); Dr R. C. Froeschner (USNM); Mr I. Lansbury (UMO); Dr J. T. Polhemus (JTPC); and Dr T. Vasarhelyi (TMB). I am much indebted to Dr L. Cheng, La Jolla, for sending me material of marine water striders, Mr I. Lansbury, Oxford, for the opportunity to examine types of species described by him as well as access to further material and field observations, and to Dr J. T. Polhemus, Englewood, Colorado, for placing his large collection of marine haloveliines at my disposal, for giving me access to his valuable field notes, and for his kind hospitality during my stay in Englewood, Colorado. My colleagues Mr M. Andersen and Dr C. Nielsen, added valuable material from Phuket Island, Thailand.

Mr I. Lansbury, Oxford, Drs D. A. Polhemus, Honolulu, and J. T. Polhemus, Englewood, Colorado, reviewed an earlier version of the manuscript which has been improved by their comments. The present work is

part of a project supported by grants from the Danish Natural Science Research Council.

### References

- Andersen, N. M. 1982. The semiaquatic bugs (Hemiptera, Gerromorpha). Phylogeny, adaptations, biogeography, and classification. *Entomograph* 3: 1–455.
- 1989a. The coral bugs, genus *Halovelia* Bergroth (Hemiptera, Veliidae). I. History, classification, and taxonomy of species except the *H. malaya*-group. *Ent. scand.* 20: 75–120.
- 1989b. The coral bugs, genus *Halovelia* Bergroth (Hemiptera, Veliidae). II. Taxonomy of the *H. malaya*-group, cladistics, ecology, and biogeography. *Ibid.* 20: 179–227.
- Bergroth, E. 1893. On two halophilous Hemiptera. *Entomologist's mon. Mag.* (2) 4 [29]: 277–279.
- China, W. E. 1957. The marine Hemiptera of the Monte Bello Islands, with descriptions of some allied species. *J. Linn. Soc. Lond. (Zool.)* 40: 342–357.
- China, W. E. & Usinger, R. L. 1949. Classification of the Veliidae (Hemiptera) with a new genus from South Africa. *Ann. Mag. nat. Hist.* (12) 2: 343–354.
- Esaki, T. 1924. On a new genus and species of the Gerridae from Formosa. *Annls ent. Soc. Am.* 17: 228–229.
- 1926. The water-striders of the subfamily Halobatinae in the Hungarian National Museum. *Annls hist.-nat. Mus. natn. hung.* 23: 117–164.
- 1927. An interesting new genus and species of Hydrometridae (Hem.) from South America. *Entomologist* 60: 181–184.
- 1930. New or little-known Gerridae from the Malay Peninsula. *J. fed. Malay St. Mus.* 16: 13–24.
- Hale, H. M. 1926. Studies in Australian aquatic Hemiptera, No. VII. *Rec. S. Aust. Mus.* 3: 195–217.
- Lansbury, I. 1989. Notes on the Haloveliinae of Australia and the Solomon Islands (Insecta, Hemiptera, Heteroptera: Veliidae). *Reichenbachia* 26: 93–108.
- Poisson, R. A. 1956. Contribution à l'étude des Hydrocorises de Madagascar (4e Mémoire). *Mém. Inst. scient. Madagascar (E)* 7: 243–265.
- Polhemus, J. T. 1982. Marine Hemiptera of the Northern Territory, including the first fresh-water species of *Halobates* Eschscholtz (Gerridae, Veliidae, Hermatobatidae and Corixidae). *J. Aust. ent. Soc.* 21: 5–11.

*Manuscript accepted August 1991.*