

THE HYDRAENIDAE (COLEOPTERA) OF THE REPUBLIC OF SINGAPORE

Manfred A. Jäch

Naturhistorisches Museum, Burgring 7, A – 1010 Wien, Austria
Email: manfred.jaech@nhm-wien.ac.at

Juan A. Díaz

Departamento de Zooloxía e Antropoloxía Física, Universidade de Santiago, Campus de Lugo, E – 27002 Lugo, Spain
Email: juanangel.diaz@usc.es

Andre Skale

Blücherstraße 46, D – 95030 Hof/Saale, Germany
Email: andre.skale@online.de

ABSTRACT. — No hydraenid species has hitherto been recorded from the Republic of Singapore. Eight species belonging to two genera (*Aulacochthebius* Kuwert, *Hydraena* Kugelann) are here recorded. Five new species of *Hydraena* are described: *H. hendrichi* (Singapore, Thailand, Malaysia, Indonesia), *H. michaelbalkei* (Singapore), *H. paulmoritz* (Singapore, Thailand, Malaysia, Indonesia), *H. singaporenensis* (Singapore), and *H. yangae* (Singapore, Malaysia). A key to the species of *Hydraena* from Singapore is included.

KEY WORDS. — Coleoptera, Hydraenidae, *Aulacochthebius*, *Hydraena*, new species, Southeast Asia, Singapore, Thailand, Malaysia, Indonesia

INTRODUCTION

The Republic of Singapore is an island city-state located at the southern tip of the Malay Peninsula. It lies about 140 km north of the equator, nested between the Malaysian state of Johor and the Indonesian Riau Archipelago. At about 700 km², it is the smallest country in Southeast Asia.

In general, the water beetle fauna of Singapore is comparatively well explored, mainly due to the painstaking collecting activities of M. Balke and L. Hendrich in 1997 (see Balke et al., 1997; Balke & Hendrich, 1999; Hendrich et al., 2004). However, the family Hydraenidae (Minute Moss Beetles) forms an exception, since no identified species has ever been recorded from Singapore.

The taxonomic knowledge of the Southeast Asian Hydraenidae is generally still very poor. Despite the fact that thousands of hydraenid specimens from Southeast Asia are deposited in various museum collections, hardly anything has ever been published on the Southeast Asian Minute Moss Beetles so far. Until today, not a single named species of *Hydraena* Kugelann was recorded from Myanmar, Thailand, Laos, Cambodia, Singapore, or Borneo (Hansen, 1998; Balke et al., 2004)!

A total of seven species of *Hydraena* has been recorded from Sumatra, Java and Bali by Orchymont (1932): *H. feuerborni* Orchymont, 1932, *H. insita* Orchymont, 1932, *H. insolita* Orchymont, 1932, *H. inusta* Orchymont, 1932, *H. jacobsoni* Orchymont, 1932, *H. squalida* Orchymont, 1932, and *H. thienemannii* Orchymont, 1932. An eighth species, *H. concinna* Orchymont, 1932, originally described from northern Vietnam, has also been recorded from Java by Orchymont (1932); however, type studies carried out recently by the first author revealed that this record is clearly based on misidentification (M. A. Jäch, unpublished).

As for Malaysia, the first record for the family Hydraenidae was provided by Maulik (1931), who recorded an unidentified “*Hydraena* sp.” from Selangor. Fernando & Gatha (1963), probably based on personal information from J. Balfour-Browne, recorded *Hydraena jacobsoni* Orchymont for “Malaya”. Additional unidentified “*Hydraena* spp.” were recorded from Selangor (Sungai Gombak) by Bishop (1973) and from Pahang (Tasek Cini) by Hebauer et al. (1999).

Balke et al. (1997) and Hendrich et al. (2004) listed three unidentified species of *Hydraena* from Singapore. Examination of these specimens and of additional material deposited in the Raffles Museum of Biodiversity Research (Singapore) and the Naturhistorisches Museum Wien

(Austria) revealed that in fact seven different species of *Hydraena* occur in Singapore, five of which are new to science. In addition, one species of *Aulacochthebius* Kuwert was detected in the collections of the Raffles Museum of Biodiversity Research (Singapore).

MATERIAL AND METHODS

This study is based on about 270 specimens of Hydraenidae collected in Singapore between 1957 and 2006 by several staff members of the Raffles Museum of Biodiversity Research (C. M. Yang, H. K. Lua, etc.), by M. Balke, L. Hendrich, H. Zettel, and the senior author.

Hundreds of additional specimens from neighbouring countries deposited in the Naturhistorisches Museum Wien (Austria) were also examined to clarify the global distribution of the species occurring in Singapore.

All types of the species described so far from Vietnam and Indonesia have been examined.

Acronyms:

| | |
|------|---|
| CDL | Coll. J.A. Díaz, Lugo, Spain |
| CSH | Coll. A. Skale, Hof, Germany |
| CWW | Coll. A. Weigel, Wernburg, Germany |
| ISNB | Institut royal des Sciences naturelles de Belgique, Bruxelles, Belgium |
| NMW | Naturhistorisches Museum Wien, Austria |
| ZRC | Zoological Reference Collection, Raffles Museum of Biodiversity Research, Singapore |
| ZSM | Zoologische Staatssammlung, München, Germany |

TAXONOMIC RESULTS

Checklist of the Hydraenidae of Singapore

- 1) *Aulacochthebius asiaticus* (Orchymont, 1929)
- 2) *Hydraena (Hydraenopsis) formula* Orchymont, 1932
- 3) *Hydraena (Hydraenopsis) hendrichi*, new species
- 4) *Hydraena (Hydraenopsis) jacobsoni* Orchymont, 1932
- 5) *Hydraena (Hydraenopsis) michaelbalkei*, new species
- 6) *Hydraena (Hydraenopsis) paulmoritz*, new species
- 7) *Hydraena (Hydraenopsis) singaporenensis*, new species
- 8) *Hydraena (Hydraenopsis) yangae*, new species

Aulacochthebius asiaticus (Orchymont, 1929) (Fig. 15)

Ochthebius (Aulacochthebius) asiaticus Orchymont, 1929: 200
Aulacochthebius asiaticus Orchymont: Hansen, 1998; Balke et al., 2004

Material examined. — SINGAPORE: 1 male (ZRC): Bukit Timah, University pond, coll. D. H. Murphy, 31 Oct. 1957; 1 male, 7 females (NMW, ZRC): Sembawang, coll. C. M. Yang & B. K. Kung, 12 Mar. 1992 “ZRC 784A”.

Distribution. — This species was described from Vietnam. It is probably widespread in the Oriental Region (see Balke et al., 2004). However, thorough faunistic studies have not been carried out yet.

In Singapore (Fig. 15), this species was collected in the Bukit Timah Nature Reserve (University pond), and near River Sembawang (natural habitat destroyed: see Hall, 2012).

Hydraena (Hydraenopsis) formula Orchymont, 1932 (Figs. 9, 14, 15, 17)

Hydraena formula Orchymont, 1932: 655; Hansen, 1998; Jäch et al., 2000.

Type locality. — Lac Thô, Hòa Bình Province, northern Vietnam.

Type material. — **Holotype** male (ISNB, examined): “♂”, “Lac Thô [handwritten] Tonkin De Cooman [printed]”, “A. d’Orchymont det [printed] H. formula TYPE [handwritten]”, “TYPE” [red], “Prép. micr. N° 710709.13” [green], “AEDEAGUS DRAWN BY P.D.PERKINS” [printed]. **Paratypes** (ISNB, examined): 1 male (aedeagus lacking), 2 females, same locality data as holotype.

Additional material examined. — SINGAPORE: 1 female (ZRC): Bukit Timah Nature Reserve, coll. Lua, 2 Apr. 1997 “NS 224”; 1 female (ZRC): same locality, but coll. Lua et al., 13 Dec. 1995 “NS 214”; 1 female (ZRC): Rifle Range Road, east of Bukit Timah, coll. C. M. Yang et al., 27 May 1993 “417 ZRC.6.18870 (NS102)”; 1 female (ZRC): Nee Soon Swamp Forest, coll. D. H. Murphy & C. M. Yang, 16 Apr. 1992 “Y790”; 1 male, 1 female (NMW, ZRC): same locality, but coll. K. L. Yeo, 6 May 1992 “424 Y794D”.

Diagnosis. — Habitus and colouration as in *H. undulata* Jäch & Díaz, 1998 (see Jäch & Díaz, 1998: Fig. 7), 1.40–1.50 mm long. See original description of the latter for details of external characters (Jäch & Díaz, 1998: 167).

Male terminal sternite and spiculum (Fig. 9e): Sternite firmly connected with spiculum, resembling a contrabass; apex slightly emarginate.

Aedeagus (Fig. 9a–c): Very similar to that of *H. undulata* from Taiwan (see Jäch & Díaz, 1998: Fig. 20a–d). It differs from the latter mainly in the following characteristics: Distal lobe with spiny apex. Both parameres shorter, right one more setose than in *H. undulata*.

Gonocoxite (Fig. 9f) and female tergite X (Fig. 9g) more or less as in *H. undulata* (see Jäch & Díaz, 1998: Fig. 20e). Cavea of inner plate of gonocoxite undivided in the specimens examined.

Spermatheca (Fig. 9h–i) not distinguishable from that of *H. undulata*.

Secondary sexual characters: Male forecoxa with a very small projection directed ventrad. Male mesoventrite slightly more deeply impressed between mesoventral disc

and mesoventral process. Male mesoventral process more slender. Male metaventral plaques (Fig. 14) very thin, carinate. Male tergite X widely and asymmetrically excavate apically (excavation distinctly deeper on left side); dorsal apical margin asymmetrically and sinuously emarginate (more strongly emarginate on left side); corners subacute, right corner hardly noticeably longer than left one.

Variability: In the specimens from Sumatra, the apical segment of the maxillary palpi is brownish subapically. In most of the few specimens examined from Singapore the apical segment of the maxillary palpi is more or less unicoloured yellowish, which may be due to tenerality.

In some of the males, the hind tibia is hardly noticeably curved subapically and widened apically.

Distribution. — This species is obviously wide-spread in the Oriental Region, from Nepal to South China and western Indonesia.

In Singapore (Fig. 15), *H. formula* was collected in the Bukit Timah Reserve, near the Rifle Range Road (east of Bukit Timah), and in the Nee Soon Swamp Forest.

***Hydraena (Hydraenopsis) hendrichi*, new species**
(Figs. 1, 6, 12, 15, 16)

Type locality. — Shady pool in small ravine between Tuk Tuk and Tomok, Samosir Island, Lake Toba, North Sumatra, Indonesia.

Type material. — **Holotype** male (NMW): “N-SUMATRA, 1990 Toba See [Lake], ca. 900 m Samosir, 3.2. leg. Jäch (1[crossed out with pen]+2)”. **Paratypes:** 9 exs. (NMW), same label data as holotype; 9 exs. (NMW): “N-SUMATRA, 1990 (19) Sibolangit, Brastagi/ Medan leg. Jäch, 25.2.”; 6 exs. (NMW): “INDONESIEN 1991 (16) W-Sumatra, 25km E Padang NSG Taman Raya Bung Hatta 400m, leg. Jäch 14.2.”; 5 exs. (NMW): same locality and date, but “leg. Schödl”; 17 exs. (NMW): “INDONESIEN 1991 (18) W-Sumatra, Bungus Beach, 10m leg. Jäch 14.2.+23.2.”; 2 males, 1 female (ZSM): “SINGAPORE, Bukit Timah swamp nr fishpond 9.IV.1997 Balke & Hendrich leg.”; 1 female (ZRC): “SINGAPORE / Bukit Timah N.R., small stream n[ear]. entrance 9.4.1997 Balke & Hendrich leg.”; 6 males, 11 females (NMW, ZRC): “Singapore, Bukit Timah NR. 9 Apr 1997. M Balke & L Hendrich”; 4 males, 6 females (ZRC): “SINGAPORE: Bukit Timah NR. 9 Apr 1997. Balke & Hendrich leg.”; 34 exs. (NMW, ZSM): “West Malaysia / JOHOR Bekok, path to waterfall 10. April 1997, 50–150m Balke & Hendrich leg.”; 1 ex. (ZSM): “West Malaysia/JOHOR Bekok, path to waterfall 10.IV. 1997, 50–150 m Balke & Hendrich leg. Coll. HENDRICH”; 15 exs. (NMW): “MALAYSIA: Pahang Tioman Island Umg. [surroundings] Kampung Tekek 16.-24.7.1993 lg. Schuh”; 13 exs. (NMW): “MALAYSIA: Pahang Tioman Island Kg. [Kampung] Tekek Umgebg. [surroundings] 15.-26.7.1992 leg. R. SCHUH”; 7 exs. (NMW): “Prov. PAHANG 28.1. Pulau Tioman (7) Tekek-Juara 80m” / “MALAYSIA 1992 leg. Schillhammer”; 1 male (NMW): “Malaysia, Pahang, Kuala Lipis env., Hutan Lipur Terengganu, 4. VI. 2001. Lake in secondary forest; shallow, warm, with poor subaquatic vege-tation.”; 116 exs. (CDL, CSH, ISBN, NMW): “Malaysia, Johor [Pahang], Tioman Island 1.5 km E Juara, small stream in dense primary forest, 20. VI. 2001, J.F. Ko

čiam lgt.”; 14 exs. (NMW): “Malaysia, Johor [Pahang], Tioman Island Tekek env., small stream in dense primary forest, 24. VI. 2001, J.F. Kočiam lgt.”; 2 males, 3 females (NMW): “MALAYSIA 21.I.1992 SELANGOR: Templer Park, N K.L. [Kuala Lumpur] leg. Jäch (1)”; 4 males, 2 females (CSH): “S-THAILAND, Phang-nga Prov., Thimung distr., 5 km S Khaolak 08°36'N, 98°15'E, 10–50 m, 03.-16.VIII.2012, leg. A. Skale”; 3 males, 1 female (CWW): same locality, but “leg. A. Weigel”; 3 males, 3 females (CSH): “S-THAILAND, Phang-nga Prov., Lamru distr., 6 km NE Lam Kaen (white banana waterfall) 08°37.324'N, 98°18.362'E, 75 m, 13.VIII.2012, leg. A. Skale”; 2 males (CWW): same locality, but “leg. A. Weigel”.

Description. — Habitus as in Fig. 1. Body length: 1.25–1.50 mm. Dorsum yellowish to reddish brown, frons dark brown, pronotum except of disc paler yellowish; maxillary palpi unicoloured yellow.

Labrum excised anteriorly; lobes rounded anteriorly, without corners. Clypeus sparsely punctate, smooth. Fronto-clypeal suture very slightly arcuate, slightly impressed. Frons sparsely (middle) to moderately densely (laterally) punctate, interstices shining; interocular grooves more or less obsolete. Eyes large, protruding, more than 30 facets visible in dorsal view.

Pronotum very weakly cordiform, wider than long; anterior margin concave; anterior angles rounded; lateral rim slightly denticulate and very slightly produced at middle; disc rather flat, sparsely punctate, glabrous, foveae more or less obsolete; anterior, posterior and lateral portions of pronotum more densely punctate.

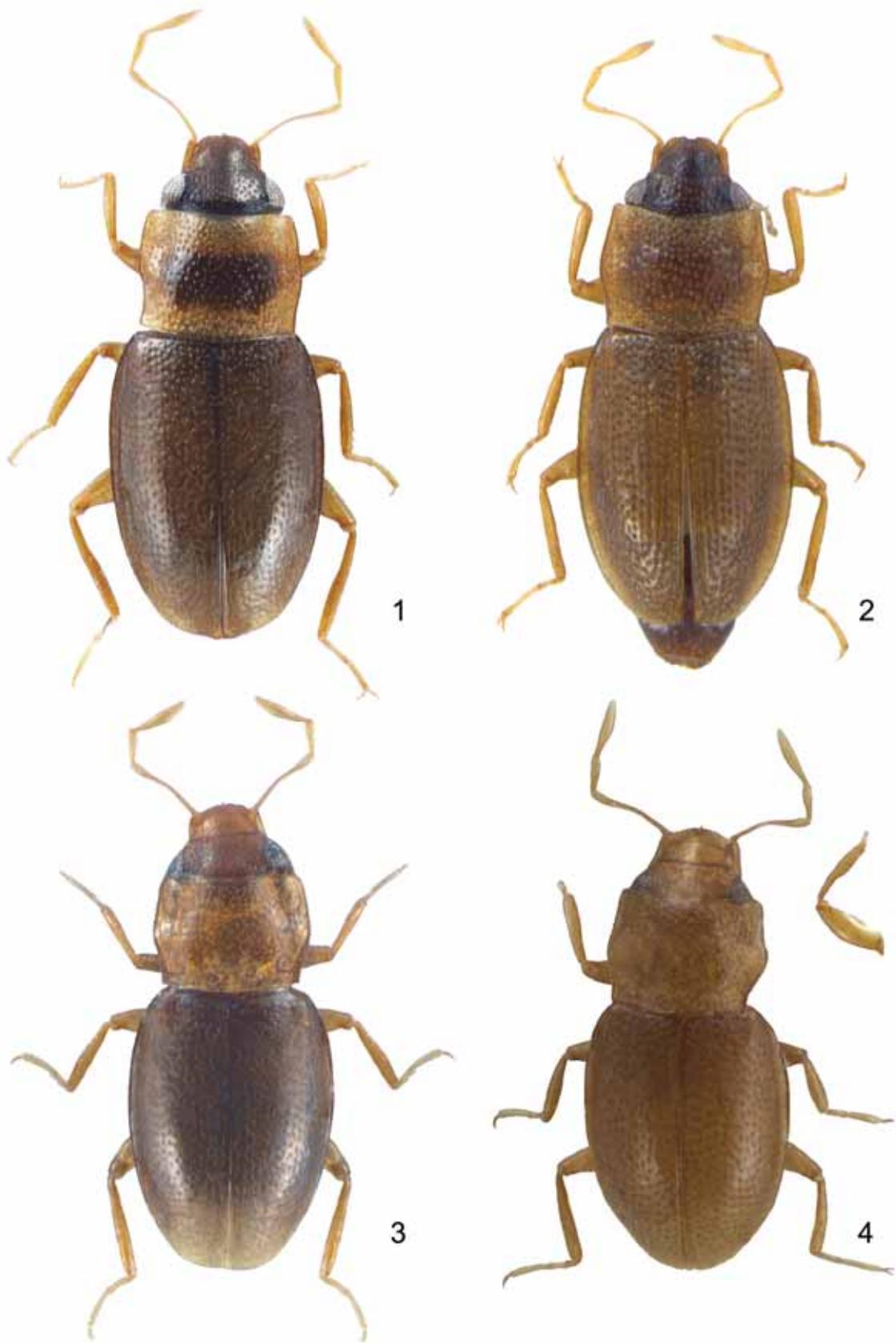
Elytra subparallel-sided; with about nine rows of punctures between suture and shoulder; punctures small, not deeply impressed, arranged in more or less regular, not impressed lines; intervals and interstices flat and glabrous; explanate margin of elytra weakly serrate posteriorly, narrow.

Foretibia slightly curved.

Mesoventral process wider than mesotibia. Metaventrite moderately deeply impressed between metaventral plaques, the latter convergent anteriorly, more or less \wedge -shaped (Fig. 12).

Male terminal sternite and spiculum (Fig. 6d): Sternite pentagonal, slightly asymmetrical, base V-shaped, not firmly connected with spiculum.

Aedeagus (Fig. 6a–c): Main piece strongly asymmetrical in ventral view, dorsally with three long setae, which are conspicuously spiny in apical part; phallobase asymmetrical, not closed proximally. Distal lobe very large, intricately shaped, with numerous conspicuous spinules and bristles, flagellum long. Parameres articulately connected with main piece, inserted near phallobase. Left paramere elongate and slender, moderately long; dorsal margin with row of moderately long setae in apical half. Right paramere larger, wide; apex with very long, partly spiny setae; ventral margin with a row of about ten shorter, furcate setae.



Figs. 1–4. Habitus of: 1, *Hydraena hendrichi*, paratype; 2, *H. paulmoritz*, paratype; 3, *H. singaporensis*, paratype; 4, *H. yangae*, holotype, right foreleg (lateral view) depicted separately (photograph taken before right elytron got unhinged).

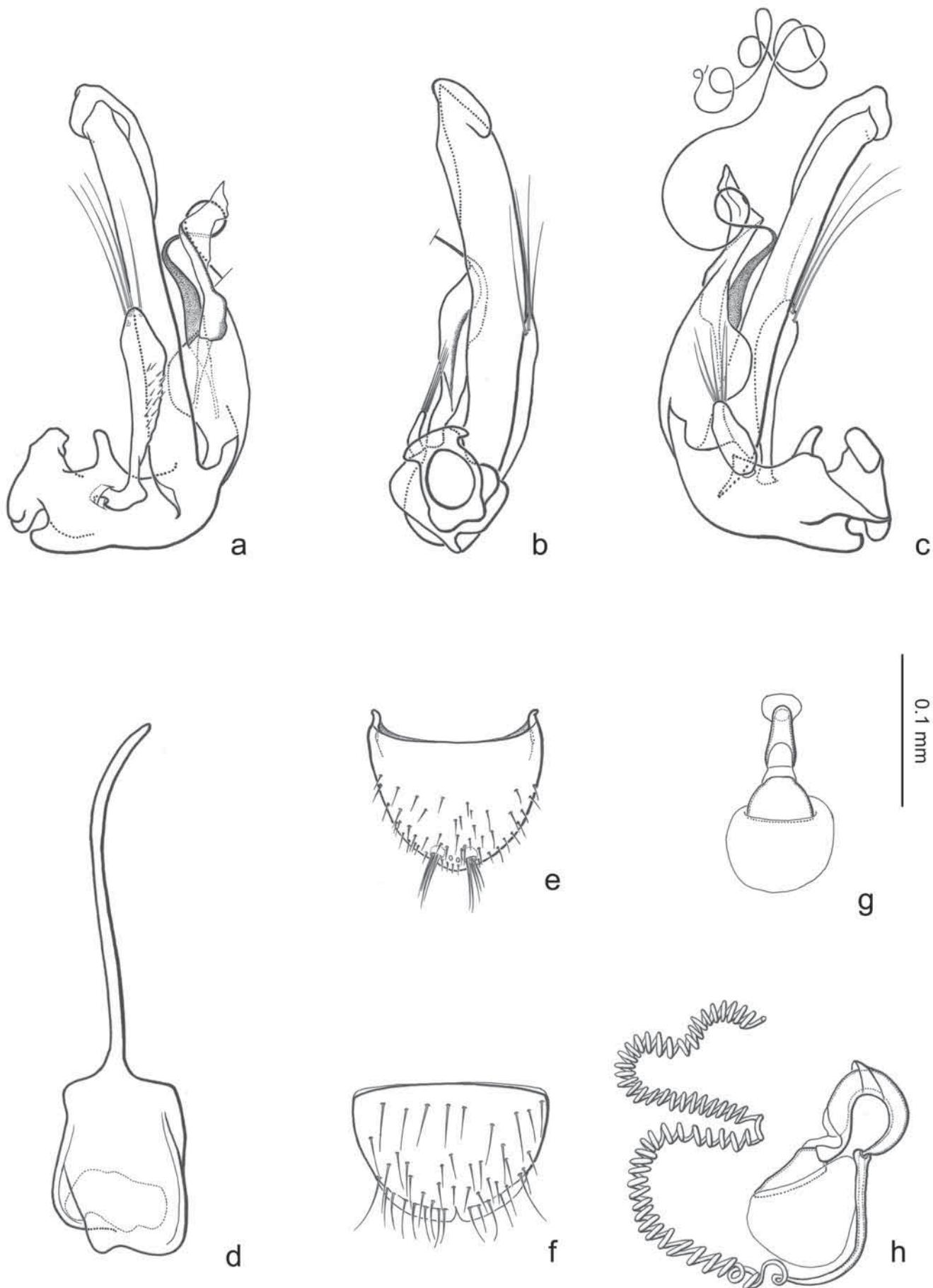


Fig. 5. *Hydraena singaporensis*: a, aedeagus in right lateral view; b, aedeagus, ventral view (flagellum not depicted completely in a, b); c, aedeagus, left lateral view; d, male sternite X and spiculum; e, gonocoxite; f, female tergite X; g, h, spermatheca.

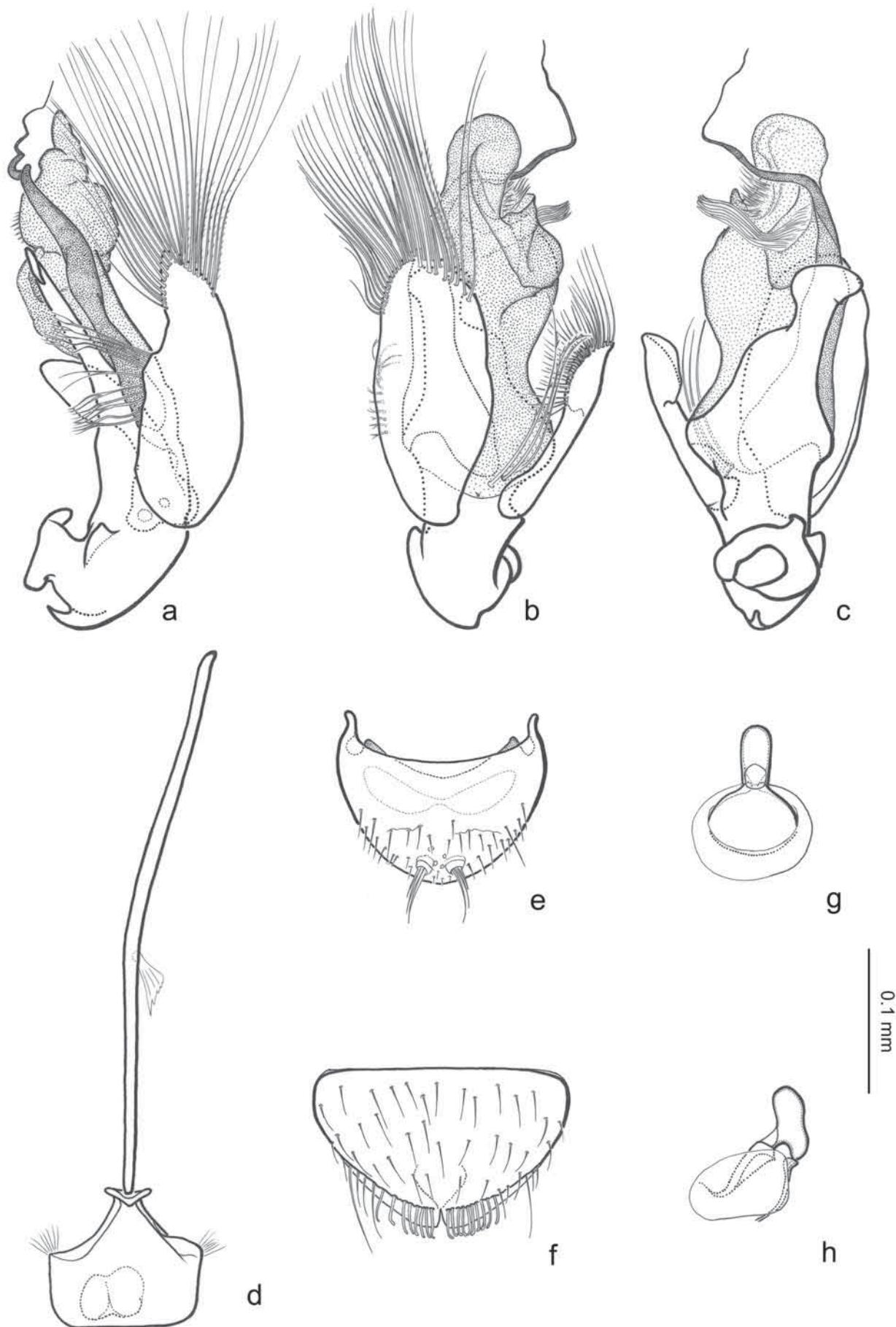


Fig. 6. *Hydraena hendrichi*: a, aedeagus in lateral view; b, aedeagus, dorsal view; c, aedeagus, ventral view (setae of parameres omitted); d, male sternite X and spiculum; e, gonocoxite; f, female tergite X; g, h, spermatheca.

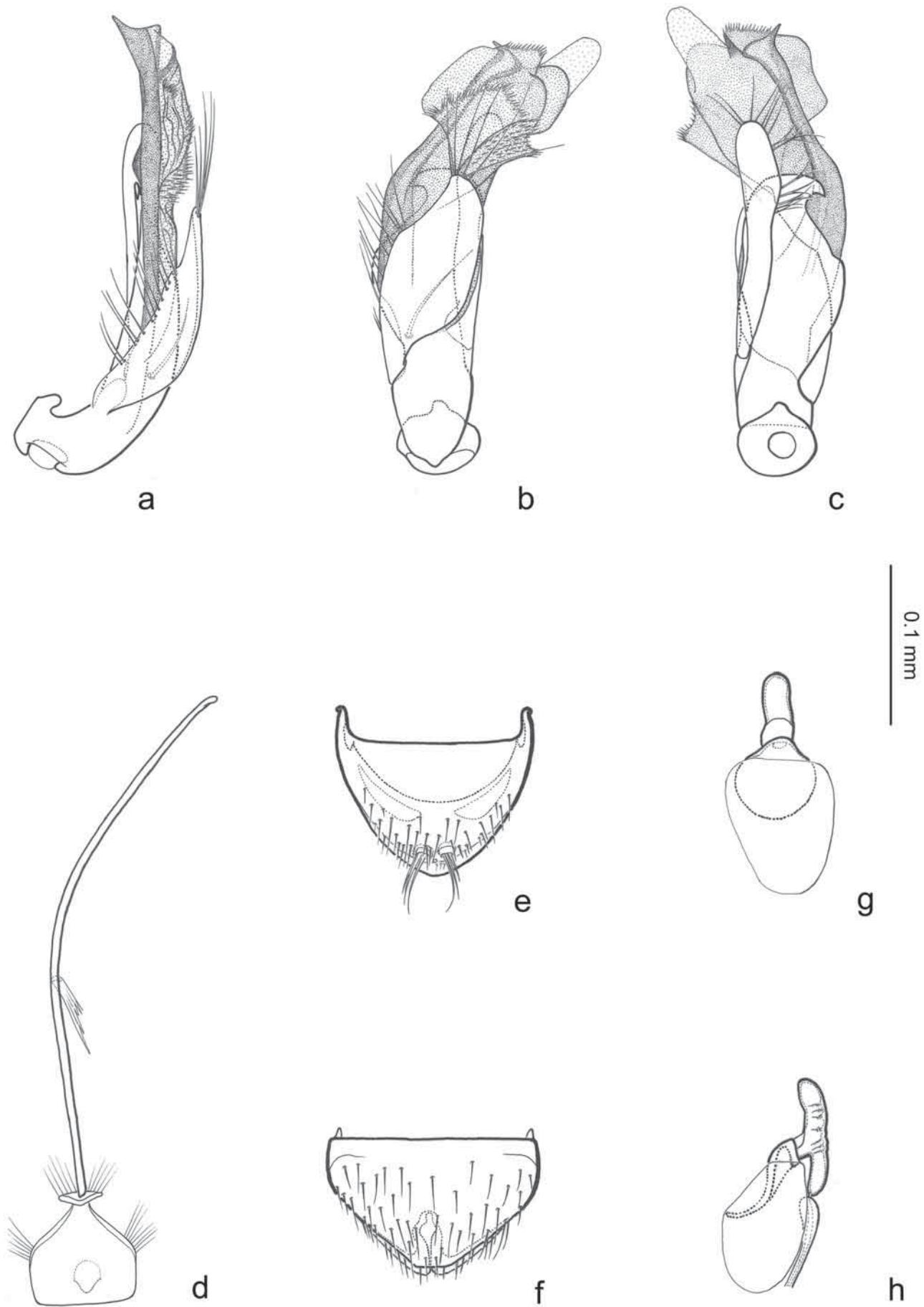


Fig. 7. *Hydraena yangae*: a, aedeagus in lateral view; b, aedeagus, dorsal view (setae of left paramere omitted in a, b); c, aedeagus, ventral view (setae of right paramere omitted); d, male sternite X and spiculum; e, gonocoxite; f, female tergite X; g, h, spermatheca.

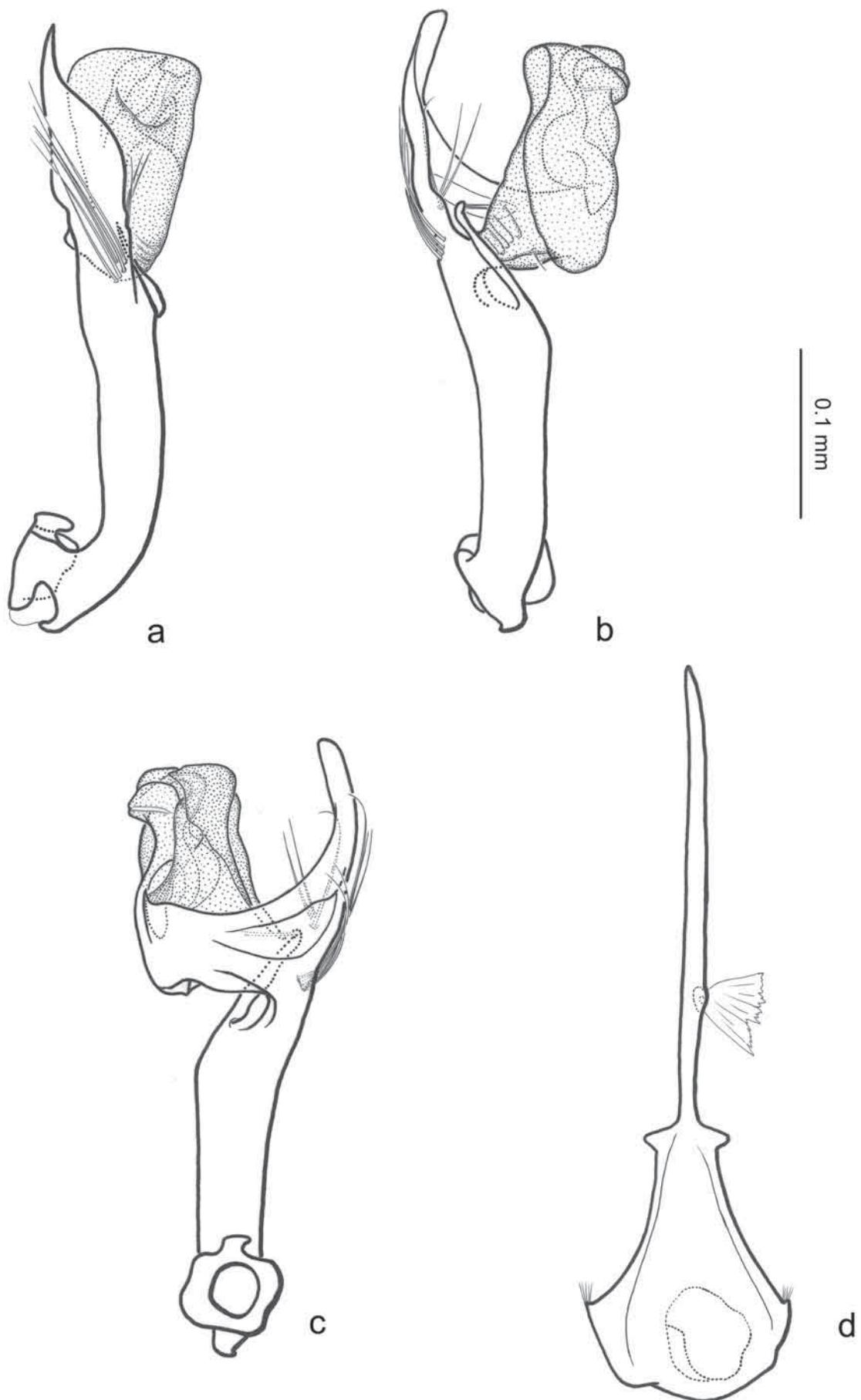


Fig. 8. *Hydraena michaelbalkei*: a, aedeagus in lateral view; b, aedeagus, dorsal view; c, aedeagus, ventral view; d, male sternite X and spiculum.

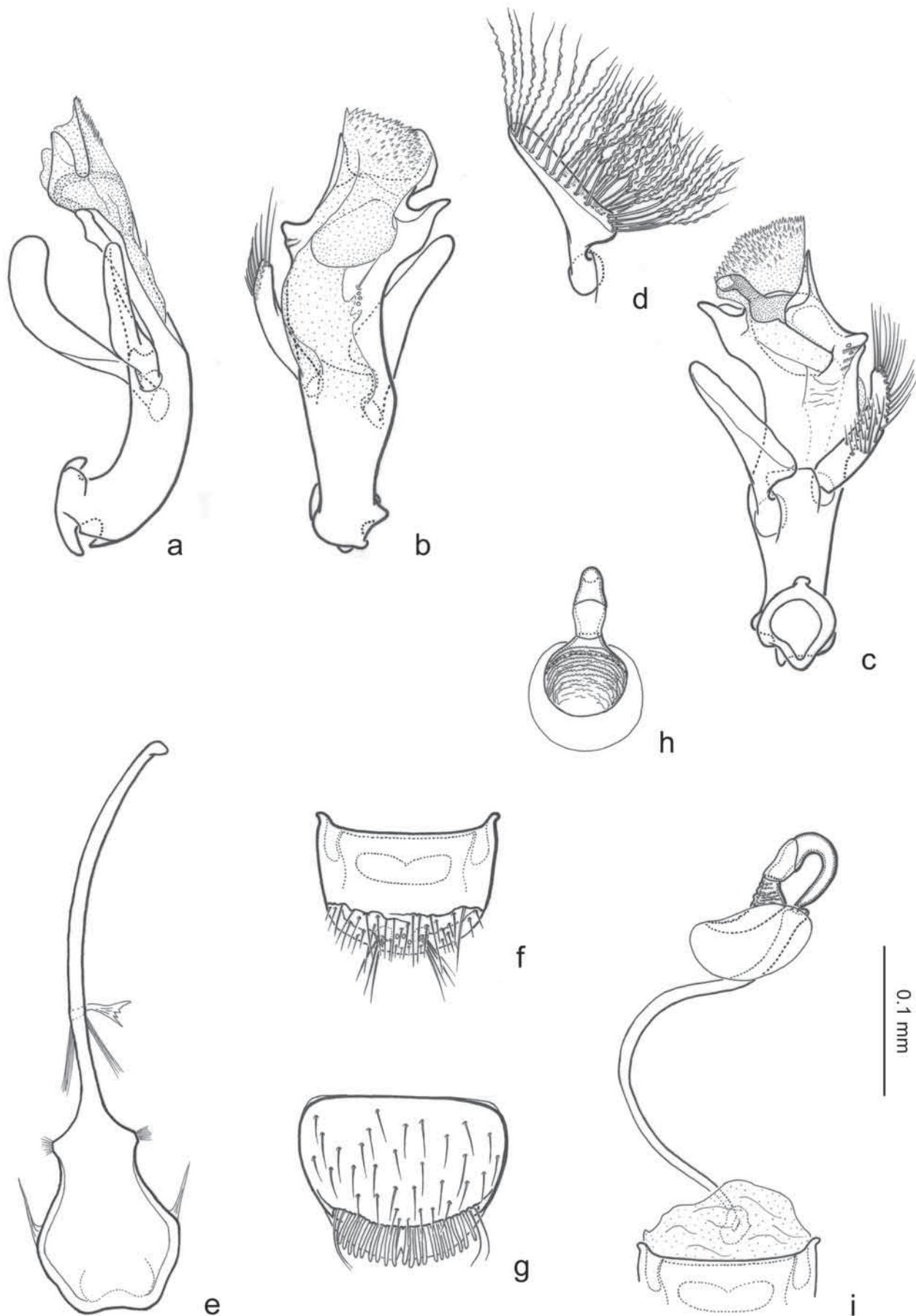


Fig. 9. *Hydraena formula*: a, aedeagus in lateral view (setae of both parameres omitted); b, aedeagus, dorsal view; c, aedeagus, ventral view (setae of left paramere omitted in b, c); d, left paramere; e, male sternite X and spiculum; f, gonocoxite; g, female tergite X; h, i, spermatheca.

Gonocoxite (Fig. 6e): Subtriangular, wider than long; lateral margins curved; inner plate slightly projecting sublaterally, with medially connected pair of caveae.

Female tergite X (Fig. 6f): Disc moderately densely covered with trichoid setae; subapical setae vermiciform; posterior margin excised.

Spermatheca (Fig. 6g–h): Proximal portion sac-like; distal portion discoidal.

Secondary sexual characters: Male foretibia slightly more curved and with a small denticle on mesal face near apex. Male mesoventrite more deeply impressed between mesoventral disc and mesoventral process. Metaventral plaques of male distinctly \wedge -shaped (Fig. 12), in female anterior part covered by setae, thus the two branches not distinctly contiguous anteriorly. Apex of male tergite X with small asymmetrical excavate projection.

Differential diagnosis. — Externally, *Hydraena hendrichi* can be distinguished easily from all other species from Singapore by the anteriorly convergent metaventral plaques. In addition, males of *H. hendrichi* possess a subapical denticle on the mesal face of the foretibia; in the only other species from Singapore with a denticle on the foretibia (*H. paulmoritz*), this denticle is not close to the apex.

Distribution. — South Thailand, Malaysia (Johor, Pahang, Selangor), Singapore (Fig. 15), Indonesia (Sumatra).

In Singapore this species was collected only once, i.e. on 9 Apr.1997 in the Bukit Timah Nature Reserve: in a small spring brook named Taban Valley (Fig. 16) and in a swamp near a fish pond (see Balke et al., 1997: pl. 1, Fig. a). Since then it has never been found in Singapore again.

Etymology. — Named for Lars Hendrich (ZSM), excellent water beetle specialist, who collected the type specimens from Singapore (together with Michael Balke).

***Hydraena (Hydraenopsis) jacobsoni* Orchymont, 1932**
(Figs. 10, 15–17)

Hydraena jacobsoni Orchymont 1932: 656; Fernando & Gatha, 1963; Hansen, 1998; Jäch et al., 2000

Type locality. — Bukittingi [Fort de Kock], West Sumatra, Indonesia.

Type material. — **Holotype** male (ISBN, examined): “♂”, “Fort de Kock (Sumatra) 920M. 1924 leg. E. Jacobson” [printed], “Knisch det. 1925 [printed] *Hydraena* ♂ *scabra* Orch. [handwritten]”, “coll d’Orchymont” [handwritten], “TYPE” [printed, red], “A. d’Orchymont det [printed] *H. jacobsoni* TYPE [handwritten]”, “AEDEAGUS DRAWN BY P.D.PERKINS” [printed]. **Paratypes** (ISBN): 3 females, same locality data as holotype; 2 females from Lake Ranau (South Sumatra), 1 female from Singkarak (Central Sumatra), 1 female from Palembang (South Sumatra). We have not examined the pygidial sclerites of these seven female paratypes to test their specific assignation.

Additional material examined. — SINGAPORE: 3 males, 5 females (NMW, ZRC): Bukit Timah Nature Reserve, coll. H. K. Lua et al., 13 Dec.1995 “NS 214”; 1 male, 1 female (ZRC): same locality, coll. H. K. Lua, 2 Apr.1997 “NS 224”; 1 male, 1 female (ZSM): Bukit Timah, swamp near fish pond, 9 Apr.1997, coll. Balke & Hendrich; 2 females (ZRC): Bukit Timah NR., small stream near entrance (Taban Valley), coll. Balke & Hendrich, 9 Apr.1997; 1 male (ZRC): Botanic Gardens, pond, coll. H. K. Lua, 22 Apr.1997 “NS0227”; 6 males, 6 females (NMW, ZRC): Nee Soon Swamp Forest, coll. D. H. Murphy & C. M. Yang, 16 Apr.1992 “Y790”; 1 female (ZRC): same locality, but coll. K. L. Yeo, 6 May 1992 “424 Y794D”; 1 male (ZRC): Lorong Banir [Nee Soon], coll. H. K. Lua et al., 16 Jun.1995 “NS 191”; 4 exs. (ZRC): Lower Peirce Reservoir, coll. H. K. Lua, 22 Apr.1997 “NS 230a”; 1 female (ZRC): Senoko nr. Sg [River] Sembawang, coll. K. K. P. Lim et al., 10 Feb.1992 “424 Y777A”; 7 exs. (ZRC): same locality and date, but coll. K. K. P. Lim et al. “Y777b”; 1 male, 2 females (ZRC): same locality, but coll. C. M. Yang & B. K. Kung, 12 Mar.1992 “784A”. Additional specimens from Nee Soon Swamp Forest and Senoko are kept in alcohol (ZRC).

Diagnosis. — Externally, this species is very similar to *H. formula*. Body length: 1.25–1.45 mm.

Terminal segment of maxillary palpi never darkened.

Externally, males can be distinguished from *H. formula* by the curved foretibia, the slightly wider mesoventral process, the unmodified metaventral plaques, and by the tergite X.

Male terminal sternite and spiculum (Fig. 10d): Somewhat resembling a contrabass, apically wider than in *H. formula*; apex more or less truncate, with tiny median projection.

Aedeagus (Fig. 10a–c): Somewhat similar to *H. formula* and *H. scabra* Orchymont, 1925 (Freitag & Jäch, 2007). Apex of main piece produced into a curved spine, pointing ventrad; one dorsal seta near apical fourth; ventral margin with conspicuous spine-like projection near insertion of left paramere. Distal lobe with spiny apex and short apical flagellum; with long dorsal setiferous appendage near base. Parameres articulately connected with main piece, inserted near middle of main piece; left paramere subtriangular, fringed with long setae along ventral margin (except near apex), and in apical part of dorsal margin; right paramere short and slender, with ventral and apical setae.

Females of *H. jacobsoni* can be distinguished from *H. formula* by the gonocoxite and by the spermatheca.

Gonocoxite (Fig. 10e) distinctly transverse, subtrapezoidal; lateral margin distinctly convex subbasally; setae confined to apical area; basal apophyses long; inner plate projecting sublaterally; paired caveae of inner plate connected medially.

Female tergite X (Fig. 10f) inconspicuous, very similar to that of *H. formula*. Hyaline margin excised apically.

Spermatheca (Fig. 10g–h): Proximal portion crescentic; distal portion cup-shaped.

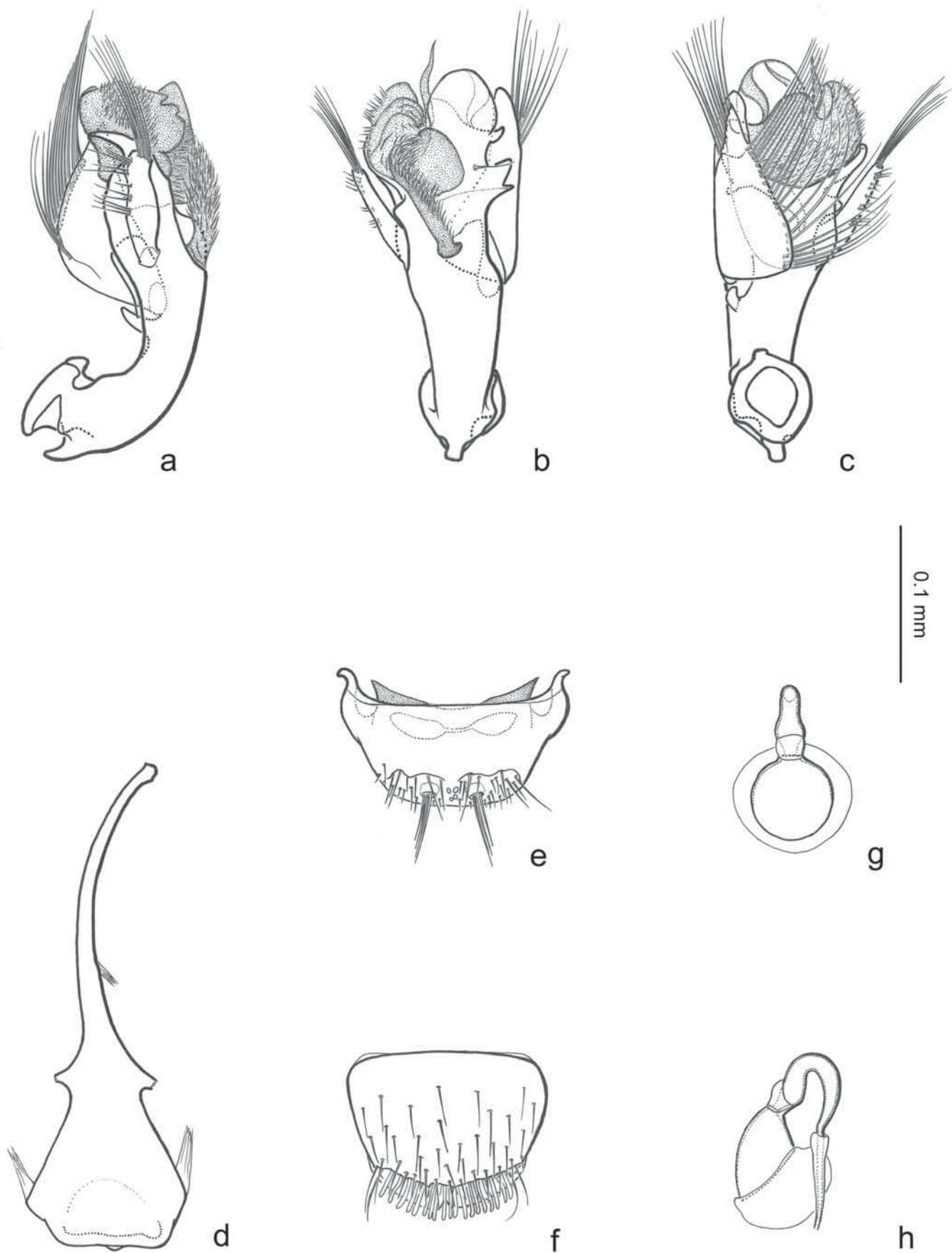


Fig. 10. *Hydraena jacobsoni*: a, aedeagus in lateral view; b, aedeagus, dorsal view; c, aedeagus, ventral view; d, male sternite X and spiculum; e, gonocoxite; f, female tergite X; g, h, spermatheca.

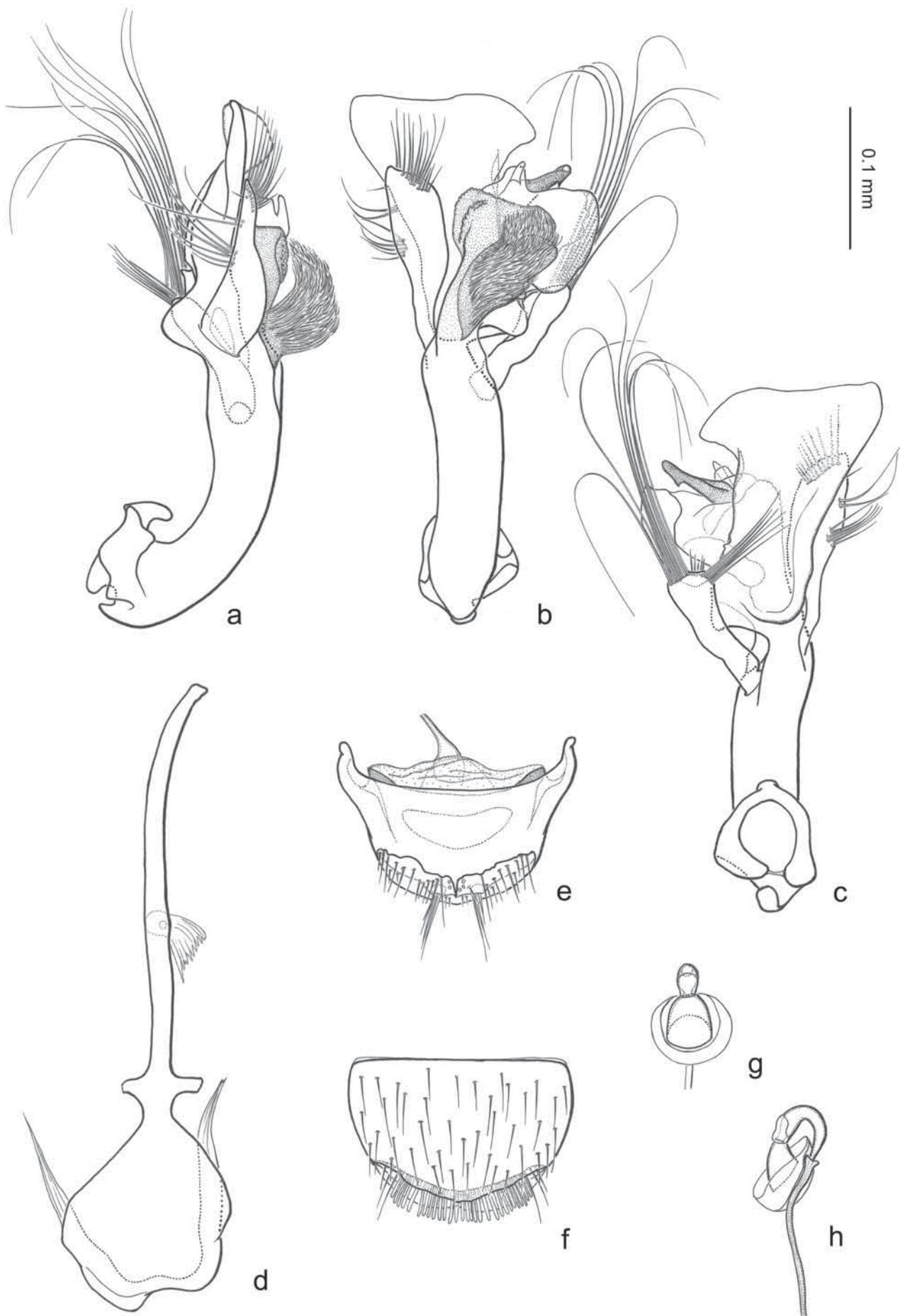


Fig. 11. *Hydraena paulmoritz*: a, aedeagus in lateral view; b, aedeagus, dorsal view; aedeagus, ventral view; d, male sternite X and spiculum; e, gonocoxite; f, female tergite X; g, h, spermatheca.

Secondary sexual characters: Male foretibia slightly curved. Male mesoventrite more deeply impressed between mesoventral disc and mesoventral process. Male tergite X apically asymmetrically excavate; apex emarginate, corners subacute, right corner slightly longer than left one.

Distribution. — Thailand, Malaysia (Perak, Kedah, Sarawak), Singapore (Fig. 15), Indonesia (Sumatra to Lombok).

In the original description (Orchymont, 1932) this species was also recorded from northern Vietnam (Lac Thô, Hòa Bình Province). However, among the type material (ISNB) there is no specimen from Vietnam (see above).

In Singapore, this species was collected in the following locations: Bukit Timah Nature Reserve (swamp near fish pond, stream in Taban Valley), Nee Soon Swamp Forest, Lower Peirce Reservoir, Botanic Gardens, and Senoko (natural habitat destroyed).

***Hydraena (Hydraenopsis) michaelbalkei*, new species**
(Figs. 8, 15)

Type locality. — Shaded pool with grass, 1°20.990'N, 103°48.677'E, near Sime Road, MacRitchie Reservoir, Singapore.

Type material. — **Holotype** male (ZRC): “SINGAPORE, Mac Ritchie, nr Sime rd, 24IV1997 Balke & Hendrich”. Maxillary palpi and legs missing.

Diagnosis. — Body length: 1.25 mm. This species is very closely related with *Hydraena manguao* Freitag & Jäch. Colouration, dorsal punctuation and body form agree very well with the latter (see Freitag & Jäch, 2007: Fig.

11). Unfortunately, the legs of the holotype are missing and therefore we are (except for the sexually dimorphic male tergite X) at present not able to find any significant characters to distinguish *H. michaelbalkei* and *H. manguao* externally. Male tergite VIII apically distinctly produced.

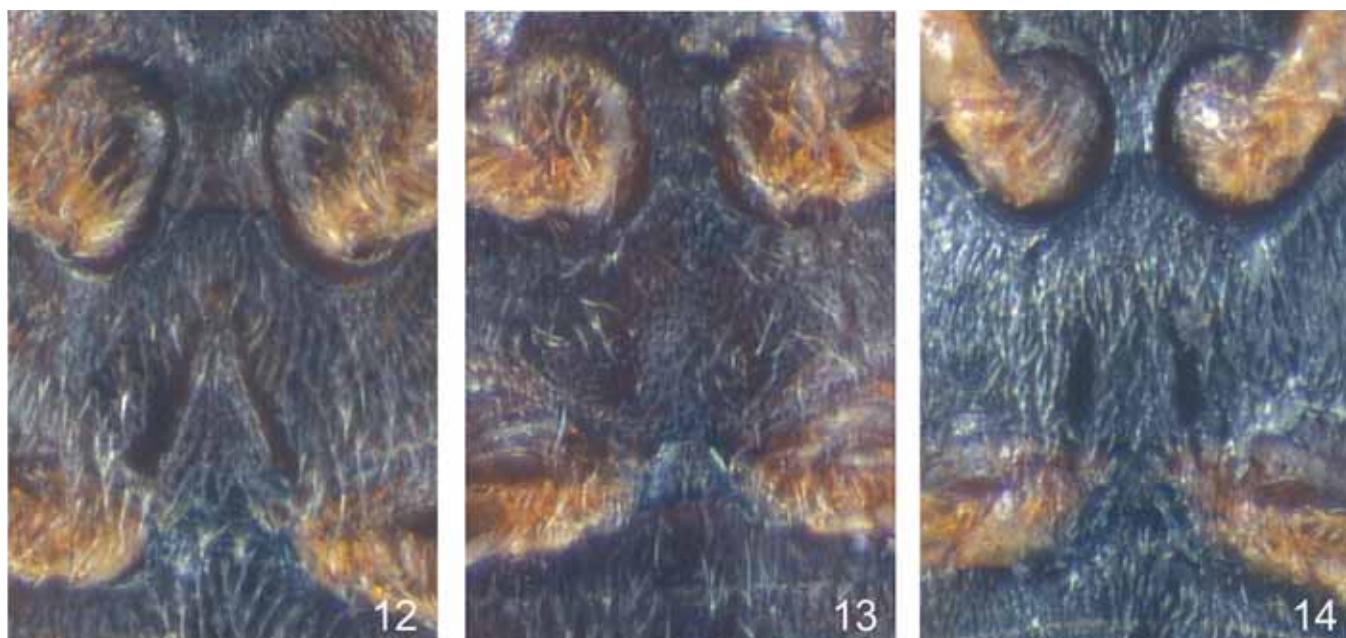
Male terminal sternite and spiculum (Fig. 8d): Somewhat resembling a contrabass, more elongate than in *H. manguao* (Freitag & Jäch 2007: Fig. 25d); apex more widely rounded.

Aedeagus (Fig. 8a–c): In ventral and dorsal view distinctly Y-shaped as in *H. manguao* (Freitag & Jäch, 2007: Fig. 25a–c), *H. sautakei* Jäch & Díaz (Jäch & Díaz, 1999: Fig. 7) and *H. miyatakei* (Jäch & Díaz, 1999: Fig. 8). Main piece rather straight in lateral view; with only one short dorsal seta near base of distal lobe. Left paramere distinctly shorter than in *H. manguao*, distinctly thinner than in *H. sautakei* and *H. miyatakei*, with few apical setae; right paramere (as in *H. sautakei* and *H. miyatakei*) completely fused to main piece, mainly indicated by the presence of two groups of setae.

Secondary sexual characters: Characters of male legs unknown. Male metaventral plaques thin and short (confined to basal half), carinate. Male tergite X with subapical, asymmetrically heart-shaped excavation; apex slightly excised, right corner longer than left one.

Etymology. — Named for Michael Balke (ZSM), excellent water beetle specialist, who collected the holotype (together with Lars Hendrich).

Distribution. — So far known only from Singapore (MacRitchie Reservoir), see Fig. 15.



Figs. 12–14. Meso- and metaventre of: 12, *Hydraena hendrichi*; 13, *H. singaporensis*; and 14, *H. formula*.

***Hydraena (Hydraenopsis) paulmoritz*, new species**
(Figs. 2, 11, 15–17)

Type locality. — Small stream near Than Mayom Waterfall, Trat Province, eastern Central Thailand.

Type material. — **Holotype** male (NMW): “O – THAILAND 1990 Ko Chang (10) Than Mayom leg. Jäch 8.12.”. **Paratypes:** 6 males, 5 females (NMW), same locality data as holotype; 1 male, 1 female (NMW): “THAILAND: 28.11.1995 Udon Thani Prov. 5km E Udon Thani leg. Zettel (32)”; 1 male (NMW): “THAILAND: 23.11.1995 Sakhon Nakhon leg. Zettel (21)”; 1 male (NMW): “MALAYSIA, Kedah W-Langkawi, S of Telaga Tujuh, swamp, 22.11. 2006 H. ZETTEL leg. (HZL 8)”; 1 male (NMW): “MALAYSIA 29.I.1992 KEDAH: Langkawi Pantai Kok leg. Jäch (13)”; 1 male (ZRC): “SINGAPORE: 424 LHK 293 Butik [Bukit] Batok Nat. Park 18.12.1995 HK Lua et al coll.”; 1 male (ZRC): “SINGAPORE: ZRC 784A 12.03. Sembawang 1992 leg. CM Yang & BK Kung”; 2 males, 3 females (ZRC): “SINGAPORE: 424 Y777B Senoko nr Sg [River] Sembawang 10.02.1992 (Y777b) leg. KKP Lim et al”; 6 males, 6 females (ZRC): “SINGAPORE: 417 ZRC.6.18500 Bukit Timah Nat. Res. 13.12.1995 (NS 214) leg. HK Lua et al”; 37 males, 22 females (CDL, CSH, ISNB, NMW, ZRC): “SINGAPORE, Bukit Timah swamp nr fishpond 9.IV.1997 Balke & Hendrich leg.”; 1 female (ZSM): “SINGAPORE, Bukit Timah swamp nr fishpond, 9IV1997 Balke & Hendrich”; 5 males (ZSM): “SINGAPORE: Bukit Timah N.R., small stream n[ear]. entrance 9.4.1997 Balke & Hendrich leg.”; 1 male, 1 female (ZSM): same label data, but “SINGAPORE / [etc.]”; 2 males, 1 female (ZRC): “Singapore, Bukit Timah University pond. 31 Oct 1957. DH Murphy.”; 5 males, 2 females (ZRC): “Singapore, Bukit Timah Reserve 2.IV.1997, HK Lua leg. (NS 224)”; 33 males, 20 females (ZRC): same label data, but “SINGAPORE [etc.]”; 2 males, 3 females (ZRC): “SINGAPORE, Nee Soon Swamp-forest 16.IV.1992 D.H. Murphy & C.M. Yang leg. (Y790)”; 4 females (ZRC): same label data, but “Singapore, Nee Soon Swamp Forest, 16.IV.1992 D.H. Murphy & C.M. Yang leg. (Y 790)”; 1 female (ZRC): “Nature Reserves Survey Nee Soon Swamp Forest NS 126E, #23 28 April 1994”; 1 female (ZRC): same locality, but “NS 126F”; 1 female (ZRC): “Singapore, Lorong Banir [Nee Soon]. 6 May 1994 NS 149B KKP Lim et al.”; 1 male (NMW): “SINGAPORE Sungei Buloh Wetland Res. 18.08.2004 leg. Jäch (SGP 4)”; 1 male, 4 females (NMW): “SINGAPORE nr. Kranji Reservoir 18.08.2004 leg. Jäch (SGP 5)”; 1 male (NMW): “INDONESIEN 1991 (12a) W-Sumatra, NSG Lemba Harau 15km NE Payakumbu leg. Jäch 11.2.”.

Additional material examined. — SINGAPORE: Additional specimens from Lower Peirce Reservoir and Senoko are kept in alcohol (deposited in the ZRC).

INDONESIA: 1 female (ISNB): “♂” [printed], “SUMATRA Da.Ranaoe [printed] Urwaldbach ²⁰ 29 [handwritten] Exp. Thienemann [printed] (60) FR2 [handwritten, underside of label]”, “Para-type” [printed, red], “A. d’Orchymont det [printed] H. insita Paratype [handwritten]”, “? H. paulmoritz det. Jäch ’12” [handwritten]. This paratype of *Hydraena insita* from the type locality is a female (not a male); it is glued upside down, and its tergite X and gonocoxite agree very well with *H. paulmoritz*.

Diagnosis. — Habitus as in Fig. 2. Externally, this species is very similar to *H. formula* and *H. jacobsoni*. Body length: 1.25–1.45 mm.

Males can be distinguished from *H. formula* by the foretibia being provided with a tiny tooth on mesal face near distal 0.3, by the slightly wider mesoventral process, by the unmodified metaventral plaques, by the last two abdominal segments being larger, and by the tergite X.

From *H. jacobsoni* males can be distinguished by the foretibia being straight and provided with a tiny tooth on mesal face near distal 0.3, by the last two abdominal segments being larger, and by the shape and size of tergite X.

Male terminal sternite and spiculum (Fig. 11d): Sternite wide and asymmetrical, strongly attenuate before lateral extensions; apex slightly emarginate, left side produced apicad.

Aedeagus (Fig. 11a–c): Very large. Apical half of main piece dorsoventrally flattened, very wide in dorsal/ventral view; phallobase not closed proximally. Distal lobe rather small, intricately shaped, near base with large dorsal setiferous hyaline appendage. Parameres articulately connected with main piece, inserted near middle of main piece; left paramere elongate, subrectangular, with numerous, variously long apical setae, some of which overreach aedeagal apex; right paramere longer, apically acute in lateral view, somewhat club-shaped in ventral/dorsal view, with groups of comparatively short setae on apex and ventral margin.

Gonocoxite (Fig. 11e) very similar to that of *H. jacobsoni*, slightly longer than in the latter; cavea distinctly transverse.

Female tergite X (Fig. 11f) more transverse than in *H. jacobsoni*. Hyaline margin slightly excised apically.

Spermatheca (Fig. 11g, h) more or less as in *H. jacobsoni*.

Secondary sexual characters: Male foretibia with a small denticle on mesal face near apical 0.3 (best seen in ventral view). Male mesoventrite more deeply impressed between mesoventral disc and mesoventral process. Male mesoventral process slightly thinner than in female. Male tergite X large, apically slightly excavate; apex asymmetrical, deeply emarginate, corners rounded, left corner longer than right one.

Variability: Foretibia sometimes very slightly curved in male and female. In some populations, the terminal abdominal segments are very large and distinctly asymmetrical.

Distribution. — Thailand (Sakhon Nakhon, Trat, Udon Thani), Malaysia (Kedah), Singapore (Fig. 15), Indonesia (Sumatra).

In Singapore, this species was collected in the following locations: Bukit Timah Nature Reserve (University pond, swamp near fish pond, stream in Taban Valley), Bukit

Batok Nature Park, Nee Soon Swamp Forest, Lower Peirce Reservoir (kept in alcohol only, ZRC), Kranji Reservoir, Sungai Buloh Wetland Reserve, and in Senoko near River Sembawang (natural habitat destroyed).

Etymology. — Named for Paul Moritz (Vienna, Austria). The epithet is a proper name in apposition.

***Hydraena (Hydraenopsis) singaporenensis*, new species**
(Figs. 3, 5, 13, 15, 17)

Type locality. — Stream in Upper Peirce Forest, Singapore.

Type material. — **Holotype** male (ZRC): “SINGAPORE: 424 Y774 Upper Pierce [Peirce] Forest, ‘J’ stream 31.10.1991 leg. DH Murphy et al”. **Paratypes**: 2 females (NMW, ZRC), same locality data as holotype; 1 female (ZRC): “Singapore Nee Soon Swamp Forest, 30. Apr. 1992 Coll. KL Yeo, Bengkeng”; 10 exs. (NMW, ZRC): “SINGAPORE, Nee Soon Swamp-forest 21 Apr 1997 \ Balke & Hendrich”; 5 exs. (ZRC): “Singapore: Nee Soon Swamp-forest. 21 Apr 1997. M Balke & L Hendrich”; 2 males, 1 female (ZSM): “SINGAPORE: 21.-28.4.1997 Nee Soon Swamp Forest flight intercept trap leg. Balke & Hendrich”; 1 female (ZSM): “SINGAPORE/Nee Soon Swamp Forest, small path n[ear]. pipeline, 21.-28.4. 1997 Flight Intercept Trap Balke & Hendrich leg.”; 1 male, 1 female (NMW): “SINGAPORE McRitchie Reservoir preserve area, 19.1.2002, leg. Zettel (SG4)”.

Description. — Habitus as in Fig. 3. 1.05–1.25 mm long. Dorsum unicoloured reddish brown to dark brown, or head

and/or pronotum paler yellowish brown; maxillary palpi always unicoloured yellowish.

Labrum excised anteriorly, very sparsely punctate. Clypeus sparsely punctate and smooth medially. Fronto-clypeal suture slightly arcuate, slightly impressed. Frons sparsely (middle) to moderately densely (laterally) punctate, interstices shining; interocular grooves more or less obsolete. Eyes large, protruding, more than 30 facets visible in dorsal view.

Pronotum weakly cordiform, wider than long; anterior margin concave; anterior angles rounded; lateral rim slightly denticulate and very slightly produced at middle; disc rather flat, sparsely punctate, glabrous, disc with a pair of shallow basal impressions, which are sometimes connected by shallow transverse groove; anterior, posterior and lateral portions of pronotum more densely punctate.

Elytra suboval, with about nine rows of punctures between suture and shoulder; punctures small, not deeply impressed, arranged in more or less regular, not impressed lines; intervals and interstices flat and glabrous; explanate margin of elytra narrow, hardly noticeably denticulate apically.

Mesoventral process (Fig. 13) about as wide as mesotibia. Metaventrite (Fig. 13) moderately deeply impressed, metaventral plaques absent.

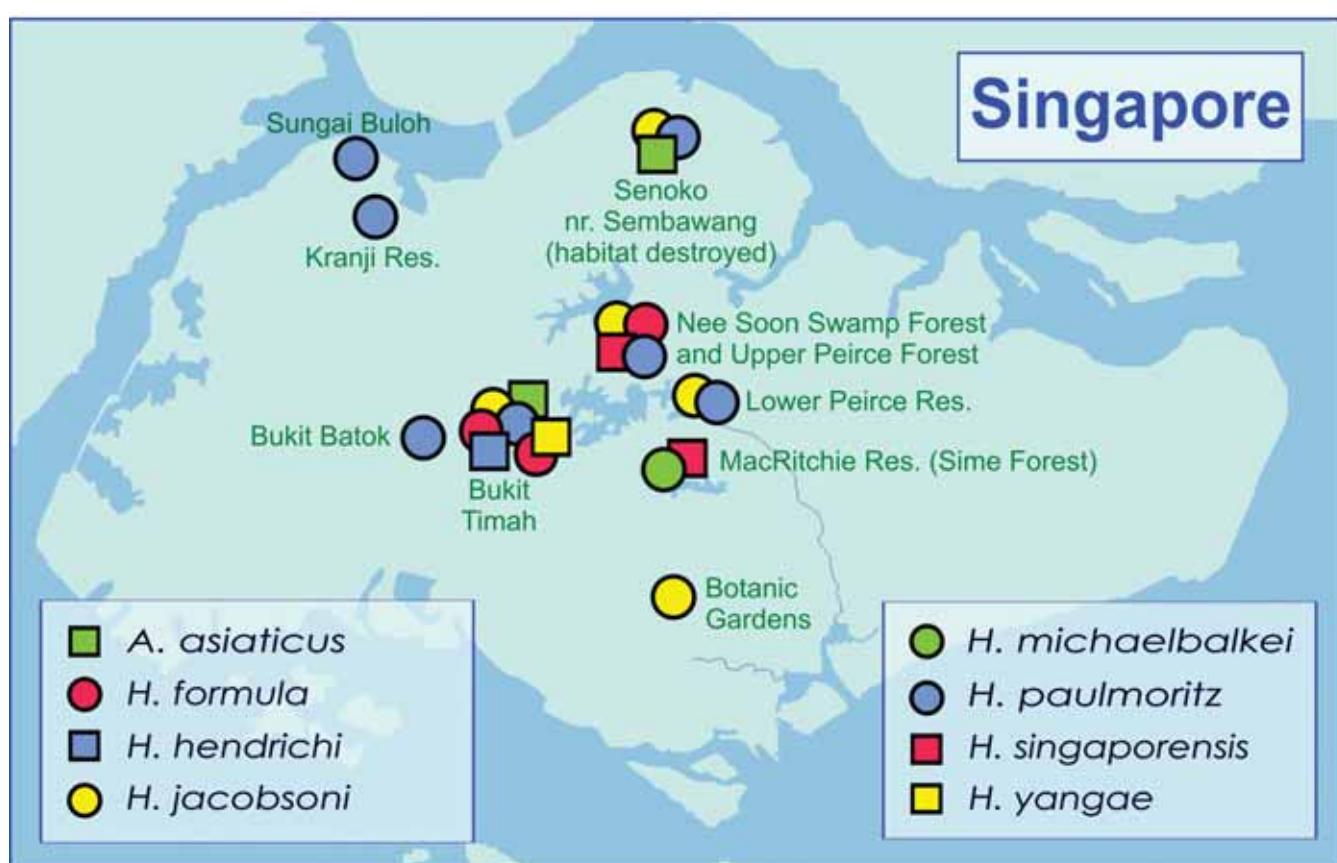


Fig. 15. Geographical map of Singapore, showing distribution of Hydraenidae.

Male terminal sternite and spiculum (Fig. 5d): Sternite subrectangular, longer than wide, apical half asymmetrical, firmly connected with spiculum.

Aedeagus (Fig. 5a–c): Main piece strongly angulate in lateral view (basal and apical part forming a right angle), apical part long and slender, almost straight, without setae, ventral margin of basal part with conspicuous spine; phallobase subsymmetrical. Distal lobe moderately large, inserted near angle between basal and apical part of main piece, not reaching apex of main piece, with an extraordinary long, thin, coiled flagellum. Parameres articulately connected with main piece, inserted near phallobase. Left paramere very short, suboval, with about five apical setae. Right paramere elongate and slender, club-shaped, reaching middle of main piece; apex with about four moderately long setae, lateral face with short spines.

Gonocoxite (Fig. 5e): Subtriangular, approximately as wide as long; lateral margins curved; inner plate hardly noticeably projecting sublaterally.

Female tergite X (Fig. 5f): Subsemicircular, disc moderately densely covered with trichoid setae; subapical setae also trichoid, vermiciform setae absent; posterior margin excised.

Spermatheca (Fig. 5g–h): Proximal portion crescentic, with sickle-shaped transverse crest in the middle; distal portion discoidal; spermathecal duct very long and conspicuously coiled.

Secondary sexual characters: Male foretibia very slightly curved. Male mesoventrite more deeply impressed between mesoventral disc and mesoventral process. Male tergite X excised apically, asymmetrical (left lobe wider and longer).

Variability: The variability in the colouration of the dorsum is quite remarkable. The three specimens from Peirce Forest are unicoloured, whereas all other specimens are more or less distinctly bicoloured. This may, however, be attributed to tenerality rather than to genetic differences. The three specimens from Peirce Forest were collected in October, while the remaining specimens were collected from January to April, some of these being distinctly teneral.

Differential diagnosis. — Externally, *Hydraena singaporenensis* can be recognised by the combination of the following characters: small body size, mesoventral process not wider than mesotibia, metaventral plaques lacking.

Distribution. — So far known only from Singapore (Upper Peirce Forest, Nee Soon Swamp Forest, MacRitchie Reservoir), see Fig. 15.

Etymology. — This species named in reference to the type locality.

Hydraena (Hydraenopsis) yangae, new species
(Figs. 4, 7, 15)

Type locality. — Sandy margin of a very shallow and slow flowing, shaded stream, 1°21'18"N 103°47'51"E, near Rifle Range Road, east of Bukit Timah, Singapore.

Type material. — Holotype male (ZRC): “SINGAPORE: (NS102) 417 ZRC.6.18870 Rifle Range Rd, 27.05.1993 leg. CM Yang et al.” The holotype is teneral; right foreleg detached and glued separately; apical tarsal segments of both forelegs lacking; right elytron not firmly attached to body.

Additional material examined. — MALAYSIA: 1 female (NMW): Small tributary of Gombak River, above Jungle Lodge, N Kuala Lumpur, Selangor, 16 Feb. 1993; 1 female (ZSM): Path to waterfall, 50–150 m, Bekok, Johor, coll. M. Balke & L. Hendrich, 10 Apr. 1997.

Diagnosis. — Habitus as in Fig. 4 (holotype). Body length: holotype 1.05 mm, females from Malaysia 1.20 mm. This species is very closely related with *H. okinawensis* Jäch & Díaz and its allies (*H. satoi* Jäch & Díaz, *H. iheya* Jäch & Díaz, *H. victoriae* Jäch & Díaz) from the Ryukyu Archipelago (see Jäch & Díaz, 1999). Colouration yellowish to reddish brown, labrum, clypeus and pronotum paler than frons and elytra. The holotype of the new species can be distinguished from the Ryukyu species mainly by the



Fig. 16. Taban Valley, Bukit Timah Nature Reserve, Singapore. Three species, *H. hendrichi*, *H. jacobsoni*, and *H. paulmoritz* were collected from this site. (Photograph by: L. Hendrich).

lacking metaventral plaques, by the pro- and metatibiae and by the aedeagus.

Ventral face of protibia of holotype (see Fig. 4) widened in apical half, very slightly tapering to apex; metatibia hardly noticeably curved, posterior margin very slightly crested subapically.

Male terminal sternite and spiculum (Fig. 7d): Quite similar to those of *H. hendrichi*; sternite more regularly pentagonal than in the latter, more or less symmetrical, apex straight, base V-shaped, not firmly connected with spiculum, which is thinner and longer than in *H. hendrichi*.

Aedeagus (Fig. 7a–c): Remarkably similar to *H. okinawensis* and its allies from the Ryukyu Archipelago (see Jäch & Díaz, 1999). Main piece conspicuously hooked apically (ventral/dorsal view), with one long dorsal seta; phallobase almost symmetrical, forming a closed ring. Distal lobe elongate, large, not clearly delimited from main piece, with numerous conspicuous spinules. Parameres articulately connected with main piece, inserted in basal half of aedeagus. Left paramere elongate, slender, with two groups of setae on apex and ventral margin in apical third, some of these being furcate; right paramere oval in dorsal view, rather narrow and acute in lateral view, with two groups of setae, one on apex and one along ventral margin in basal two thirds.

The aedeagus of *H. yangae* can primarily be distinguished from the aedeagi of its relatives from Ryukyu by the main piece, which is wider in apical 0.3. Furthermore, it lacks a flagellum. However, the aedeagus of the holotype of *H. yangae* is quite teneral and it cannot be excluded that the flagellum got lost during preparation.

Gonocoxite (Fig. 7e): Closely resembling that of the *H. okinawensis* and its allies from the Ryukyu Archipelago, especially *H. iheyia*. It is, however, more slender than in these species.

Female tergite X (Fig. 7f): Closely resembling *H. okinawensis* and its allies from the Ryukyu Archipelago, especially by the subacuminate apex and the conspicuous subapical sclerotisation. However, the disc lacks squamose setae.

Spermatheca (Fig. 7g–h): More or less as in the Ryukyu species.

Discussion: The females from Malaysia agree very well with the holotype, with which they share the wide mesosternal process and the lack of metaventral plaques. They are, however, more vividly coloured, because they are not teneral. They are very probably conspecific with the holotype, because it is unlikely, that two very closely related species occur in the same area. Bekok lies only 100 km NNW of Singapore.

Differential diagnosis. — Externally, this species closely resembles *Hydraena singaporensis*, especially in body size, body shape, colouration and lack of metaventral plaques. However, these two species are clearly distinguished by the width of the mesosternal process, by the male protibia, and by the male and female genital characters.

Distribution. — Singapore (Rifle Range Road, east of Bukit Timah), see Fig. 15, Malaysia (Johor, Selangor).

Etymology. — Named for Chang-Man Yang, former curator of Insecta at the ZRC. She is doing a great job, even after



Fig. 17. Nee Soon Swamp Forest, Singapore; C.M. Yang on right. Four species, *H. formula*, *H. jacobsoni*, *H. paulmoritz*, and *H. singaporensis* were collected from this site. (Photograph by: L. Hendrich).

retirement. The holotype of this obviously rare species was collected by her.

DISCUSSION

Hydraena yangae is a member of the *H. porcula* group (see Jäch & Díaz, 1998, 1999; Freitag & Jäch, 2007). It is remarkably similar to several species from the Ryukyu Archipelago (*H. okinawensis*, *H. satoi*, *H. iheya*, and *H. victoriae*).

Hydraena hendrichi obviously also belongs to the *H. porcula* group because of several morphological characteristics (e.g., mesoventral process wide; overall morphology of aedeagus; shape of male terminal sternite and spiculum, gonocoxite and spermatheca). However, *H. hendrichi* and *H. yangae* seem to belong to different subgroups within the *H. porcula* group (phallobase proximally open in *H. hendrichi*).

Hydraena michaelbalkei belongs to the *H. miyatakei* lineage (see Jäch & Díaz, 1998, 1999; Freitag & Jäch, 2007) due to the Y-shaped aedeagus and the strongly produced sternite VIII. *Hydraena mangauo*, *H. sautakei*, *H. sauteri* Orchymont, and maybe *H. tenuis* Janssens also belong to this lineage.

Three Singaporean species, *H. formula*, *H. jacobsoni*, and *H. paulmoritz*, are widely distributed. They belong to a group of species, which is usually found in open water bodies, such as buffalo wallows, rice fields, fish ponds, road side ditches, and other isolated, shallow, grassy and muddy pools. These species share general habitus, colouration (head black head, pronotum and elytra amber, pronotal disc usually darker brown), rather deeply impressed punctuation on pronotum and elytra, and quite regular elytral striae.

Hydraena formula is very closely related with *H. undulata* from Taiwan. They share several synapomorphies, such as the carinate male metaventral plaques, the overall aedeagal morphology, including the undulate furcate setae of the left paramere, morphology of gonocoxite and female tergite X, as well as the wrinkled distal portion of the spermatheca.

Hydraena jacobsoni and *H. paulmoritz* might be rather closely related due to the highly apomorphic brush-like dorsal aedeagal appendage and due to the remarkably similar gonocoxites and spermathecae. Based on the aedeagal morphology, *H. knischi* Orchymont, 1928 (described from Vietnam) is closely related with these two species, especially with *H. paulmoritz*. *Hydraena scabra* (from the Philippines) and probably *H. fontana* Orchymont, 1932 (from India) also belong to this group.

Hydraena formula and *H. jacobsoni* are not unsimilar to each other in respect to the general aedeagal morphology (e.g., shape and position of parameres, spiny apex of distal lobe), the very similar male terminal sternite and spiculum, as well as similarities in the female tergite X and the

spermatheca. Therefore, it can be assumed that *H. fontana*, *H. formula*, *H. jacobsoni*, *H. knischi*, *H. paulmoritz*, and *H. scabra* belong to the same group of species.

Phylogenetically, *Hydraena singaporesis* seems to be quite isolated. It is characterised by several conspicuous apomorphies: metaventral plaques absent (shared by *H. yangae*); aedeagal main piece strongly angulate in lateral view, ventral margin of basal part with conspicuous spine; distal lobe with extraordinary long, thin, coiled flagellum; proximal portion of spermatheca with sickle-shaped transverse crest, spermathecal duct very long and conspicuously coiled. Furthermore, it has no veriform setae on female tergite X (shared by *H. yangae*). Despite the fact that *H. singaporesis* and *H. yangae* share the same size, body form and colouration, and some other interesting characters, including lack of metaventral plaques, they are probably not closely related.

Five of the eight Singaporean hydraenid species are more or less wide-spread in Southeast Asia, occurring in at least three countries. The remaining three species (*Hydraena michaelbalkei*, *H. singaporesis*, *H. yangae*) are so far confirmed with certainty only for Singapore, although the two females collected in Malaysia (Johor, Selangor), see above, very probably belong to *H. yangae*.

The most common hydraenid species in Singapore is *Hydraena paulmoritz*. It was collected from a total of seven Singaporean locations.

The most diverse area in Singapore is the Bukit Timah Nature Reserve. A total of six species was collected in or around Bukit Timah Nature Reserve. Only two species, *Hydraena michaelbalkei* and *H. singaporesis* have not been collected there so far.

Hydraena jacobsoni, recorded here from Borneo, is the first hydraenid ever recorded from that island.

KEY TO THE SPECIES OF HYDRAENA FROM SINGAPORE

1. Punctures of dorsal surface, especially pronotum and elytra small and shallow, elytral interstices not convex (Figs. 1, 3, 4). Body length: 1.05–1.50 mm 2
- Punctures of dorsal surface, especially pronotum and elytra, moderately large, dense and well impressed, elytral interstices convex (Fig. 2). Body length: 1.25–1.50 mm 4
2. Mesoventral process (Fig. 12) wider than mesotibia. Metaventral plaques present or absent. Body length: 1.05–1.50 mm 3
- Mesoventral process (Fig. 13) not wider than mesotibia. Metaventral plaques absent. Body length: 1.05–1.25 mm *H. singaporesis*
3. Middle of pronotum darkened (except for teneral specimens). Metaventral plaques present, distinctly convergent anteriorly (Fig. 12). Male: foretibia slightly curved, not dilated, with subapical denticle on mesal face. Female tergite X and gonocoxite (Fig. 6e, f) more transverse, laterally more rounded. Body length: 1.25–1.50 mm *H. hendrichi*

- Middle of pronotum not darkened. Metaventral plaques absent. Male: foretibia not curved, dilated (lateral view), without denticle. Female tergite X and gonocoxite (Fig. 7e, f) less transverse, laterally less rounded, apically subacuminate. Body length: 1.05–1.20 mm. *H. yangae*
- 4. Male: Metaventral plaques thin, carinate (Fig. 14). Aedeagi as in Figs. 8a–c or 9a–c. Female: Abdominal sternite VIII produced apically (see Jäch & Díaz, 1999: Fig. 7d) or gonocoxite small, subquadrate (Fig. 9f). 5
- Male: Metaventral plaques unmodified. Aedeagi as in Figs. 10a–c or 11a–c. Female: Abdominal sternite VIII apically never produced; gonocoxite transverse, lateral margin distinctly convex subbasally (Figs. 10e, 11e). 6
- 5. Maxillary palpi never darkened subapically. Aedeagus Y-shaped (Fig. 8a–c). Female: Abdominal sternite VIII produced apically (see Jäch & Díaz, 1999: Fig. 7d) .. *H. michaelbalkei*
- Maxillary palpi usually slightly darkened subapically. Aedeagus not Y-shaped (see Fig. 9a–c). Female: Abdominal sternite VIII not produced apically. *H. formula*
- 6. Male foretibia slightly curved, without denticle. Aedeagus as in Fig. 10a–c, ventral margin of main piece with conspicuous denticle near insertion of left paramere; apex of main piece not wide in ventral view. Female tergite X (Fig. 10f) less transverse. Gonocoxite (Fig. 10e) more transverse. *H. jacobsoni*
- Male foretibia not curved, provided with very small denticle on mesal face near apical 0.3. Aedeagus as in Fig. 11a–c, ventral margin of main piece without conspicuous denticle; apex of main piece very wide in ventral view. Female tergite X (Fig. 11f) more transverse. Gonocoxite (Fig. 11e) less transverse. *H. paulmoritz*

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