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Taxonomic Study on the Genus *Hydrocyphon* (Coleoptera, Scirtidae) of Japan and her Adjacent Regions

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Abstract Five new species of the genus *Hydrocyphon*, namely *H. satoi* sp. nov., *H. iriomotensis* sp. nov., *H. taiwanus* sp. nov., *H. nakanei* sp. nov. and *H. aritai* sp. nov., are described and illustrated from Japan and her adjacent regions with a key to the species. The larva of *H. satoi* is also described. *Hydrocyphon satoi*, *H. iriomotensis* and *H. taiwanus* belong to the *renati* species-group which has been known from Oriental Asia, while *H. nakanei* and *H. aritai* belong to the *nakanei* species-group proposed in this paper. This is the first proper record of the genus from Japan, Taiwan and Korea.

Introduction

The genus *Hydrocyphon* REDTENBACHER, 1858 comprises very small-sized scirtid beetles, and is represented by thirty-four species distributed over the Palearctic and Oriental Regions, though mostly from Europe and Oriental Asia (Vietnam, Myanmar, Bhutan and Nepal) (PIC, 1914; KLAUSNITZER, 1976, 1980 a, b; NYHOLM, 1967, 1972 a, 1981).

This genus has not been properly recorded from Japan, except NAKANE (1958) who reported a *Hydrocyphon* collected at Tanebe in the Shimokita Peninsula. It has not been recorded from neighboring countries of Japan, either, with the exception of DUDGEON (1995) who reported the biology of an unidentified *Hydrocyphon* from Hong Kong.

In the present paper, I am going to describe five new species of the genus from Japan, Taiwan and Korea on the basis of more than two hundred adult specimens. This is the first proper record of the genus from Japan, Taiwan and Korea. In addition, immature stages of *H. satoi* sp. nov. are also described in this paper.

The abbreviations used in the present paper are as follows: PL – length of pronotum; PW – width of pronotum; EL – length of elytra; EW – width of elytra; TL – total length (PL plus EL). Average value is given in parenthesis after the range.

The terminology generally refers to NYHOLM (1967) for the genital organs, and to HANNAPPEL and PAULUS (1991) and YOSHITOMI (1997) for the larval mouth parts.

The holotypes and some paratypes will be deposited in the collection of the National Science Museum, Tokyo (NSMT), and other paratypes are in the Biological Laboratory, Nagoya Women's University (NWU), Naturhistorisches Museum Wien

(NMW), Toyohashi Museum of Natural History (TMNH), Entomological Laboratory, Ehime University, Matsuyama (EUM), and in my private collection.

Genus *Hydrocyphon* REDTENBACHER

[Japanese name: Keshi-maruhananomi Zoku]

Hydrocyphon REDTENBACHER, 1858, Fauna Austr., ed. 2, 519. —— PIC, 1914, Coleopt. Cat., (58): 38. —— NYHOLM, 1967, Opusc. ent., **32**: 9; 1972 b, Ent. scand., **3**: 97. —— KLAUSNITZER, 1975, Dtsch. ent. Z., **22**: 61 [key]. —— HANNAPPEL & PAULUS, 1994, Käfer Mitteleuropas, **2**: 77. Type species: *Cyphon deflexicollis* MÜLLER, 1821 (by original designation).

Description. Adult. Body very small, about 2.0–3.0 mm, covered closely with hairy setae. Head moderate in size, strongly deflexed, covered by pronotum in proximal part. Antennae filiform, moderate in length; scape ovate; pedicel ovate, somewhat smaller than scape; 3rd the smallest, about a half of pedicel in size, with distal margin diagonal. Pronotum transverse, nearly trapezoidal, lightly convex dorsally in the middle area, rounded in each corner; posterior margin longer than anterior margin, gently curved posteriad. Scutellum triangular, visible from above. Mesosternum deeply notched in anterior margin; prosternal process rather short, with rounded apex. Elytra oval or oblong, strongly convex on dorsum. Legs moderate in length; hind femora normal.

Male genitalia. Eighth tergite well sclerotized, trapezoidal, with a pair of short apodemes; 8th sternite lightly sclerotized, nearly triangular; 9th tergite lightly sclerotized, trapezoidal, with a pair of rather long apodemes; 9th sternite lightly sclerotized, trapezoidal, with a pair of long apodemes. Tegmen moderately or lightly sclerotized, with a pair of distinct parameres; anterior part projecting anteriorly ("Kapulus"

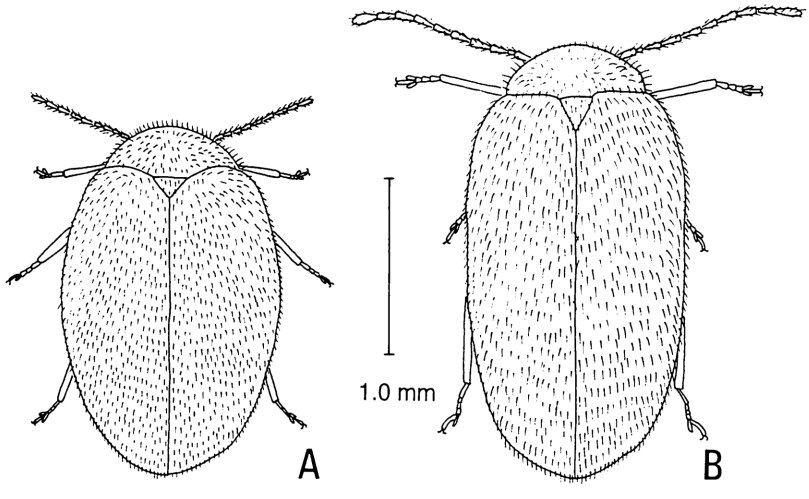


Fig. 1. Habitus of *Hydrocyphon* spp. —— A, *H. satoi* sp. nov.; B, *H. nakanei* sp. nov.

in NYHOLM, 1972 a). Penis well sclerotized, symmetrical or asymmetrical; parameroids well developed; trigonium provided with one or two projections protruding posteriorly; basal part ("para" in NYHOLM, 1972 a) elongated circular.

Female genitalia. Eighth tergite lightly sclerotized, with a pair of very long apodemes; 8th sternite lightly sclerotized, oblong. Ovipositor with very long baculus; prehensor well developed or indistinct, covered with spines on caudal part.

Larva. Body well sclerotized, elongated campodeiform, subparallel-sided in thorax and abdomen, having short or long setae on lateral margins. Head visible in dorsal aspect. Antennae long, filiform, attaining to abdominal segment. Labrum with a pair of stout and extra setae on anterior margins of ventral lobes. Epipharynx provided with a pair of ventral setae whose sockets have simple surrounding parts. Mandibles lacking terminal tooth, with feathered bristles on inner areas arising from ventral surface. Maxillary palpi three-segmented, with many sensory organs in apical area of 3rd segment. Hypopharynx strongly transverse, with separated keel-sclerite and sockets of tooth-bristles; apical margins of tooth-bristles multicornute; claw apparatus wide. Thorax a little broader than abdomen. First to 7th abdominal segments with short setae on each posterior margin.

Biological notes. The larvae of previously known species live in running waters (HANNAPPEL & PAULUS, 1994; DUDGEON, 1995). In Hong Kong, *Hydrocyphon* sp. produces four generations a year (DUDGEON, 1995).

Remarks. In the adult, this genus is similar to the genus *Cyphon* PAYKULL, but has small 3rd antennal segment, the anterior margin of mesosternum deeply notched, and different characteristics of male genitalia. In the larva, the genus is quite different from the other genera in the three-segmented maxillary palpi, absence of terminal tooth, strongly transverse hypopharynx and its habitat (living in running waters).

The genus has been divided into five species-groups, *viz*., *kambaiticus*, *renati*, *australis*, *deflexicollis* and *pallidicollis* species-groups (NYHOLM, 1967, 1972 a, 1981), four of which have been known from Oriental Asia. The species dealt with in this paper are divided into two species-groups as shown below.

Key to the Species of *Hydrocyphon* from Japan and her Adjacent Regions

(Male)

1. Body oval, shining; 7th abdominal sternite shallowly concave; [*renati* species-group] ..... 2.
— Body oblong, strongly shining; 7th abdominal sternite deeply concave; [*nakanei* species-group] ..... 4.
2. Penis shortened in parameroids ..... *H. satoi* sp. nov.
— Penis elongated in parameroids ..... 3.
3. Pronotum paler in coloration than elytra; parameroids rounded at apices ..... *H. iriomotensis* sp. nov.
— Pronotum same in coloration as elytra; parameroids slender in apices .....

Table 1. Measurements of *Hydrocyphon* spp. (for abbreviation, see Introduction).

Species name	*renati* species-group			
	H. satoi sp. nov.		*H. iriomotensis* sp. nov.	*H. taiwanus* sp. nov.
Sex	male	female	male	male
No.	4	5	1	3
TL (mm)	1.80–1.97 (1.90)	1.70–1.86 (1.78)	1.87	2.15–2.33 (2.24)
PL (mm)	0.30–0.35 (0.32)	0.26–0.32 (0.30)	0.32	0.40–0.43 (0.41)
PW (mm)	0.70–0.78 (0.74)	0.66–0.75 (0.73)	0.9	0.88–0.93 (0.91)
EL (mm)	1.50–1.64 (1.58)	1.44–1.55 (1.48)	1.55	1.75–1.93 (1.83)
EW (mm)	1.10–1.36 (1.21)	1.00–1.86 (1.78)	1.04	1.15–1.30 (1.24)

Table 2. Measurements of *Hydrocyphon* spp. (for abbreviation, see Introduction).

Species name	*nakanei* species-group		
	H. nakanei sp. nov.		*H. aritai* sp. nov.
Sex	male	female	male
No.	3	5	1
TL (mm)	1.90–2.01 (1.95)	2.01–2.30 (2.15)	2.47
PL (mm)	0.29–0.31 (0.30)	0.32–0.37 (0.34)	0.45
PW (mm)	0.70–0.81 (0.75)	0.76–0.86 (0.80)	0.95
EL (mm)	1.60–1.70 (1.65)	1.68–1.95 (1.81)	2.02
EW (mm)	1.04–1.16 (1.11)	1.16–1.30 (1.23)	0.68

..... *H. taiwanus* sp. nov.

4. Penis short; tegmen with rounded apices ..... *H. nakanei* sp. nov.

— Penis long; tegmen with pointed apices ..... *H. aritai* sp. nov.

It is impossible at present to prepare a key to females.

Group of *Hydrocyphon renati*

This species-group is well characterized chiefly by the structure of the aedeagus. It consists of two previously known species from Myanmar (NYHOLM, 1981).

Hydrocyphon satoi sp. nov.

[Japanese name: Keshi-maruhananomi]
(Figs. 1 A, 2–7)

Cyphon sp.: HAYASHI, 1991, 368 (larva).

Description. Male. Body oval, covered closely with yellowish white pubes-

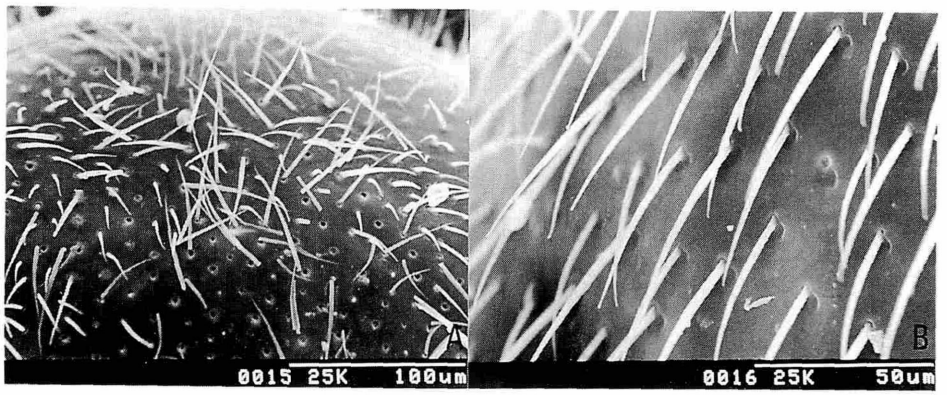


Fig. 2. Scanning electron micrographs of *Hydrocyphon satoi* sp. nov., female, collected from Amami-Ôshima; A, pronotum; B, caudal part of elytron.

cence. Coloration almost brown, but the mouth parts, 1st to 3rd antennal segments, lateral parts of pronotum, pronotal epipleura and legs are paler.

Head lightly convex, with rather long clypeus. Eyes moderate in size, prominent, the distance between eyes about 2.3 times the diameter of an eye. Labrum strongly transverse, with straight front margin. Antennae moderate in length, reaching about proximal 1/5 of elytra; approximate ratio of each segment as 3.0 : 2.5 : 1.0 : 2.7 : 2.2 : 2.3 : 2.5 : 2.7 : 2.5 : 2.5 : 3.7 (n=1, paratype). Pronotum short and rather small; PW/PL 2.23–2.39 (2.32). Elytra oval, widest at the middle, lightly convex dorsad; EL/EW 1.19–1.42 (1.31); EL/PL 4.63–5.29 (4.99); EW/PW 1.47–1.74 (1.65); TL/EW 1.45–1.70 (1.57).

Apical margin of 7th abdominal sternite gently arcuate. Eighth tergite semicircular, covered with minute spines on posterior part; 8th sternite more heavily sclerotized in lateral parts; 9th tergite with minute spines on posterior margin; 9th sternite with irregular setae on posterior margin. Tegmen wide, not protruding posteriorly in parameres, covered sparsely with punctures on lateral parts, with a pair of long plates situated on antero-lateral parts; lateral parts projecting antero-laterally, concave at apices. Penis long, about four times as long as wide, about twice as long as tegmen; basal part trapezoidal, widest at anterior end; trigonium large, expanding posteriorly, bifurcate in median part, covered closely with minute serrae in apices of lateral parts, with rather short median plate; parameroids relatively short and broad, touching each inner margin of basal area, sparsely punctate in caudal parts.

Female. Almost the same in external features as male. Antennae somewhat shorter than in male; 3rd segment a little larger than that of male; approximate ratio of each segment as 2.4 : 2.0 : 1.0 : 1.4 : 1.4 : 1.6 : 1.7 : 1.7 : 1.7 : 1.7 : 2.7 (n=1, paratype). PW/PL 2.20–2.88 (2.44); EL/EW 1.20–1.50 (1.33); EL/PL 4.68–5.53 (4.94); EW/PW 1.35–1.82 (1.54); TL/EW 1.42–1.82 (1.60).

Apical margin of 7th abdominal sternite arcuate. Eighth tergite covered sparsely

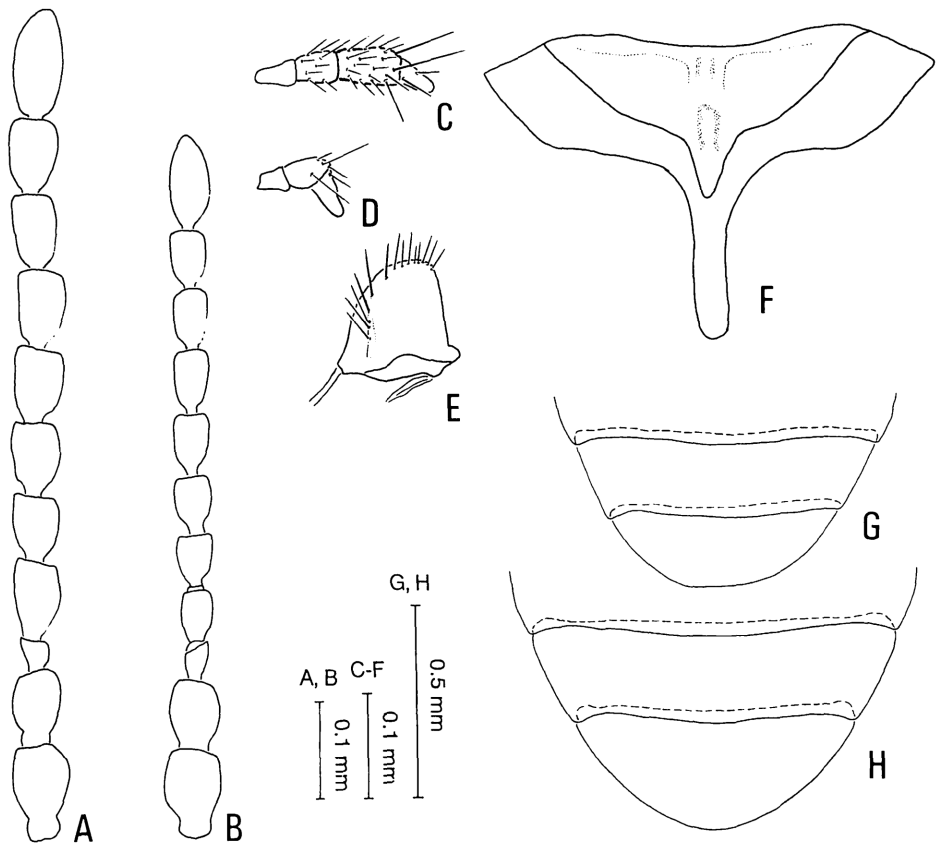
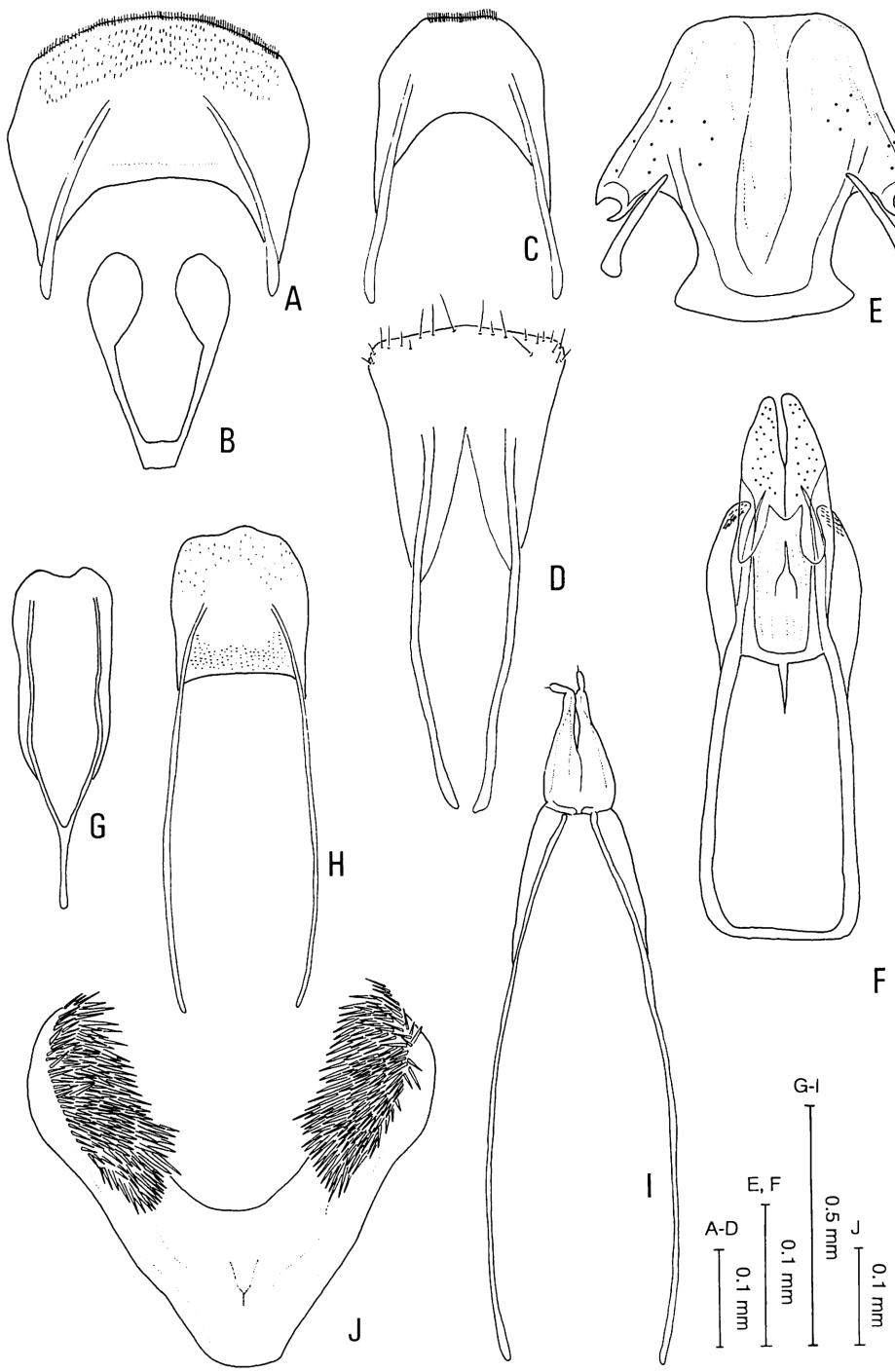


Fig. 3. *Hydrocyphon satoi* sp. nov. —— A–B, Antennae of male (A) and female (B); C, left maxillary palpus; D, left labial palpus; E, mandible in dorsal aspect; F, mesosternum; G–H, 5th to 7th abdominal sternites of male (G) and female (H).

with short spines in apical area, and closely with minute spines in posterior part, with long and slim apodemes; 8th sternite with Y-shaped, more heavily sclerotized portion. Ovipositor simple; approximate ratio of the lengths of stylus, coxite and baculus as 1 : 5 : 24; prehensor distinct and strongly sclerotized, relatively short, covered closely with short spines in the internal areas of caudal halves.

Larva (based on the fully expanded specimens collected from Okinawa-hontô). Body long, subparallel-sided in thorax and abdomen, with short and long setae on lateral margins. Coloration almost light brown, but the ventral surface of the body is paler.

Fig. 4. *Hydrocyphon satoi* sp. nov. —— A–F: Male genitalia (paratype); A, 8th tergite; B, 8th sternite; C, 9th tergite; D, 9th sternite; E, tegmen; F, penis. —— G–J: Female genitalia (paratype); G, 8th sternite; H, 8th tergite; I, ovipositor; J, prehensor.


A
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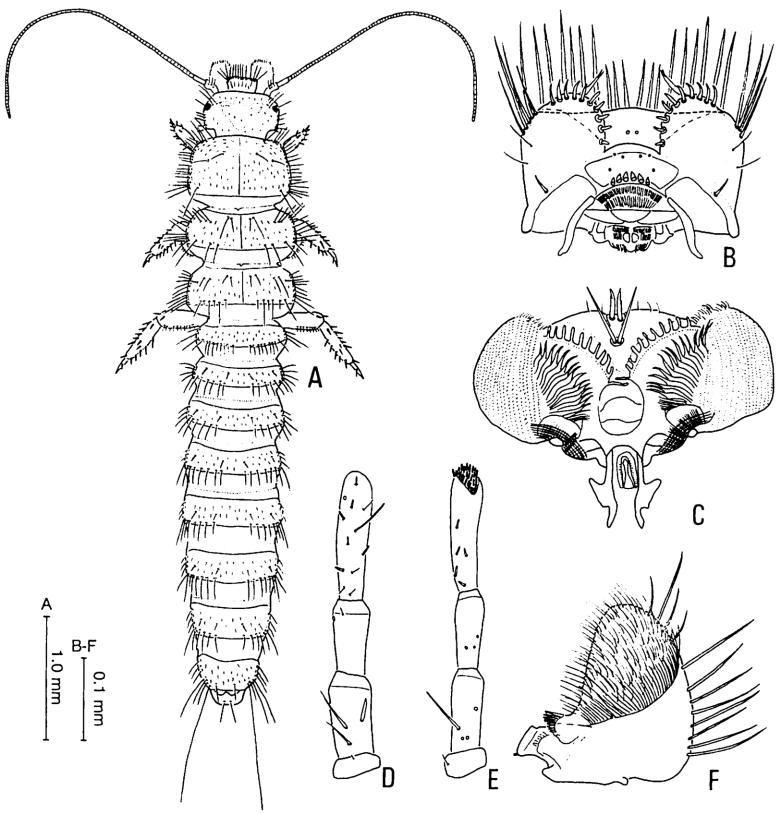

Fig. 5. *Hydrocyphon satoi* sp. nov., mature larva. —— A, Dorsal aspect. —— B–F: Mouth parts; B, labrum in ventral aspect; C, hypopharynx; D–E, left maxillary palpus in dorsal (D) and ventral (E) aspects; F, left mandible in ventral aspect.

Head not protruding laterally, with two pairs of long setae and a pair of melanized part situated near antero-lateral corners. Antennae long, reaching 2nd abdominal segment; scape curved posteriorly, covered with short setae; pedicel shorter than scape; flagellum 62–74 segmented (n=4). Labrum transverse, covered with rather long setae, with straight front margin. Epipharynx with ventral lobes protruding anteriorly, covered with short and stout setae on internal and anterior margins of ventral lobes. Maxillary palpi slender, 1st with some long setae on dorsal surface; 3rd rounded at apex, with minute and sparse setae, covered closely with many sensory organs in apical area; relative length of each segment (1st to 3rd) as 1.1 : 1.0 : 1.6. Mandibles nearly triangular, rounded at apex; hairy setae present from apical half of ventral surface, those in inner proximal area feathered. Hypopharynx typical for the genus; a pair of setae on keel-sclerite long, about twice as long as tooth-bristles.

Thorax almost parallel-sided, widest at posterior margin of mesothorax; prothorax about twice as wide as long, two pairs of short setae at about distal 1/3 of dorsal sur-

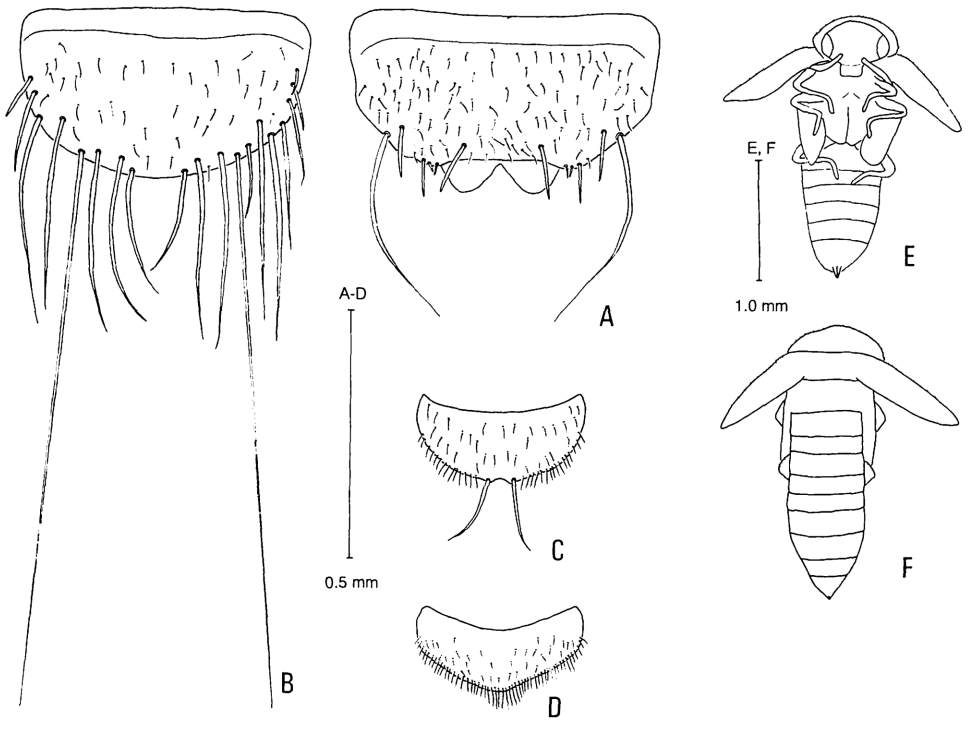

Fig. 6. *Hydrocyphyon satoi* sp. nov. —— A–D: Abdominal segments of larva; A, 8th tergite; B, 8th sternite; C, 9th tergite; D, 9th sternite. —— E–F: Pupa; E, ventral aspect; F, dorsal aspect.

face, with a pair of long setae near postero-lateral corners; mesothorax about three times as wide as long, with five pairs of relatively long setae near anterior margin, two pairs of which are situated near the median line, with some setae near posterior margin; metathorax almost the same in size as mesothorax, with five pairs of short setae near anterior margin, two pairs of which are situated near the median line, with short or long setae near posterior margin.

Abdomen almost parallel-sided, but the 1st segment is somewhat narrow, gently tapering in 7th and 8th segments, with short setae on lateral parts of posterior margin; 8th tergite trapezoidal, shallowly concave in posterior margin, with a pair of long setae on lateral margins, with some short setae near postero-lateral corners; 8th sternite semicircular, closely with long setae on lateral and posterior margins, with a pair of very long setae which are about three times as long as the length of 8th sternite at the middle part of lateral margins; 9th tergite semicircular, concave at apex, with short setae on lateral margins, with a pair of long setae at apex; 9th sternite semicircular, with short setae on posterior margin. Legs relatively long, covered with spinous setae.

Measurements of larva (n=4). HW: 0.6–0.8 mm; PL: 0.4–0.5 mm; PW: 0.7–0.8 mm; TL: 3.3–4.6 mm; TW: 0.8–1.0 mm.

Pupa. Body oblong, very soft, covered with short setae. Coloration almost white. Pronotum lacking extra setae.

Measurements of pupa (n=2). TL: 2.08 & 2.16 mm; TW: 0.93 & 1.04 mm.

Type materials. Holotype: Male, Yona, Okinawa-hontô, Larva coll. from river (running water), 2–IV–1996, H. YOSHITOMI leg. (NSMT). Paratypes: 3♂♂, 8♀♀, same data as the holotype (1♂ preserved on slides nos. HY 355–359; 1♀ preserved on slides nos. HY 360–362, left antenna on slides no. HY 363; NSMT, NWU, NMW); 2♂♂, 3♀♀, same locality, date and collector as for the holotype (adults were collected by beating) (NSMT, NWU, NMW); 2♂♂, same locality, 4–IX–1970, M. CHÛJÔ leg. (EUM); 2♂♂, 1♀, same locality, 25~27–V–1974, M. SATÔ leg. (EUM); 2♂♂, same locality, 1~3–V–1976, H. TAKIZAWA leg.; 5♂♂, same locality, 17–VII–1965, Y. HORI leg. (EUM); 4♂♂, 6♀♀, Yonaha-dake, Okinawa-hontô, Larvae coll. from river (running water), 2–IV–1996, H. YOSHITOMI leg. (NWU, TMNH, EUM); 1♀, same locality, 3–IV–1974, T. KINOSHITA leg.

Additional adult materials (specimens preserved in 70% ethanol are omitted).

[Hokkaido] 1♂, Yukomanbetsu, 2–VII–1958, F. TAKECHI leg.; 16♂♂, 7♀♀, Daisetsu, Yukomanbetsu, 11–VII–1970, Y. NAKANE leg.

[Honshu] 〈Aomori Pref.〉 2♂♂, Jûniko, 12–VII–1968, T. OKADOME leg. 〈Miyagi Pref.〉 3♀♀, Ohtaki-gawa, 5–VI–1978, M. SATÔ leg. 〈Fukushima Pref.〉 1♀, Hatonomiya, 25–V–1986, S. TSUYUKI leg.; 1♂, Gohyakugawa, 19–VII–1992, Y. HIRANO leg. 〈Kanagawa Pref.〉 6♂♂, 7♀♀, Shiroganebashi, Hakone, 3–VIII–1991, Y. HIRANO leg.; 8 exs., Ikuta-ryokuchi, Kawasaki-shi, 16–VI–1988, N. HAYASHI leg. (reared from larvae). 〈Yamanashi Pref.〉 2♀♀, Hogawa, 11–VIII–1982, Y. HIRANO leg. 〈Nagano Pref.〉 1♀, Adera-keikoku, 22~24–VI–1992, M. YAMAMOTO leg.; 1♀, Nebamura, 26–VII–1995, N. TAKAHASHI leg.; 1♀, Shimashima-dani (ca. 1,260 m), 1–VIII–1995, N. TAKAHASHI leg. 〈Aichi Pref.〉 1♂, 1♀, Tokoku, Moriyama, 5–VII–1975, Y. HORI leg. 〈Mie Pref.〉 1♀, Yunoyama, 16–VI–1957, Z. NARUSE leg.; 1♂, Kohchidani, 12–VI–1966, T. OHKAWA leg. 〈Gifu Pref.〉 1 ex., Hikawa, Hida, 21–VII–1967, M. SATÔ leg. 〈Nara Pref.〉 1♀, nr. Ôdaigahara, 24–VIII–1995, N. TAKAHASHI leg.

[Shikoku] 〈Ehime Pref.〉 1♂, Odamiyama, 9~10–VII–1974, Y. NOTSU leg.; 10♂♂, 6♀♀, ditto, 19–VII–1993, N. OHBAYASHI, M. SAKAI, M. KAWANABE & K. OKADA leg. (1♂ genit. s. no. HY 380); 1♂, Komenono, 4–VI–1976, Y. NOTSU leg.; 1♂, 2♀♀, ditto, 11–VI–1993, K. AITA leg. (1♀ genit. s. nos. HY 391, 392); 1♂ , 2♀♀, Omogokei, 25~26–V–1969, M. SAKAI leg. (1♂ genit. s. no. HY 379); 1♂, Shiratsue, 3–V–1968, M. SAKAI leg. 〈Kôchi Pref.〉 1♂, Kuroson, 14–VII–1956, Z. NARUSE leg.

[Kyushu] 〈Saga Pref.〉 1♂, 1♀, Hiratani, 28–IV–1981, S. IMASAKA leg. 〈Nagasaki Pref.〉 1♂, Todoroki Fall, 31–V–1978, S. IMASAKA leg. 〈Ôita Pref.〉 1♀, Kyusuikei, 11–V–1993, S. IMASAKA leg.

[Ryukyu Isls.] 〈Yaku-shima〉 1♂, Kosugi-dani, 24–V–1963, N. OHBAYASHI leg.; 2♀♀, Yodogawa-path, 9–VII–1994, S. TSUYUKI leg. 〈Amami-Ôshima〉 4♂♂, 3♀♀, Yuwan-dake, 19–IV–1971, M. SAKAI leg.; 1♂, 1♀ & 15 exs., ditto, 5–XI–1984, M. TOMOKUNI leg.; 28♂♂, 13♀♀, Hatsuno, 2~13–IV–1963, N. OHBAYASHI & Y. ARITA

leg.; 4♀♀, ditto, 12–IV–1971, M. SAKAI leg.; 2♀♀, ditto, 14～15–VI–1962, M. SATÔ leg.; 1♂, 1♀, Daikuma, 10–IV–1971, M. SAKAI leg.; 3♀♀, Suko, 16–IV–1971, M. SAKAI leg.; 1♀, Nishinakama, 22–V–1973, H. MAKIHARA leg.; 1♀, Kinsakubaru, 3–X–1988, M. TOMOKUNI leg.; 1♀, Shinmura, 12–VI–1962, M. SATÔ leg.; 1♂, 1♀, Uken-son, 16–VI–1980, S. IMASAKA leg.; 1♀, Santarô-tôge, 26–IV–1995, N. TAKAHASHI leg. ⟨Tokuno-shima⟩ 5♂♂, 4♀♀, Mikyô, 10～11–IV–1968, IOKI leg. ⟨Ishigaki-jima⟩ 1♂, Banna, 26–II–1993, Y. HIRANO leg.; 1♂, Omoto, 17–IV–1969, M. CHÛJÔ leg.; 1♂, ditto, 1–VI–1974, M. SATÔ leg.; 1♂, 1♀, ditto, 22–III–1996, H. YOSHITOMI leg. (genit. s. nos. HY 367–368); 1♀, Arakawa, 17–VII–1996, M. I. JENG leg.; 1♀, Yoshihara, 14–VI–1983, S. IMASAKA leg.; 4♀♀, Takeda-rindô, 14～15–IV–1996, N. TAKAHASHI leg. ⟨Iriomote-jima⟩ 1♂, Yutsun-gawa, 18–IV–1996, N. TAKAHASHI leg.; 1♂, 1♀, Gunkan-iwa – Kampira, 17–IV–1996, N. TAKAHASHI leg.

[Taiwan] ⟨Taipei Hsien⟩ 1♂, Wulai, 21–IV–1972, M. SAKAI leg. ⟨Nantou Hsien⟩ 1♂, Wushe, 24–V–1972, M. SAKAI leg.; 3♂♂, Wuling, 3–VII–1989, M. SAKAI leg. (genit. s. nos. HY 372–374, 395); 1♂, Nanshanchi, 3–VIII–1968, Y. HORI leg.

[Korea] 1♂, Mt. Sudosan / 700 m, Kyongsangpuk-do, 9～12–VII–1971, K. YAMAGISHI leg.

Larval and pupal materials. [Honshu] 9 larvae & 4 pupae, Ikuta-ryokuchi, Kawasaki-shi, 16–VI–1988, N. HAYASHI leg. [Okinawa-hontô] 4 mature larvae, 5 larval skins & 3 pupae, Yona, 2–IV–1996, H. YOSHITOMI leg. (1 larval skin on slide No. HY 390); 4 mature larvae, 3 larval skins & 1 pupa, Yonaha-dake, 2–IV–1996, H. YOSHITOMI leg. [Ishigaki-jima] 8 mature larvae & 1 pupa, Omoto, 22–III–1996, H. YOSHITOMI leg.

Distribution. Japan (Hokkaido, Honshu, Shikoku, Kyushu, Yaku-shima, Amami-Ôshima, Tokuno-shima, Okinawa-hontô, Ishigaki-jima, Iriomote-jima), Taiwan, Korea.

Biological notes. Larval habitats are clear streams (Fig. 7). Larvae are collected by net from under stones or sand in running waters. Larvae feed on fallen leaves under rearing condition, but in general, they may feed on detritus judging from the structure of mouth parts and their microhabitats. Pupation takes place under fallen leaves or on the surface of water, and pupal periods are two or three days under rearing condition. In the field, pupation seems to take place on the under surfaces of stones in the water (HAYASHI, 1991). Adults are obtained by sweeping and beating near streams. Judging from the collecting data of the adults in the Ryukyu Islands, some generations may be brought forth within a year. In Honshu, however, only one generation may be passed in a year.

Remarks. This species is very similar to *H. renati* NYHOLM known from Myanmar in the character of male genitalia, but is distinguished from it by the penis with short parameroids and tegmen relatively elongated laterad.

Etymology. The specific epithet is given after Dr. Masataka SATÔ of Nagoya Women's University, in expressing my sincere gratitude for his continuous guidance.

Fig. 7. Larval habitat of *Hydrocyphon satoi* sp. nov. Yona, Kunigami-son, Okinawa-hontô, 2–IV–1996, photo by H. YOSHITOMI.

Hydrocyphon iriomotensis sp. nov.

[Japanese name: Iriomote-keshi-maruhananomi]
(Fig. 8)

Description. Male. Very similar to *H. satoi* in general characters, but the coloration of the pronotum is somewhat paler. Approximate ratio of each segment of antenna in the paratype (probably mal-formation of 11th segment) as 3.4 : 2.4 : 1.0 : 3.6 : 2.8 : 2.8 : 2.8 : 2.8 : 3.0 : 3.0 : 6.6. PW/PL 2.81; EL/EW 1.49; EL/PL 4.84; EW/PW 1.16; TL/EW 1.80.

Apical margin of 7th sternite very shallowly concave. Eighth and 9th tergites and sternites very similar to those of *H. satoi*. Tegmen similar to that of *H. satoi*, but lacking a pair of lateral plates. Penis long, broadest at the anterior end; basal part tapering posteriorly, distinctly concave in anterior margin; trigonium relatively small, with long median plate; parameroids long, rounded at apex, straightly expanding laterad in about apical 1/3, punctate in caudal area.

Female unknown.

Type materials. Holotype: Male, Kampira, Iriomote-jima, 30–IV–1981, Y. HIRANO leg. (NSMT). Paratype: 1♂, same data as for the holotype (genit. s. nos. HY 375–377; EUM).

Distribution. Japan (Iriomote-jima).

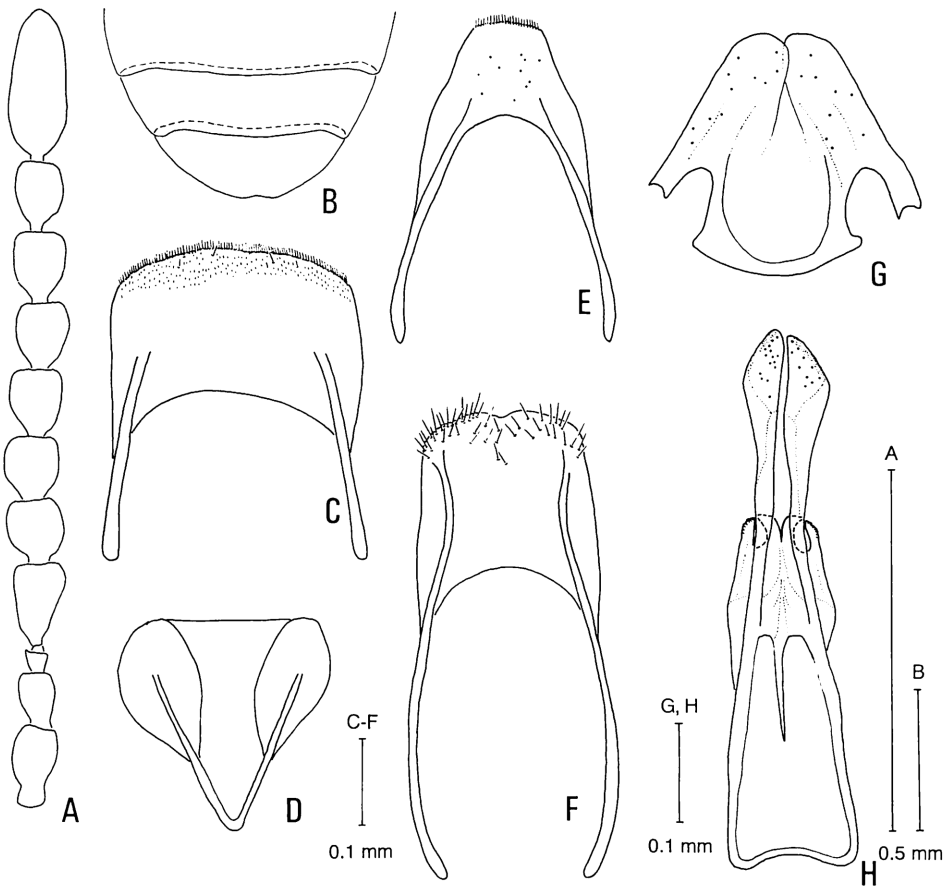

Fig. 8. *Hydrocyphon iriomotensis* sp. nov., paratype, male. —— A, Left antenna; B, 5th to 7th abdominal sternites; C, 8th tergite; D, 8th sternite; E, 9th tergite; F, 9th sternite; G, tegmen; H, penis.

Remarks. This species can be easily distinguished from *H. satoi* sp. nov. by the differently shaped penis.

Etymology. The specific epithet is given after the type locality.

Hydrocyphon taiwanus sp. nov.

(Fig. 9)

Description. Male. Very similar to the preceding two species in general appearance. Apical margin of 7th sternite gently arcuate. Eighth and 9th tergites and sternites similar to those of *H. satoi*, but the 8th sternite is laterally elongated. Tegmen similar to that of *H. satoi*, though a little longer in lateral plates. Penis similar to that of *H. iriomotensis*; parameroids long and slender, gently tapering posteriad.

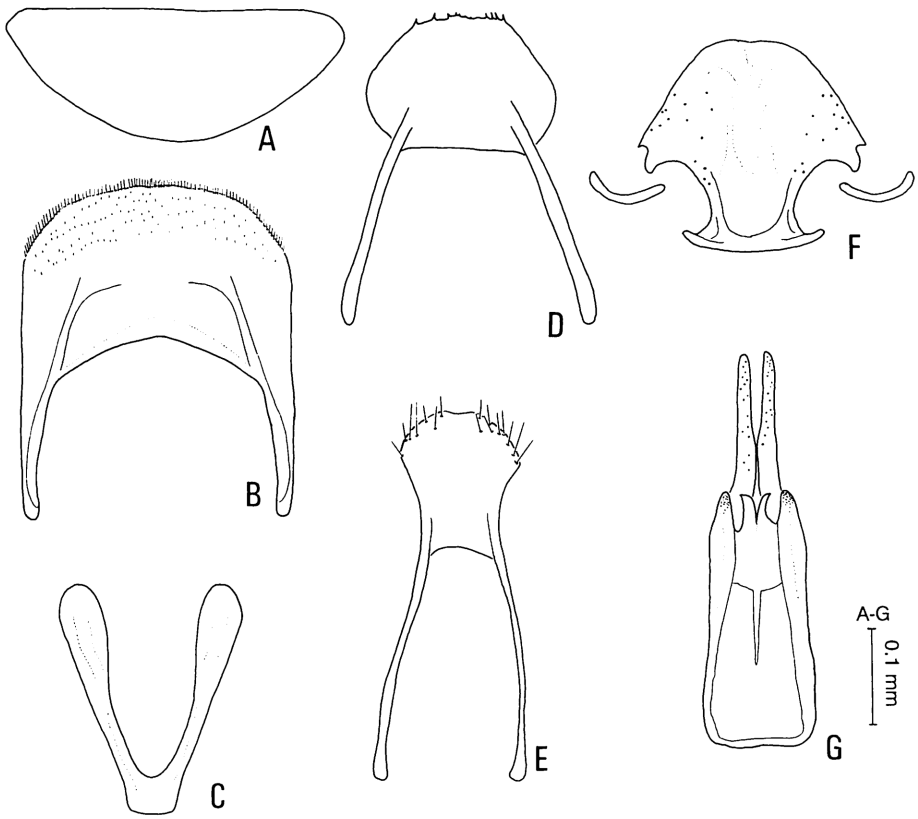

Fig. 9. *Hydrocyphon taiwanus* sp. nov., paratype, male. —— A, Seventh abdominal sternite; B, 8th tergite; C, 8th sternite; D, 9th tergite; E, 9th sternite; F, tegmen; G, penis.

Female unknown.

Type materials. Holotype: Male, Fuyuan, Hwalien Hsien, Taiwan, 9~11–V–1972, M. SAKAI leg. (NSMT). Paratypes: 2♂♂, same data as for the holotype (NSMT, NWU); 1♂, Puli, Nantou Hsien, 12–VII–1968, M. TOMOKUNI leg. (EUM); 1♂, Nanshanchi, Nantou Hsien, 1–V–1982, N. OHBAYASHI leg. (NWU).

Distribution. Taiwan.

Remarks. In general appearance, this species cannot be readily separated from *H. satoi* which is sympatrically distributed in Taiwan, but they are easily distinguishable from each other by the differently shaped penis.

Etymology. The specific epithet is given after the type locality.

Group of *Hydrocyphon nakanei*

This species-group is characterized by the following characteristics: flat tegmen;

symmetrical penis, with distinct parameroids; indistinct prehensor. Judging from the male genitalic characters, this species-group is closely related to the *kambaiticus* species-group which includes three species distributed in Myanmar and Bhutan (NYHOLM, 1981), but is easily distinguishable from it by the unique tegmen.

Hydrocyphon nakanei sp. nov.

[Japanese name: Naga-keshi-maruhananomi]
(Figs. 1 B, 10, 11)

Description. Male. Body oblong, dorsally convex, shining, closely covered with yellowish white hairs. Coloration dark brown, but the 1st to 4th antennal segments, proximal part of 5th antennal segment, labrum and front leg are yellowish brown, mid and hind trochanters, tibiae and tarsi are somewhat paler.

Head lightly convex above, with almost straight front margin of clypeus. Eyes moderate in size, prominent; the distance between eyes about 2.5 times as long as the diameter of an eye. Labrum transverse; front margin gently arcuate. Antennae rather long, reaching about proximal 1/4 of elytra; approximate ratio of each segment as 3.3 : 2.0 : 1.0 : 3.0 : 3.3 : 3.3 : 3.5 : 3.5 : 3.5 : 3.3 : 4.5 (n=1, paratype). Pronotum short, with almost straight front margin; PW/PL 2.41–2.61 (2.50). Elytra oblong, lightly convex dorsad, widest near the middle; EL/EW 1.47–1.54 (1.49); EL/PL 5.33–5.69 (5.50); EW/PW 1.39–1.60 (1.47); TL/EW 1.73–1.83 (1.76). Legs relatively long.

Apical margin of 7th abdominal sternite deeply concave. Eighth tergite moderately sclerotized, semicircular, covered closely with short spines on posterior margin, with some long and short setae in caudal area; 8th and 9th sternites widely membranous, but the lateral parts are more heavily sclerotized and rod-like, 9th tergite weakly sclerotized, somewhat expanding posteriad, covered sparsely with fine punctures in postero-lateral parts, with a pair of rather long apodemes. Tegmen well sclerotized, flat, broad Y-shaped; lateral margins of caudal part triundulate. Penis well sclerotized, about twice as long as tegmen, lightly tapering posteriorly, broadest at a little before the base, with almost straight anterior margin; parameroids long and slender, rounded at apex, covered with fine punctures; trigonium with long median plate.

Female. The external feature is almost the same as in male. Antennae shorter than those of male; 3rd segment a little larger than in male; approximate ratio of each segment as 2.0 : 1.5 : 1.0 : 1.7 : 1.7 : 1.7 : 1.7 : 1.8 : 1.8 : 1.7 : 2.5 (n=1, paratype). PW/PL 2.16–2.46 (2.34); EL/EW 1.40–1.50 (1.47); EL/PL 4.86–5.65 (5.30); EW/PW 1.50–1.60 (1.54); TL/EW 1.68–1.80 (1.75).

Apical margin of 7th abdominal sternite gently arcuate. Eighth tergite elongated trapezoidal, covered with fine punctures and minute setae in apical part, with a pair of long apodemes; 8th sternite lightly sclerotized, oblong, notched at posterior margin, covered with minute setae and fine punctures in posterior part. Ovipositor long; coxite covered rather closely with fine punctures; relative lengths of stylus, coxite and baculus as 1.0 : 3.1 : 15.3; prehensor indistinct.

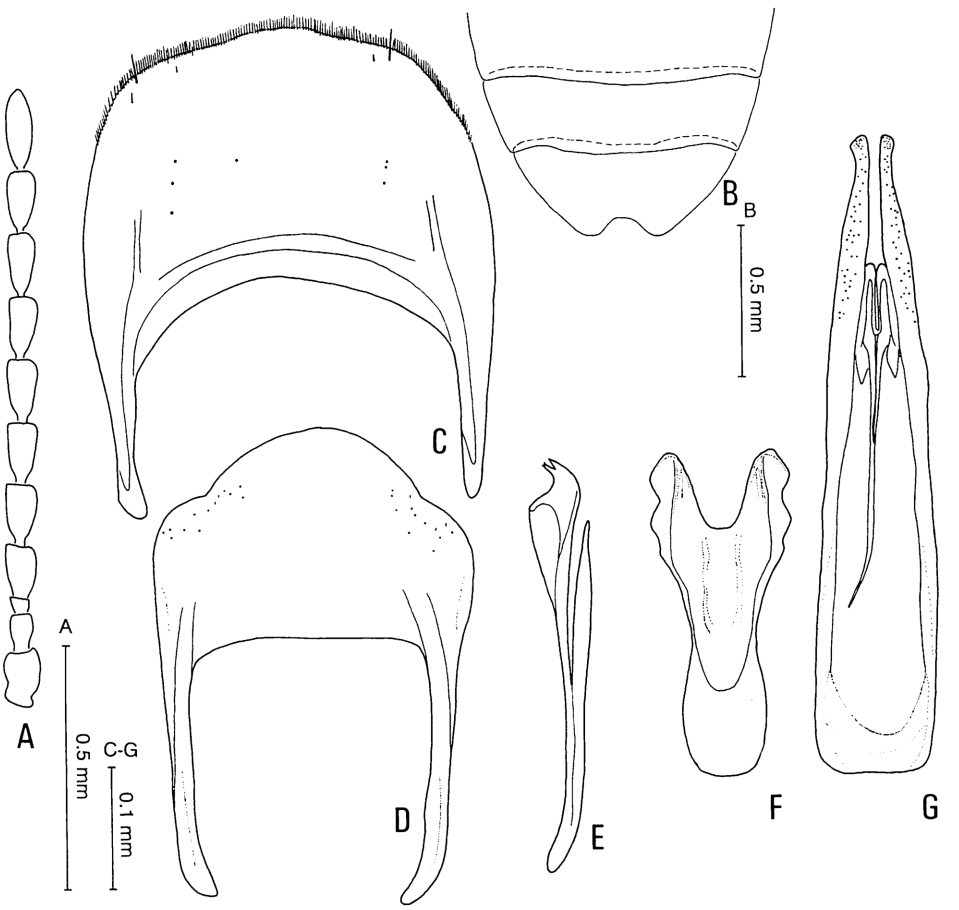

Fig. 10. *Hydrocyphon nakanei* sp. nov., paratype, male. —— A, Left antenna; B, 5th to 7th abdominal sternites; C, 8th tergite; D, 9th tergite; E, 8th and 9th sternites; F, tegmen; G, penis.

Type materials. Holotype: Male, Fudô-dani, Miyama-chô, Mie Pref., 19–V–1996, H. YOSHITOMI leg. (genit. s. no. HY 378; NSMT). Paratypes: 1♂, 6♀♀, same data as the holotype (1♂ genit. & left antenna on slides nos. HY 364–366; 1♀ genit. & left antenna on slides nos. HY 369–371, 389; NSMT, NWU, EUM); 1♂, 1♀, Kamikuroiso, Kuroiso-shi, Tochigi Pref., 14–VI–1992, S. OHMOMO leg.; 1♀, Nakamiyori, Fujiwara-chô, Tochigi Pref., 23–VI–1995, S. OHMOMO leg.; 1♀, Aya, Miyazaki Pref., 29–IV–1987, T. & T. NAKANE leg.; 2♀♀, ditto, 9–V–1987, T. & T. NAKANE leg.; 11♂♂, 8♀♀, ditto, 17–V–1988, T. & T. NAKANE leg. (NSMT, NWU, EUM, NMW, TMNH); 1♂, Kaeda, Miyazaki Pref., 29–IV–1986, T. & T. NAKANE leg.; 1♂, 8♀♀, Hinokage, Miyazaki Pref., 16–V–1987, T. & T. NAKANE leg. (NWU, EUM, NMW); 1♀, Inohae, Miyazaki Pref., 24–V–1987, T. & T. NAKANE leg.

Distribution. Japan (Honshu, Kyushu).

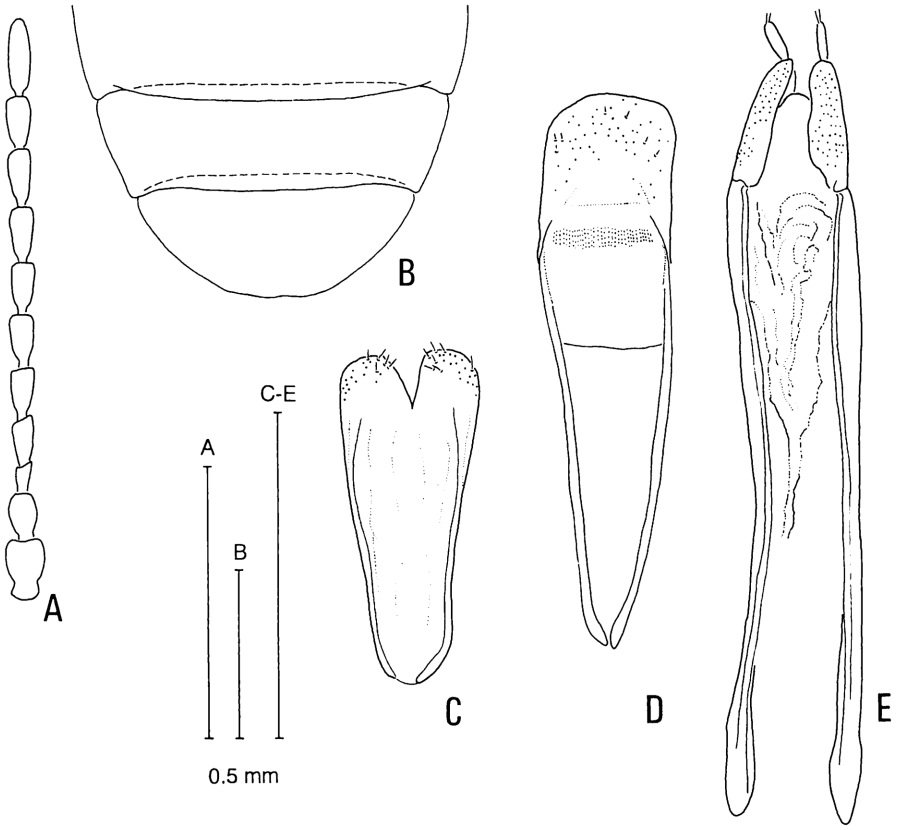

Fig. 11. *Hydrocyphon nakanei* sp. nov., paratype, female. —— A, Left antenna; B, 5th to 7th abdominal sternites; C, 8th sternite; D, 8th tergite; E, ovipositor.

Biological notes. In Mie Prefecture, Honshu, adults were collected from the surface of stones lying at the water edges of the Chôshi-gawa (small river). This stream was very clear and rapid, and seemed to serve as a larval habitat.

Remarks. This species is easily distinguished from the other Japanese species of the genus by the more darkened and shining coloration, relatively slender body and different characteristics of the male and female genitalia.

Etymology. The specific epithet is dedicated to the late Dr. Takehiko NAKANE, in expressing my sincere gratitude for his help by offering precious materials.

Hydrocyphon aritai sp. nov.

(Fig. 12)

Description. Male. Very similar to *H. nakanei* in general appearance. EL/EW 3.0; EL/PL 4.5; EW/PW 0.71; TL/EW 3.7. Apical margin of 7th sternite deeply con-

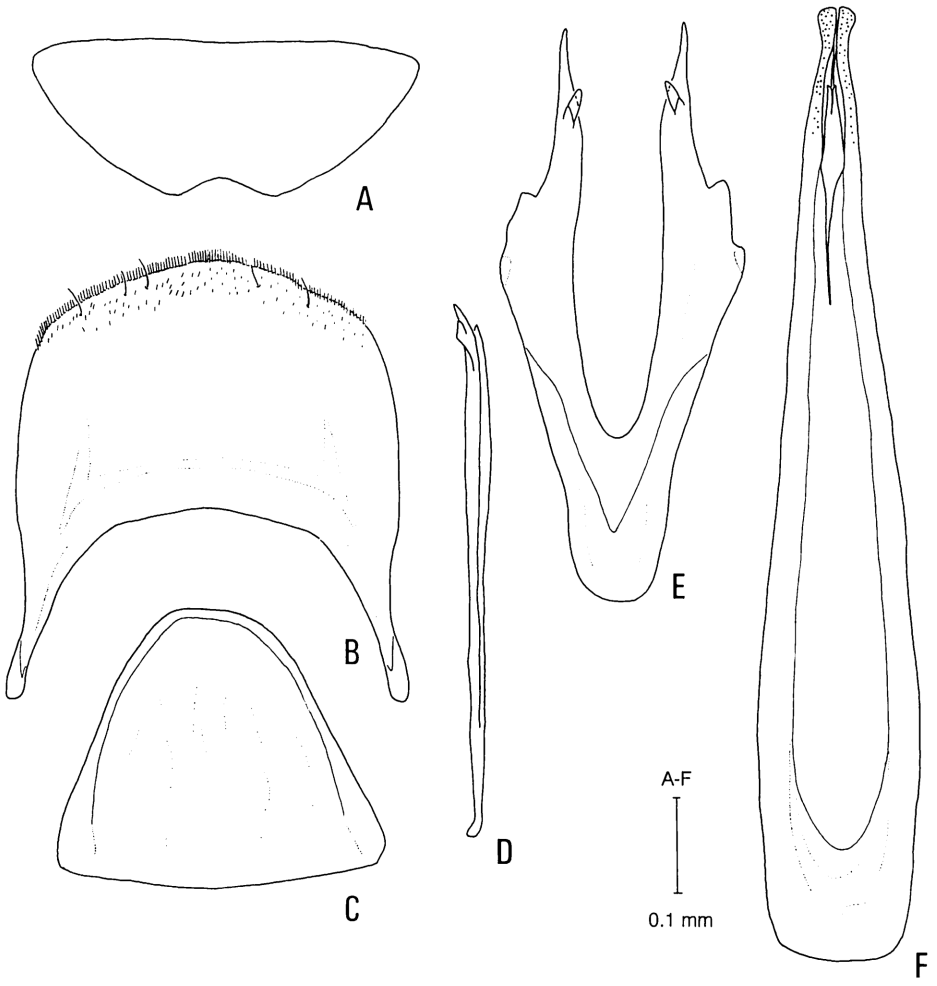

Fig. 12. *Hydrocyphon aritai* sp. nov., holotype, male. —— A, Seventh abdominal sternite; B, 8th tergite; C, 9th tergite; D, left lateral sclerite of 8th and 9th sternites; E, tegmen; F, penis.

cave. Mala genitalia also similar to those of *H. nakanei*; 8th and 9th sternites somewhat longer; tegmen pointed at apices, with a pair of projections on inner margins of apical areas; penis longer, with a short projection on anterior margin of trigonium.

Female unknown.

Type material. Holotype: Male, Lishan, Taichung Hsien, Taiwan, 22–VI–1976, H. MAKIHARA leg. (NSMT).

Distribution. Taiwan.

Remarks. This species is allied to *H. nakanei*, but is easily distinguished from it by the conformation of tegmen and penis.

Etymology. The specific epithet is dedicated to Dr. Yutaka ARITA of Meijo Uni-

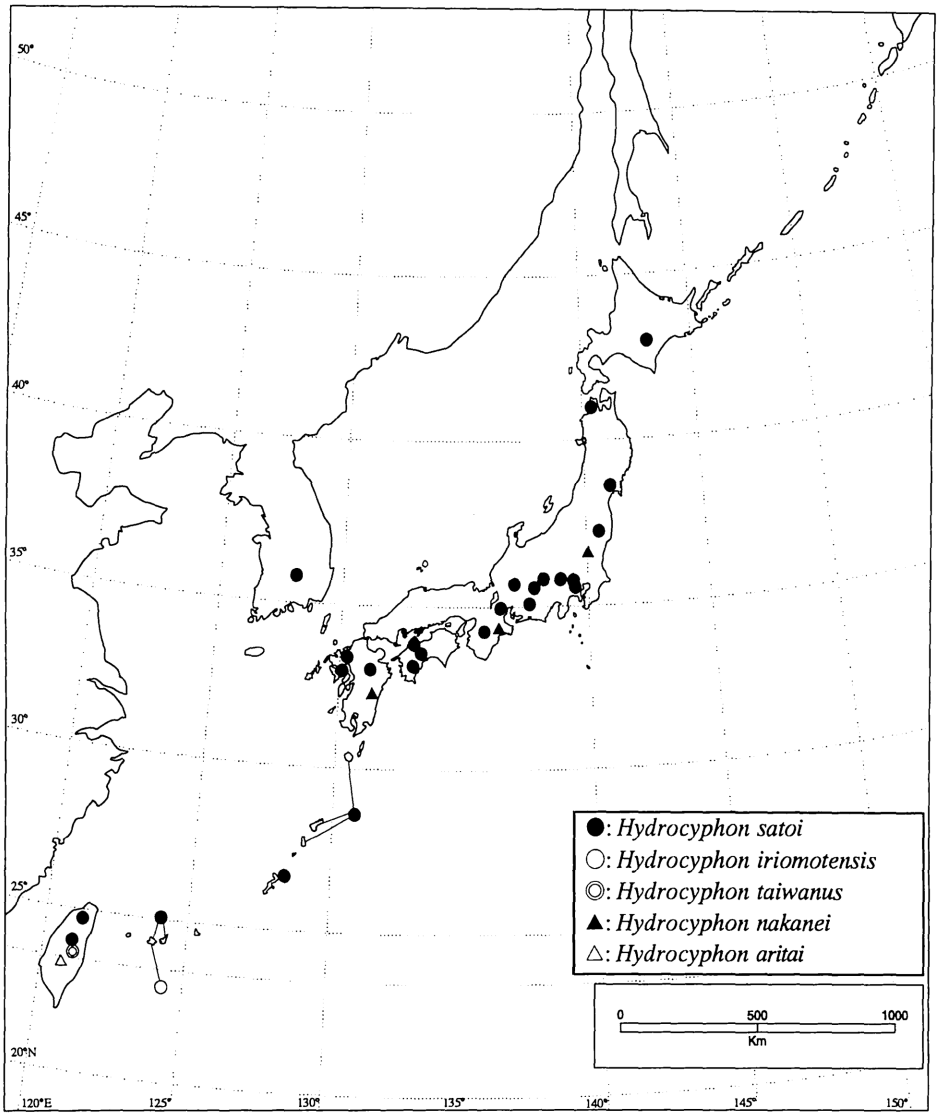

Fig. 13. Map showing the distribution of the genus *Hydrocyphon* in Japan and her adjacent regions.

versity, in expressing my sincere gratitude for his continuous guidance.

Discussion

According to the phylogenetic study on the adult stage (KLAUSNITZER, 1974), *Hydrocyphon* shows a sister-group relationship with the genus *Cyphon* in the cladogram. However, this inference was not supported by the cladogram based on the characteris-

tics of the larval stage (KLAUSNITZER, 1974; HANNAPPEL & PAULUS, 1987). The tree based on the larval mouth parts by HANNAPPEL and PAULUS (1987) shows that the genus *Hydrocyphon* is a sister-group of the clade containing the genera *Scirtes*, *Cyphon*, *Microcara* and *Prionocyphon*. The gap between the two cladograms should be brought about from the following two reasons. In the first place, the genus *Cyphon*, which is the largest genus in the family Scirtidae and contains more than 300 species from all over the world, is probably paraphyletic taxon (mentioned already by HANNAPPEL & PAULUS, 1987). Secondly, male genital structure is very complex in this family (SHARP & MUIR, 1912; NYHOLM, 1972 b), so that it is very difficult to analyze character states. Though I do not deal with the generic phylogeny of the family Scirtidae in this paper, I prefer to approve of the cladogram proposed by HANNAPPEL and PAULUS (1987), since larval characters seem to me more practical than adult ones for analyzing phylogenetic relationships between genera in the family Scirtidae. In any case, the genus *Hydrocyphon* must be monophyletic, judging from some character states that are recognized as autapomorphy.

From this study, it has become clear that the species dealt with in the present paper are more closely related to Southeast Asian species than to European ones from the similarity of male genitalic features.

Acknowledgment

I wish to express my sincere gratitude to Dr. S.-I. UÉNO of the National Science Museum, Tokyo, Dr. N. OHBAYASHI and Dr. M. SAKAI of Ehime University, and Dr. M. SATÔ of Nagoya Women's University for their continuous guidance and reading the original manuscript, and to Dr. Y. ARITA and Dr. S. HASHIMOTO of the Zoological Laboratory, Meijo University for their encouragement and advice. My hearty thanks are also due to Dr. N. HAYASHI, Mr. Y. HIRANO, Mr. S. IMASAKA, Mr. N. KANIE, Dr. T. KISHIMOTO, the late Dr. T. NAKANE, Dr. S. OHMOMO, Mr. K. SATÔ, Dr. K. TAKAHASHI, Mr. N. TAKAHASHI and Dr. H. TAKIZAWA for their kind offer of materials.

要　　約

吉富博之：日本とその周辺のケシマルハナノミ属の分類学的研究．—— 日本とその周辺から正式な記録のなかったケシマルハナノミ属（和名新称）*Hydrocyphon* REDTENBACHER の分類学的研究を行い，成虫，幼虫および蛹の属および種の記載を行った．本属は成虫の外見上，*Cyphon* 属に類似するが，触角第3節が小さいこと，中胸腹板前縁が深く切れ込むこと，雄交尾器の特徴などから区別することができる．幼虫は，小顎肢が3節であること，大顎に先端歯を欠くこと，下咽頭が強く横長であること，流水中に生息することなどの特徴から，他属と容易に区別することができる．日本，台湾，韓国から5種を認め，ケシマルハナノミ *H. satoi*（分布：日本全域，台湾，韓国），イリオモテケシマルハナノミ *H. iriomotensis*（西表島），*H. taiwanus*（台湾），ナガケシマルハナノミ *H. nakanei*（本州，九州），*H. aritai*（台湾）を記載し，ケシマルハナノミについては幼虫と蛹の記載も行った．前3種は東洋アジアから2種が知られ

る*renati*種群に属し，後2種は本研究で提唱した*nakanei*種群に属する．それぞれの種は，検索表に示すとおり，おもに雄交尾器の特徴で区別することができる．

KLAUSNITZER (1974)は，成虫の形態形質を基にした系統樹を示し，本属は*Cyphon*属と姉妹群関係にあるとした．しかし幼虫の形態形質を基にした研究では，この仮説は支持されなかった (KLAUSNITZER, 1974; HANNAPPEL & PAULUS, 1987). そのうちHANNAPPEL & PAULUS (1987)は，本属を *Scirtes*, *Cyphon*, *Microcara*, *Prionocyphon*の4属からなる分岐群の姉妹群としている．この2つの系統仮説の差異は，*Cyphon*属の単系統が疑わしい点とマルハナノミ科の雄交尾器がたいへん複雑で形質状態の把握が困難である点に起因すると考えられる．本研究では属の系統関係については触れていないが，私はHANNAPPEL & PAULUS (1987)の仮説を支持する．いずれの系統仮説の場合においても，本文中で指摘した固有派生形質に基づきケシマルハナノミ属の単系統は疑いないと考えられる．

今回記載した東アジアの5種は，雄交尾器の特徴からヨーロッパの種よりも東南アジアの種により近縁であることが分かった．

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