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## Further new Helotrephini (Insecta: Heteroptera: Helotrephidae) from Vietnam, Malaysia, and the Philippines

H. Zettel\*

### Abstract

Five new species of Helotrephini are described: *Ascetotrephes schawalleri* sp.n. from Sabah, Borneo; *Helotrephes confusus* sp.n. from Lao Cai, Vietnam, of the newly established *H. confusus* species group; *Hydrotrephes mireki* sp.n. from northern Palawan, the Philippines, of the *H. mirus* species group; *Hydrotrephes freitagii* sp.n. from Mindanao, the Philippines, of the *H. philippinus* species group; *Hydrotrephes benomensis* sp.n. from West Malaysia of the *H. martini* species group.

**Key words:** Heteroptera, Helotrephidae, Helotrephini, *Ascetotrephes*, *Helotrephes*, *Hydrotrephes*, *Helotrephes confusus* group, *Hydrotrephes mirus* group, *Hydrotrephes martini* group, *Hydrotrephes philippinus* group, new species group, new species, Vietnam, Malaysia, Borneo, Philippines, Mindanao, Palawan, taxonomy

### Zusammenfassung

Fünf neue Arten aus der Tribus Helotrephini werden beschrieben: *Ascetotrephes schawalleri* sp.n. von Sabah, Borneo; *Helotrephes confusus* sp.n. von Lao Cai, Vietnam, aus der hier neu etablierten *H. confusus*-Artengruppe; *Hydrotrephes mireki* sp.n. von Nordpalawan, Philippinen, aus der *H. mirus*-Artengruppe; *Hydrotrephes freitagii* sp.n. von Mindanao, Philippinen, aus der *H. philippinus*-Artengruppe; *Hydrotrephes benomensis* sp.n. von Westmalaysien aus der *H. martini*-Artengruppe.

### Introduction

For a long time, the Hemispherical Backswimmers, Helotrephidae were considered a small, exotic insect family, and this opinion changed relatively late after recognizing the enormous species diversity, especially in Southeast Asia. Presently more than 70 species (about 40% of the world's fauna) are known from that region, and almost all of them were described during the last fifteen years (see PAPÁČEK & ZETTEL 2005). Still, almost regularly, new species are discovered and described, especially from the least explored mountain regions in Indochina and the Malay Archipelago. The better knowledge of species diversity and the establishing of species groups slowly leads to the improvement and the stability of the phylogenetic system, especially in the most diverse tribe, the Helotrephini.

This study presents some new additions to the taxonomy of Helotrephini in Southeast Asia. Dr. Wolfgang Schawaller from the State Museum of Natural History in Stuttgart kindly sent me some specimens from Borneo, which contained a new species of *Ascetotrephes* POLHEMUS & POLHEMUS, 2003; surprisingly, this is the fourth species of

\* Dr. Herbert Zettel, Natural History Museum, International Research Institute of Entomology, Burgring 7, A-1010 Vienna, Austria. – herbert.zettel@nhm-wien.ac.at

this small genus from northwestern Borneo. Further material became available by the help of Dr. Tran Anh Duc, who gave me his interesting Vietnam collection to study. One peculiar species of *Helotrephes* STAL, 1860 is reported from that collection. Samples from Mindanao, the Philippines, kindly donated to the Natural History Museum by Dr. Hendrik Freitag, contain a hitherto overlooked species of *Hydrotrephes* CHINA, 1935. Two other new species of *Hydrotrephes* were discovered during recent field work in Palawan, the Philippines, and in a sample from West Malaysia deposited in the Natural History Museum Vienna.

### Material and methods

Examined material was mounted on card squares. Genitalia were glued on the same plates with specimens after examination. Locality data are given by citing the original labels. The following acronyms are used for repositories:

#### Acronyms of collections:

NHMW	Natural History Museum, Vienna, Austria
SMNS	State Museum of Natural History, Stuttgart, Germany
UPLB	Museum of Natural History, University of the Philippines Los Baños, Laguna, Philippines
ZMHU	Zoological Museum, Hanoi University of Science, Vietnam
ZRCS	Zoological Reference Collection, Raffles Museum for Biodiversity Research, National University of Singapore

Terminology and methods follow previous taxonomic works by the author (mainly ZETTEL & POLHEMUS 1998 and ZETTEL 2003). The digital photographs of specimens (Figs. 1–3, 11–13, 21–23, 31–33, 41–43) were taken with a Leica DFC490 camera attached to a Leica MZ16 binocular microscope with the help of Image Manager IM50 and processed with Auto-Montage Pro and Adobe Photoshop 7.0 programmes. Specimen labels (Figs. 4, 14, 24, 34, 44) were photographed with a Sony Cybershot DSC-T5 digital camera.

### Descriptions of new species

#### *Ascetotrephes schawalleri* sp.n. (Figs. 1–10)

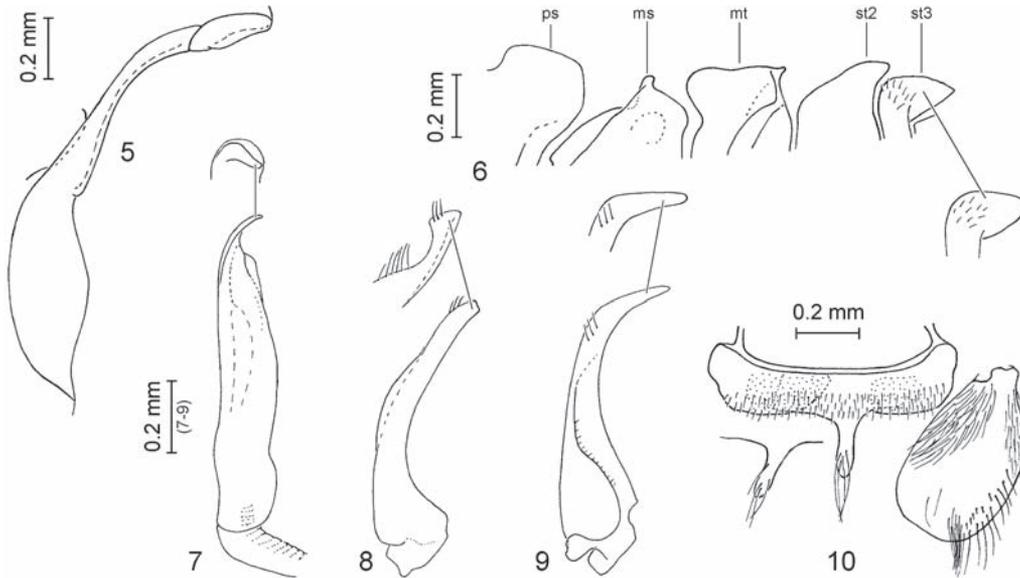
**Type material.** Holotype (hindwing-micropterous, SMNS) and paratypes (1 hindwing-micropterous male, 2 hindwing-micropterous females; SMNS, NHMW) labelled "BORNEO: SABAH\ Kinabalu N.P.: Poring\ 500 m, 29.XI.-2.XII.1996\ leg. W. SCHAWALLER" (Fig. 4).

**Description.** Hindwing-micropterous male. Habitus: see Figures 1–3. Body slightly depressed; anterior margin of head moderately convex. Body size: length 3.53–3.60 mm; width 2.54–2.60 mm.

Colour: Dorsum (Figs. 1–3) brown, small yellowish marks not sharply delimited. Venter mostly brownish. Legs and antennae yellow. Rostrum light brown.



Figs. 1–4: *Ascetotrephes schawalleri* sp.n., holotype, hindwing-micropterous male (body length 3.53 mm; figures not on scale). (1) Habitus, dorsal aspect. (2) Habitus, lateral aspect. (3) Habitus, frontal aspect. (4) Labels. © NHMW Hemiptera Image Collection.



Figs. 5–10: *Ascetotrepes schawalleri* sp.n. (5) Genal and pronotal plate, ventrolateral aspect. (6) Medioventral carinae, lateral aspect, venter turned upward; with variation of carina of sternite 3 (ps – prosternal carina, ms – mesosternal carina, mt – metasternal carina, st2, st3 – carinae of sternites 2, 3). (7) Aedeagus. (8) Right paramere. (9) Left paramere. (10) Subgenital plate and left ventral laterotergite 7 of female, ventral aspect; with variation of terminal process.

Cephalonotum with weakly rounded hind corners. Head (Fig. 3) shiny to matt, very finely punctured, distances of punctures mostly larger than diameters; interspaces posteriorly and medially smooth, anterolaterally micropunctured. Eye index: 4.4. Fourth rostral segment 2.0 times as long as third. Pronotum (Fig. 1) finely punctured, on disk punctures hardly larger than those on head, but distinctly larger towards sides; distances ca. 1–3 times diameters, interspaces delicately reticulate, shiny. Genal plate (Fig. 5) slender. Pronotal plate (Fig. 5) with shallow emargination, anteriorly very slender. Inner corner of propleural plate truncate. Mesoscutellum (Fig. 1) coarsely punctured, distances of punctures ca. 0.5–2 diameters, interspaces smooth and shiny. Hemielytron (Fig. 2) anteriorly with very large, deep, and dense punctures, posteriorly gradually smaller, shallower, and more sparse; distances of punctures ca. 0.5–2.0 diameters, interspaces densely microgranulated, matt.

Ventral carinae (Fig. 6): Prosternal carina with obtuse posterior corner, posterior edge slightly convex. Mesosternal carina with short apex, without thin lamina. Metasternal carina with ventral margin straight to slightly sinuate, posteriorly produced into short tip. Carina of sternite 2 with ventral margin slightly convex. Carina of sternite 3 small, with triangular posterior process.

Genitalia: Aedeagus (Fig. 7) moderately slender, with rather long and slender apical lamella curved anteriorly and to right side, apex acute. Right paramere (Fig. 8) long and sinuate, apically triangularly dilated and with a few short setae, another row of setae

posteriorly near midlength. Left paramere (Fig. 9) with very large lobe in basal half, strongly narrowed and curved, almost bent in distal third, apex acute.

Hindwing-micropterous female. Body size: length 3.39–3.44 mm; width 2.50–2.59 mm. Colour either as in male or with larger yellow marks and with broad, uninterrupted, transverse yellow stripe at anterior half of pronotum. Most structural characteristics as in male. Eye index: 4.2–4.3. Abdomen anteriorly symmetrical. Subgenital plate (Fig. 10) very short, with inner, asymmetrical swellings delimiting a median channel, with mediiodistal process long and very slender, symmetrical in one, but slightly bent to right side in the other specimen. Ventral laterotergite 7 (Fig. 10) very broad, apically almost truncate and with long tuft of setae, distolaterally with row of short spines.

Macropterous morph. Unknown.

**Notes and discussion.** *Ascetotrephes schawalleri* sp.n. is the eighth species of *Ascetotrephes* and already the fourth species from northwestern Borneo. The female is most easily distinguished by the only slightly asymmetrical subgenital plate with a very narrow, tail-like mediiodistal process (Fig. 10). In other species of *Ascetotrephes*, the subgenital plate has either an almost symmetrical, broad, tongue-shaped mediiodistal lobe, or a comparatively broad, strongly asymmetrical process (see ZETTEL 2004). By using ZETTEL's (2004) key, the male would key to *A. mesilau* POLHEMUS & POLHEMUS, 2003 and *A. keningau* POLHEMUS & POLHEMUS, 2003, both described from Sabah, because of its relatively large body size and the apically dilated right paramere (Fig. 8). However, other details of genitalia are very different: In *A. mesilau* the apical lamella of the aedeagus is curved posteriad and the distal part of the left paramere is sinuate and recurved; in *A. keningau* the apical lamella of the aedeagus is very short and the right paramere forms a distinct apical hook (see ZETTEL 2004). One hindwing-micropterous male of *A. mesilau* bears the identical label data as the type series of *A. schawalleri* sp.n. and is repositated in SMNS.

**Distribution.** Malaysia: northern Borneo (Sabah).

**Etymology.** This new species is dedicated to Dr. Wolfgang Schawaller, coleopterist and curator in SMNS, who has collected the type series and kindly sent it to the author to study.

### *Helotrephes confusus* sp.n. (Figs. 11–20)

*Helotrephes trani* ZETTEL, 2005: 68 ff. (in part: female misidentified).

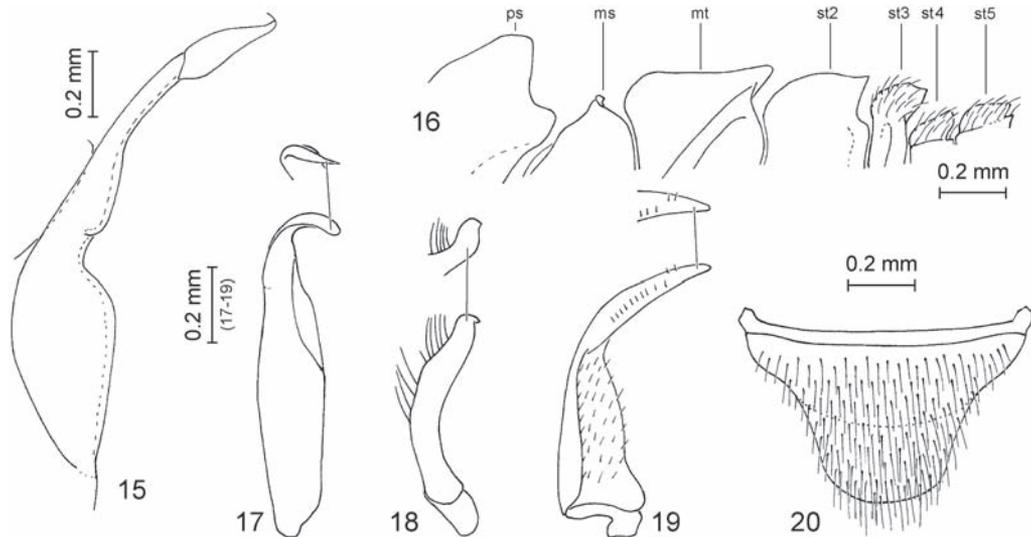
**Type material.** Holotype (hindwing-micropterous male, ZMHU) labelled "VIETNAM: Lao Cai Prov.\ Sa Pa, Hoang Lien NP, Nui Xe, upstream of Suoi\ Vang, 4.VII.2004, leg. Tran A.D. TAD0416" (Fig. 14). Paratypes: 4 hindwing-micropterous females, 1 macropterous female, same label data as holotype (ZMHU, NHMW); 1 macropterous male, 3 macropterous females, 1 hindwing-micropterous female "VIETNAM: Lao Cai Prov.\ Sa Pa, Hoang Lien N'Park\ Sin Chai, 3 July 2004,\ Coll. Tran A.D., TAD0415" (ZRCS, NHMW); 2 hindwing-micropterous females (paratypes of *H. trani*) "Vietnam: Lao Cai Prov.\ Sa Pa, Thac Bac waterfall\ (12 km from Sa Pa town)\ 2.VI.2003\ Coll. Tran A.D. (TAD0341)" (ZRCS, NHMW).

**Description.** Hindwing-micropterous male. Habitus: see Figures 11–13. Body size: length 3.68 mm, width 2.50 mm.



Figs. 11–14: *Helotrephes confusus* sp.n., holotype, hindwing-micropterous male (body length 3.68 mm; figures not on scale). (11) Habitus, dorsal aspect. (12) Habitus, lateral aspect. (13) Cephalonotum, frontal aspect. (14) Labels. © NHMW Hemiptera Image Collection.

Colour of dorsum peculiar, dark areas much extended (Figs. 11–13). Cephalonotum mainly brownish black, head around eye margins yellow, with small, yellow dot in centre, and with paired triangular yellow marks at anterior margin; pronotum with small yellow dot in the middle of anterior margin and with irregular, yellow, transverse fascia along hind margin. Mesoscutellum and hemielytra mainly dark brown, partly with small, irregular, yellow marks. Venter mostly brownish. Legs and antennae yellowish; coxae, trochanters, bases of femora, and apices of tarsi infuscated. Rostrum brown.



Figs. 15–20: *Helotrephes confusus* sp.n. (15) Genal and pronotal plate of macropterous specimen, ventrolateral aspect. (16) Medioventral carinae, lateral aspect, venter turned upward (ps – prosternal carina, ms – mesosternal carina, mt – metasternal carina, st2, st3, st4, st5 – carinae of sternites 2–5). (17) Aedeagus. (18) Right paramere. (19) Left paramere. (20) Subgenital plate of female, ventral aspect.

Cephalonotum with weakly rounded hind corners. Head (Fig. 13) mostly shiny, except anterolaterally matt, finely punctured, distances of punctures ca. 1–4 times diameters; interspaces with fine micropunctuation, denser towards sides and anterior margin. Eye index: 3.4. Fourth rostral segment 2.2 times as long as third. Pronotum (Fig. 11) finely punctured; punctures of about the same size as those on head; punctuation towards sides denser, but not coarser; distances on disk ca. 3–5 times diameters, on sides ca. 1.5–3 times diameters, interspaces shiny, without microsculpture. Genal plate (Fig. 15) slender. Pronotal plate (Fig. 15) with semicircular emargination, anteriorly very slender. Inner corner of propleural plate slightly convex. Mesoscutellum and hemielytra (Figs. 11, 12) coarsely punctured, distances ca. 0.5–2 diameters, interspaces shiny, without microsculpture, but punctures partly connected by wrinkles.

Ventral carinae (Fig. 16): Prosternal carina with broadly rounded, lobate posterior corner, posterior edge distinctly concave. Mesosternal carina low, with short apex. Metasternal carina with ventral margin almost straight, posteriorly produced into tip. Carina of sternite 2 with ventral margin strongly convex, apically slightly sinuate. Carina of sternite 3 small, pilose, roundish, posteriorly with small tip. Sternites 4–6 each with small carina.

Genitalia: Aedeagus (Fig. 17) moderately slender, with long, slender, strongly antierad curved apical lamella, apex very acute. Right paramere (Fig. 18) slightly shorter than left paramere, sinuate, posteriorly with row of setae; apex relatively broad, minutely pointed. Left paramere (Fig. 19) basally wide and with lobe, distally narrow and

strongly tapered towards acute apex; on inner face with numerous short setae, distally with row and two isolated short setae.

Hindwing-micropterous female. Body size: length 3.50–3.79 mm, width 2.46–2.66 mm. Colour, especially of mesoscutellum and hemielytra, slightly varying; in darkest specimens mesoscutellum and hemielytra almost uniformly brown; in light specimens yellow patches on mesoscutellum and hemielytra much extended, in the extreme forms mesoscutellum and posterior half of hemielytra uniformly pale yellowish. Most structural characteristics as in male. Eye index: 3.4–3.6. Wrinkles on hemielytron usually strongly developed. Abdomen anteriorly symmetrical. Sternite 6 with straight hind margin. Subgenital plate (Fig. 20) with slightly convex base and with broad mediiodistal lobe; surface beset with long pilosity. Ventral laterotergite 7 slender ovate, with apical tuft of hairs.

Macropterous male. Body size: length 3.63 mm, width 2.56 mm. Colour slightly darker than in hindwing-micropterous male. Structures similar as in hindwing-micropterous male. Eyes comparatively larger, eye index 3.2. Mesoscutellum much larger. Hemielytron with embolar and claval sutures.

Macropterous female. Body size: length 3.54–3.80 mm, width 2.50–2.70 mm. Colour as in dark hindwing-micropterous females. Structures similar as in hindwing-micropterous female, except for characteristics stated for macropterous male. Eye index 3.1–3.3.

**Notes and discussion.** *Helotrephes trani* ZETTEL, 2005 of the *H. sausiai* species group (sensu ZETTEL & POLHEMUS 1998) was described in one male and two females from the Thac Bac waterfalls 12 km from Sa Pa in Lao Cai Province, northern Vietnam. In the original description, ZETTEL (2005) ascribed differences between the male holotype and the female paratypes, notably in colour and puncturation, to intraspecific variation or sexual dimorphism. New samples from the vicinity of Sa Pa, however, yielded males of a further new species; and now it becomes totally clear that the females which were thought to belong to *H. trani* must be transferred to this new taxon. Despite many similarities – e.g., large size, shiny dorsum, and posteriorly emarginated prosternal carina – *H. confusus* sp.n. should not be placed in the *H. sausiai* group, because the male's aedeagus has no apical plate (Fig. 17). Moreover, species of the *H. sausiai* group strictly follow an allopatric species pattern so far, and the sympatric occurrence of *H. trani* and *H. confusus* sp.n. does not correspond with that scheme. At our present state of knowledge, I suggest that *H. confusus* sp.n. should be regarded as an isolated species forming a "group" by its own, a group defined by the following characteristics:

***Helotrephes confusus* species group** (new): Large species, body length 3.5–3.8 mm. Dark colouration extended. Cephalonotum with fine puncturation, strongly shining. Hind margin of pronotum without tubercles. Pronotal plate posteriorly with convergent sides. Prosternal carina with rounded lobe and posterior emargination. Male: Aedeagus without apical plate, with hook-shaped apical lamella. Both parameres relatively slender. Female: Sternite 6 with straight hind margin. Sternite 7 with broad mediiodistal lobe.

**Distribution.** Northern Vietnam: Lao Cai Province: Sa Pa area.

**Etymology.** The specific epithet is a Latin adjective and refers to the circumstance that the type series of *H. trani* was "confused" with this new species.



Figs. 21–24: *Hydrotrepes mireki* sp.n., paratype, hindwing-micropterous female (body length 2.23 mm; figures not on scale). (21) Habitus, dorsal aspect. (22) Habitus, lateral aspect. (23) Habitus, frontal aspect. (24) Labels. © NHMW Hemiptera Image Collection.

*Hydrotrephes mireki* sp.n. (Figs. 21–30)

**Type material.** Holotype (hindwing-micropterous male; UPLB) and paratypes (1 hindwing-micropterous male, 2 hindwing-micropterous females; NHMW): "Philippines: Palawan (N) 20 km N Taytay, Pularaquin\ Canequi Falls, 25m, 19.11.\ 2007, leg. H. Zettel (489)" (Fig. 24).

**Description.** Hindwing-micropterous male. Habitus as in female (compare Figs. 21–23). Body size: small, length 2.17–2.20 mm, width 1.58–1.59 mm.

Colour of dorsum, especially of cephalonotum, with peculiar pattern (see female, Figs. 21–23). Head posteriorly dark brown, anteriorly with approximately triangular yellow area bearing small, ring-shaped brown mark. Pronotum anteriorly with more or less interrupted, yellow, transverse fascia, posteriorly almost entirely brown. Mesoscutellum and hemielytra yellowish brown, speckled with numerous, more or less confluent brown marks; base of mesoscutellum entirely brown. Venter mostly dark brownish. Antenna yellow. Legs yellowish, variably infuscated. Rostrum dark brown.

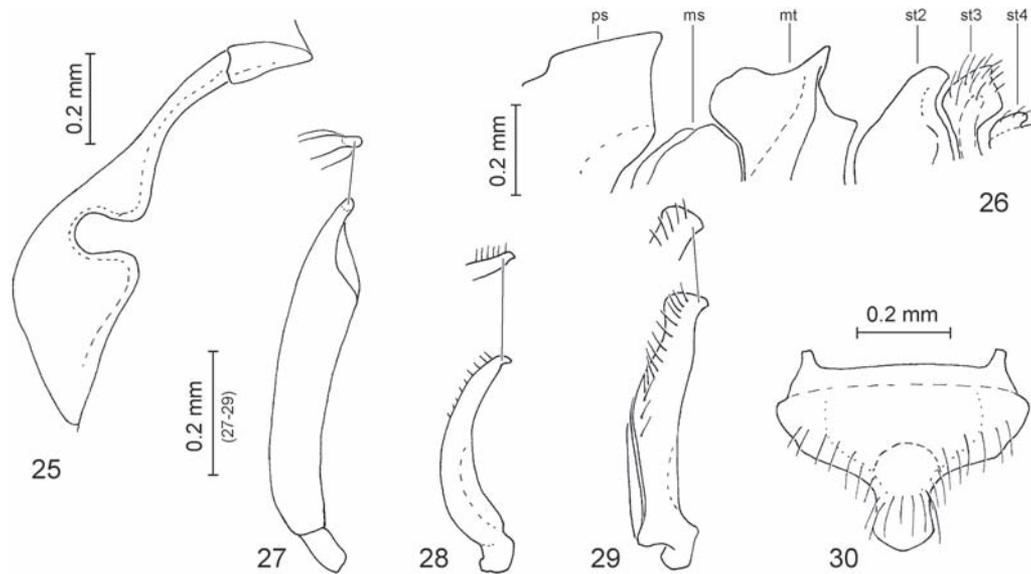
Cephalonotum with weakly rounded hind corners. Head (Fig. 23) almost matt, except along midline shiny, with large punctures, distances of punctures ca. 0.5–1.5 times diameters; interspaces mostly smooth, but with fine micropunctuation anterolaterally. Eye index: 2.6–2.7. Fourth rostral segment 2.0 times as long as third. Pronotum (Fig. 21) on disk and sides with large punctures as on head, but with finer punctures towards hind margin; punctuation towards sides denser, but not coarser; distances on disk ca. 1–2 times diameters, on sides ca. 0.3–1 times diameters, interspaces shiny, without microsculpture. Genal plate (Fig. 25) slender. Pronotal plate (Fig. 25) with very deep, almost circular incision, anteriorly slender. Inner corner of propleural plate truncate. Mesoscutellum and hemielytra (Figs. 21, 22) coarsely punctured, distances ca. 0.3–1 diameters, interspaces smooth, but on hemielytra partly with some wrinkles connecting punctures transversely.

Ventral carinae (Fig. 26): Prosternal carina with slightly acuminate posterior corner, posterior edge very weakly concave. Mesosternal carina very low, distally without lamina. Metasternal carina distally without lamina, ventral outline slightly sinuate, posterior apex slightly pronounced. Carina of sternite 2 curved posteriad. Carina of sternite 3 without denticles, approximately of rhomboid shape. Sternite 4 with small carina.

Genitalia: Aedeagus (Fig. 27) simple, weakly curved, distally slightly widened, without modification of hind margin, with narrow, upright apex bearing minute, hyaline lamella. Right paramere (Fig. 28) long, slightly shorter than left paramere, at distal hind margin with row of setae, in distal half undulate and evenly narrowed, with almost straight apex. Left paramere (Fig. 29) basally rather slender, with small lobe, in middle of length weakly curved, in distal half subparallel, posteroapically broadly rounded, anteroapically forming slightly acute corner.

Hindwing-micropterous female. Habitus see Figures 21–23. Body size: length 2.23–2.38 mm, width 1.66–1.70 mm. Colour (Figs. 21–23) as described for male. Most structural characteristics as in male. Eye index: 2.8–3.0. Abdomen symmetrical. Sternite 6 with slightly concave hind margin. Subgenital plate (Fig. 30) basally convex, with long, subparallel-sided, apically triangular distal lobe, with half-circular inner ridge. Ventral laterotergite 7 slender, apical margin obliquely truncate and with tuft of hairs.

Macropterous morph. Unknown.



Figs. 25–30: *Helotrepes mireki* sp.n. (25) Genal and pronotal plate of hindwing-micropterous specimen, ventrolateral aspect. (26) Medioventral carinae, lateral aspect, venter turned upward (ps – prosternal carina, ms – mesosternal carina, mt – metasternal carina, st2, st3, st4 – carinae of sternites 2–4). (27) Aedeagus. (28) Right paramere. (29) Left paramere. (30) Subgenital plate of female, ventral aspect.

**Notes and discussion.** *Hydrotrepes mireki* sp.n. belongs to the *H. mirus* species group sensu ZETTEL (1998). With its deeply incised pronotal plate (Fig. 25), the outline of the ventral carinae, and similarly developed subgenital plate of the female and the genitalia of the male, this species is close to two other species from the Palawan Region: *H. palawanensis* ZETTEL, 2003 from Central Palawan and *H. busuanganus* ZETTEL, 2003 from the island of Busuanga in the Calamianes Archipelago (see ZETTEL 2003). In several characteristics *H. mireki* sp.n. resembles the one or the other species. For example, just as in *H. palawanensis* the body size is relatively large and the prosternal carina is only moderately produced. On the other hand, the metasternal carina is distinctly produced as in *H. busuanganus*, the mediiodistal lobe of the female's sternite 7 is much more slender than in *H. palawanensis* and almost identical to that of *H. busuanganus*, and the apex of the male's aedeagus has a minute apical lamella in *H. mireki* sp.n. (Fig. 27) and *H. busuanganus*. In perpendicular view, the apex of the right paramere of *H. mireki* sp.n. (Fig. 28) is almost straight, and not strongly curved to the right side as in both *H. busuanganus* and *H. palawanensis*. The puncturation of the cephalonotum is denser in *H. mireki* sp.n. than in the two named species.

**Distribution.** Philippines: probably endemic to the north of Palawan Island.

**Etymology.** I name this species in honour of Prof. Dr. Miroslav ("Mirek") Papáček, who shares my research interest in Helotrepidae for many years.

*Hydrotrepes freitag* sp.n. (Figs. 31–40)

**Type material.** Holotype (hindwing-micropterous male; NHMW) and paratypes (3 hindwing-micropterous males, 1 hindwing-micropterous female, 1 macropterous female; NHMW, UPLB): "Philippines: Mindanao, Davao\ Kidapawan, Balabag, 1.2 km E\ Mawreg; Paniqiu Fall, prim.for.\ 1000m, 07°02'N 125°13'E\ 14.4.1995, leg.Freitag (36a)M" (Fig. 34).

**Description.** Hindwing-micropterous male. Habitus as in female (compare Figs. 31–33). Body size: length 3.29–3.35 mm, width 2.23–2.29 mm.

Colour of dorsum vivid and strongly contrasting (see female, Figs. 31–33). Head posteriorly dark brown, anteriorly yellow with variably extended dark brown marks. Pronotum yellow with dark brown fascia along cephalonotal suture and large, brown, more or less confluent marks in posterior half. Mesoscutellum and hemielytra brownish yellow speckled with numerous, more or less confluent brown marks; base of mesoscutellum, in some specimens also of hemielytra, entirely brown. Venter mostly dark brown. Antennae yellow. Legs yellow, infuscated at base. Rostrum dark brown.

Cephalonotum with weakly rounded hind corners; sides behind eyes slightly concave. Head (Fig. 33) medially shiny, laterally matt; punctures of medium size, medially rather sparse, with distances very uneven, ca. 0.5–2.5 times diameters, laterally very dense with distances mostly below 1 diameter; interspaces in posterior half smooth, in anterior half with dense micropunctures. Eye index: 3.0–3.1. Fourth rostral segment 2.2 times as long as third. Pronotum (Fig. 31) with punctures on disk and sides slightly larger than those on head, much smaller towards hind margin; puncturation very uneven, distances on disk and posteriorly ca. 1–5, on sides ca. 0.3–1 times diameters; all interspaces shiny, without microsculpture. Genal plate (Fig. 35) moderately wide. Pronotal plate (Fig. 35) with small, semicircular emargination, anteriorly relatively broad. Inner corner of propleural plate truncate. Mesoscutellum (Fig. 31) with punctures of about same size as on pronotal disk, but less sharply impressed; distances medially ca. 1–4 times diameters, laterally denser; interspaces medially smooth, laterally with indistinct microgranulation. Hemielytra (Fig. 32) with punctures denser than on mesoscutellum, apically almost confluent; interspaces with dense microgranulation, matt.

Ventral carinae (Fig. 36): Prosternal carina with more or less acute apex, with posterior edge deeply, almost rectangularly incised; mesosternal and metasternal carinae rather high, distally with small and rather indistinctly delimited laminate parts; carina of sternite 3 with indistinct denticles, relatively pilose, posteriorly triangularly produced; sternite 4 without carina.

Genitalia: Aedeagus (Fig. 37) moderately slender, with very small tooth at about three-fifths of posterior margin, apically curved and tapered to acute tip; laminate distal part bent to left side, without distinct apical plate. Right paramere (Fig. 38) much shorter than left paramere, with very narrow, curved base and flag-shaped distal part, posteriorly and at dorsal outline with very short setae. Left paramere (Fig. 39) long, moderately slender, widest at middle, distally strongly tapered, with rows of setae; apex in lateral view acute, in posterior view narrowly rounded.

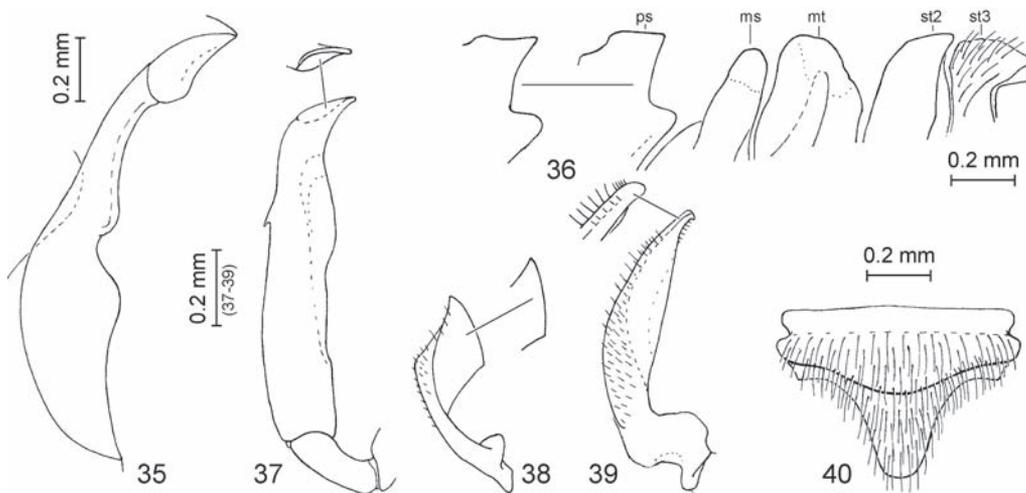
Hindwing-micropterous female. Habitus see Figures 31–33. Body size: length 3.44 mm, width 2.38 mm. Similar to hindwing-micropterous male. Eye index: 2.9. Abdomen symmetrical. Sternite 6 with straight hind margin. Subgenital plate (Fig. 40) with medial sur-



Figs. 31–34: *Hydrotrepes freitagi* sp.n., paratype, hindwing-micropterous female (body length 3.44 mm; figures not on scale). (31) Habitus, dorsal aspect. (32) Habitus, lateral aspect. (33) Habitus, frontal aspect. (34) Labels. © NHMW Hemiptera Image Collection.

face convex and posteriorly with convex margin, with evenly distributed long pilosity; distal lamella laterally short, medially forming long, slender, tongue-shaped mediobasal lobe; inner ridge indistinct. Ventral laterotergites 7 very broad, egg-shaped.

Macropterous female. Body size: length 3.35 mm, width 2.41 mm. Characteristics as in hindwing-micropterous female, except the following: Colour of head anteriorly entirely yellow, posteriorly black. Dark marks on pronotum, mesoscutellum, and hemielytra



Figs. 35–40: *Hydrotrepes freitagii* sp.n. (35) Genal and pronotal plate of hindwing-micropterous specimen, ventrolateral aspect. (36) Medioventral carinae, lateral aspect, venter turned upward (ps – prosternal carina, ms – mesosternal carina, mt – metasternal carina, st2, st3 – carinae of sternites 2, 3). (37) Aedeagus. (38) Right paramere. (39) Left paramere. (40) Subgenital plate of female, ventral aspect.

larger than in hindwing-micropterous female and much more confluent, leaving only small patches yellow; post-anterior parts of mesoscutellum and hemielytra entirely blackish brown. Eyes comparatively large, eye index: 2.7. Cephalonotum with weakly elevated area close to posterior corners. Mesoscutellum larger, with more strongly developed microgranulation. Hemielytra with embolar and claval sutures.

Macropterous male. Unknown.

**Notes and discussion.** *Hydrotrepes freitagii* sp.n. belongs to the *H. philippinus* species group sensu ZETTEL (2003). Hitherto this group contained six species from the Philippines (ZETTEL 2004). Only one of them, *H. pardalos* NIESER & CHEN, 1999, occurs in Mindanao and is also recorded from the Mount Apo (NIESER & CHEN 1999, ZETTEL 2003). However, *H. pardalos* is a morphologically isolated species, which has been placed in the *H. philippinus* group only with reservation (ZETTEL 2003). In contrast, *Hydrotrepes freitagii* sp.n. is closely related to *H. philippinus* ZETTEL, 2003. Males of the new species can be easily recognized by the characteristic shape of the aedeagus (Fig. 37) and by the flag-shaped right paramere (Fig. 38). The female's subgenital plate differs from those of related species by the long and slender mediodistal lobe (Fig. 40). *Hydrotrepes freitagii* sp.n. was collected together with *H. stereos* NIESER & CHEN, 1999 in the same habitat.

**Distribution.** Philippines: Mindanao: Davao.

**Etymology.** This new species is dedicated to its discoverer, the limnologist and entomologist Dr. Hendrik Freitag.

*Hydrotrephes benomensis* sp.n. (Figs. 41–50)

**Type material.** Holotype (macropterous male; NHMW) and paratypes (5 macropterous males, 7 macropterous females; NHMW, ZRCS): "W MALAYSIA: Pahang\ Benom Mts., 3,53N 102,01E\ 15 km E Kam-poeng Dong\ 24.3.-15.4.1998, 300-1000 m\ Dembicky & Pacholatko leg." (Fig. 44).

**Description.** Macropterous male. Habitus as in female (see Figs. 41–43). Body size: length 2.60–2.74 mm, width 1.84–1.95 mm.

Colour: Dorsum (Figs. 41–43) yellowish, mostly with fine brown speckles, but most of head, anterior part of pronotum, and base of mesoscutellum solid dark brown. Venter mostly brownish. Legs and antennae yellow. Rostrum light brown.

Cephalonotum in dorsal view (Fig. 41) with lateral margins slightly concave behind eyes, sharp margin of pronotal part ending in short distance from posterolateral corner and there forming a small, rather blunt angulation. Head (Fig. 43) with densely set small punctures, with very narrow interspaces, almost dull, anteromedially with some transverse wrinkles. Disk of pronotum (Fig. 41) set with numerous very fine micropunctures (evanescent in centre only), and with scattered, unequally distributed and somewhat larger punctures becoming much denser towards sides. Mesoscutellum (Fig. 41) 1.0 times as long as wide, with puncturation of similar size, but denser than on disk of pronotum, micropunctures medially obliterated. Hemelytron (Fig. 42) with slightly stronger puncturation, interspaces shagreened and dull. Genal plate (Fig. 45) stout. Pronotal plate (Fig. 45) with roundish incision, anteriorly relatively wide. Inner corner of propleural plate very broadly truncate. Eye index: 2.3–2.5. Fourth rostral segment 2.5 times as long as segment 3.

Ventral carinae (Fig. 46): Prosternal carina with posterior corner slightly acute, with posterior edge strongly concave; apices of meso- and metasternal carina thin-laminate; carina of sternite 3 with few small denticles on ventral head-shaped part, posteroproximal tooth sharp, of variable length. Abdominal segments strongly asymmetrical.

Aedeagus (Fig. 47) moderately slender, posterior face with extremely fine tooth at about three-fifths of length; apex strongly narrowed and acute; in apical view distodorsal edge very narrow, without distinct apical plate, apex slightly bent to left side. Right paramere (Fig. 48) slightly shorter than left paramere, slender-lanceolate and curved, apex curved and sharply pointed. Left paramere (Fig. 49) slender, especially in distal half, evenly narrowed towards very narrowly rounded apex.

Macropterous female. Habitus see Figures 41–43. Body size: length 2.70–2.80 mm, width 1.93–2.11 mm. Eye index: 2.2–2.4. Colour (Figs. 41–43) and most structural characteristics as in male. Abdomen symmetrical. Sternite 6 with straight hind margin, posterolaterally with tufts of long setae. Subgenital plate (Fig. 50): outer surface short, at posterior margin with small, roundish medial lobe; mediodistal process very long and slender; distal lamina short, truncate; incision between outer surface and lamina very short. Ventral laterotergites 7 relatively broad, leaf-shaped.

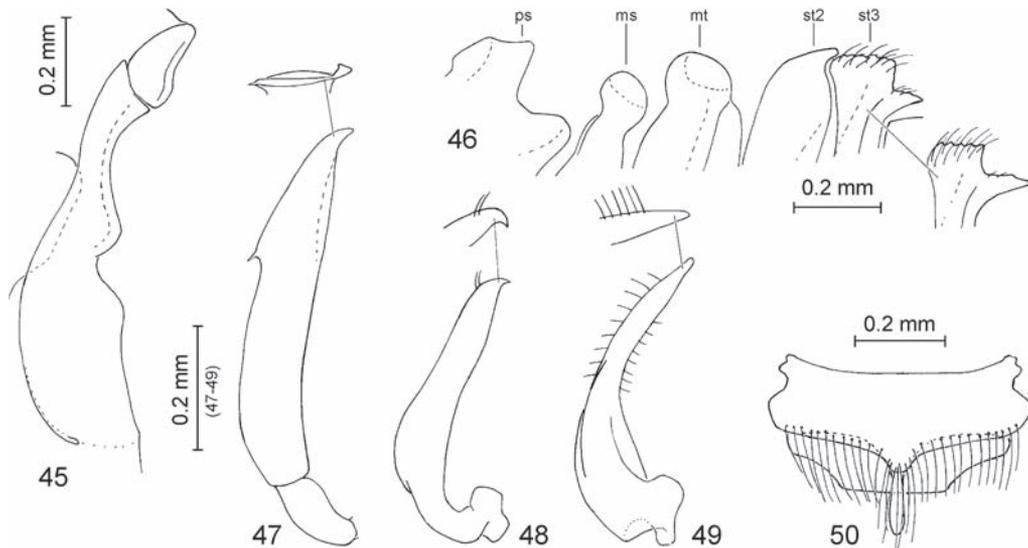
Hindwing-micropterous morph. Unknown.

**Notes and discussion.** This species belongs to the *Hydrotrephes martini* group as defined by ZETTEL (2000). Hitherto, this species group contained nine described species.



Figs. 41–44: *Hydrotrepes benomensis* sp.n., paratype, macropterous female (body length 2.71 mm; figures not on scale). (41) Habitus, dorsal aspect. (42) Habitus, lateral aspect. (43) Habitus, frontal aspect. (44) Labels. © NHMW Hemiptera Image Collection.

The only species in West Malaysia is *Hydrotrepes langkawicus* from Langkawi Island in Kedah (ZETTEL & TRAN, in press). Other species inhabit the islands of Borneo (five species), Sumatra, Siberut, and Nias (one species each) (ZETTEL 2004, PAPÁČEK &



Figs. 45–50: *Hydrotrepes benomensis* sp.n. (45) Genal and pronotal plate of macropterous specimen, ventrolateral aspect. (46) Medioventral carinae, lateral aspect, venter turned upward (ps – prosternal carina, ms – mesosternal carina, mt – metasternal carina, st2, st3 – carinae of sternites 2, 3). (47) Aedeagus. (48) Right paramere. (49) Left paramere. (50) Subgenital plate of female, ventral aspect.

ZETTEL 2005). *Hydrotrepes langkawicus* differs strongly from *H. benomensis* sp.n. by its very small size, weakly concave hind margin of the prosternal carina, thicker structures of the male's genitalia (aedeagus and both parameres), a lobate sternite 7 of the female, and many other features (compare ZETTEL & TRAN, in press). Only some females of the *H. martini* group have a mediolateral process, namely *H. intermixtus* ZETTEL, 2000, *H. grabenwegeri* ZETTEL, 2000, *H. flavus* ZETTEL, 2001, *H. appendiculatus* ZETTEL, 2004, and an unnamed female from Borneo (see ZETTEL 2000, 2001, 2004, ZETTEL & PAPÁČEK 2008). However, only in the last two species, this process is as long and slender as in *H. benomensis* sp.n. (Fig. 50). *Hydrotrepes appendiculatus* and *H. benomensis* sp.n. differ distinctly in size, colour pattern of the cephalonotum, and distal parts of both parameres, which are conspicuously slender in *H. appendiculatus* (see ZETTEL 2004). The aedeagi of the two species are very similar and distinguish them from the Bornean representatives of the *H. martini* group.

**Distribution.** Malaysia: Pahang: Gunong Benom.

**Etymology.** Named after the area of the type locality, the Benom Mountains.

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