

A Revision of the Genus *Heterlimnius* HINTON (Coleoptera, Elmidae)

Yuuki KAMITE

Entomological Laboratory, Faculty of Agriculture, Ehime University,
Tarumi 3–5–7, Matsuyama, 790–8566 Japan

Abstract The genus *Heterlimnius* is revised. Seven species are recognized and four of them are newly described: *H. emearthrus* sp. nov., *H. hisamatsui* sp. nov., *H. jaechi* sp. nov., and *H. shepardii* sp. nov. *Optioservus hasegawai* and *O. ater* are transferred to *Heterlimnius*. *H. koebelei* is synonymized under *H. corpulentus*. Both *O. kubotai kubotai* and *O. k. saghaliensis* are synonymized under *H. hasegawai*. *O. hayashii* is synonymized under *H. ater*. A key is provided for all species of *Heterlimnius*. Descriptions are provided for the larvae of *H. ater*, *H. corpulentus* and *H. hasegawai*.

HINTON (1935) established the elmid genus *Heterlimnius* with 9 species, namely *Elmis divergens* LÉCONTE, *E. elegans* LÉCONTE, *E. koebelei* MARTIN, *E. ovalis* LÉCONTE, *E. quadrimaculatus* HORN, *E. tardellus* FALL, *Limnius cryophilus* MUSGRAVE, *L. subarcticus* BROWN and *L. trivittatus* BROWN. Subsequently, SANDERSON (1954) transferred *H. cryophilus*, *H. divergens*, *H. ovalis*, *H. quadrimaculatus* and *H. trivittatus* to the new genus *Optioservus*. He also transferred *H. elegans*, *H. subarcticus* and *H. tardellus* to the new genus *Promoresia*. In addition, SANDERSON (1954) newly transferred *Elmis corpulentus* LÉCONTE to *Heterlimnius*. As a result, only 2 species from the western states of USA remained in *Heterlimnius*. SANDERSON (1954) established the *Optioservus* based on larval characters, but he didn't show adult features sufficient to separate *Optioservus* from *Heterlimnius*. Later, keys to the genera of Nearctic Elmidae were made by BROWN (1972), SHEPARD (2002) and WHITE and ROUGHLEY (2008).

In this paper, I revise the genus *Heterlimnius* and provide descriptions for all adults and larval features for three species. This paper is dedicated to a memory of the late Dr. Sadanari HISAMATSU who was one of the greatest leaders of Japanese coleopterologists.

Materials and Methods

Abbreviations used in the present paper are as follows: PL = pronotal length along midline in dorsal view; PW = maximum width of pronotum; EL = elytral length along suture from scutellar basis to elytral apices; EW = maximum width of elytra; TL = total length of PL and EL; BF = brachypterous form; MF = macropterous form; CASC = California Academy of Sciences, San Francisco; CKN = collection of Yuuki KAMITE, Nagoya, Japan; EUM = Entomological Laboratory, Faculty of Agriculture, Ehime University, Matsuyama, Japan; MCZC = Museum of Comparative Zoology, Harvard University, Cambridge, MA; NMW = Naturhistorisches Museum, Wien; NSMT = National Science Museum, Tokyo.

Averages are given in parenthesis after the ranges.

Specimens were examined with a stereoscopic microscope (Olympus SZH10), a biological microscope (Olympus BX51, Nikon OPTIPHOT-2) and a scanning electron

microscope (SEM; JEOL LTD. JSM-T20). The specimens observed by SEM were sputter coated with gold.

The terminology generally follows KODADA and JÄCH (2005).

Genus *Heterlimnius* HINTON

Heterlimnius HINTON, 1935: 178. — SANDERSON, 1953: 154 [key to genera by adults], 158 [key to genera by larvae]; SANDERSON, 1954: 2; BERTRAND, 1972: 500; BROWN, 1972: 43 [key to genera and species by adults], 64 [key to genera by larvae]; BROWN and WHITE, 1978: 6; SHEPARD, 1993: 4; SHEPARD, 2002: 119 [key to genera by adults]; WHITE and ROUGHLEY, 2008: 638 [key to genera by larvae], 644 [key to genera by adults]. Type species: *Elmis koebeleri* MARTIN, 1927, by the original designation.

Adult. Body elongate oval to oblong, well convex dorsally. Plastron setae on genae, hypomera, epipleura, lateral parts of prosternum, meso- and metaventrites and abdominal sterna except for a medial bare area.

Head slightly convex, retracted into prothorax, punctuate on dorsal surface. Eyes moderate in size. Clypeus and labrum separated, transverse, somewhat pubescent; antero-lateral corners of labrum densely pubescent.

Antennae filiform, 9 to 11-segmented; antennomeres 1 and 2 somewhat swollen; last 3 antennomeres enlarged. Mandible with 3 apical teeth; mola dentate. Maxilla as in Fig. 28; galea 2-segmented; sparsely pubescent; basigalea short; maxillary palpomere 4-segmented, 1–3 short, 4th long and slender, sparsely pubescent. Labium as in Fig. 30; labial palpomere 3-segmented, sparsely pubescent; terminal palpomere large, longer than preceding segments combined; ligula umbrella-shaped, wider than mentum.

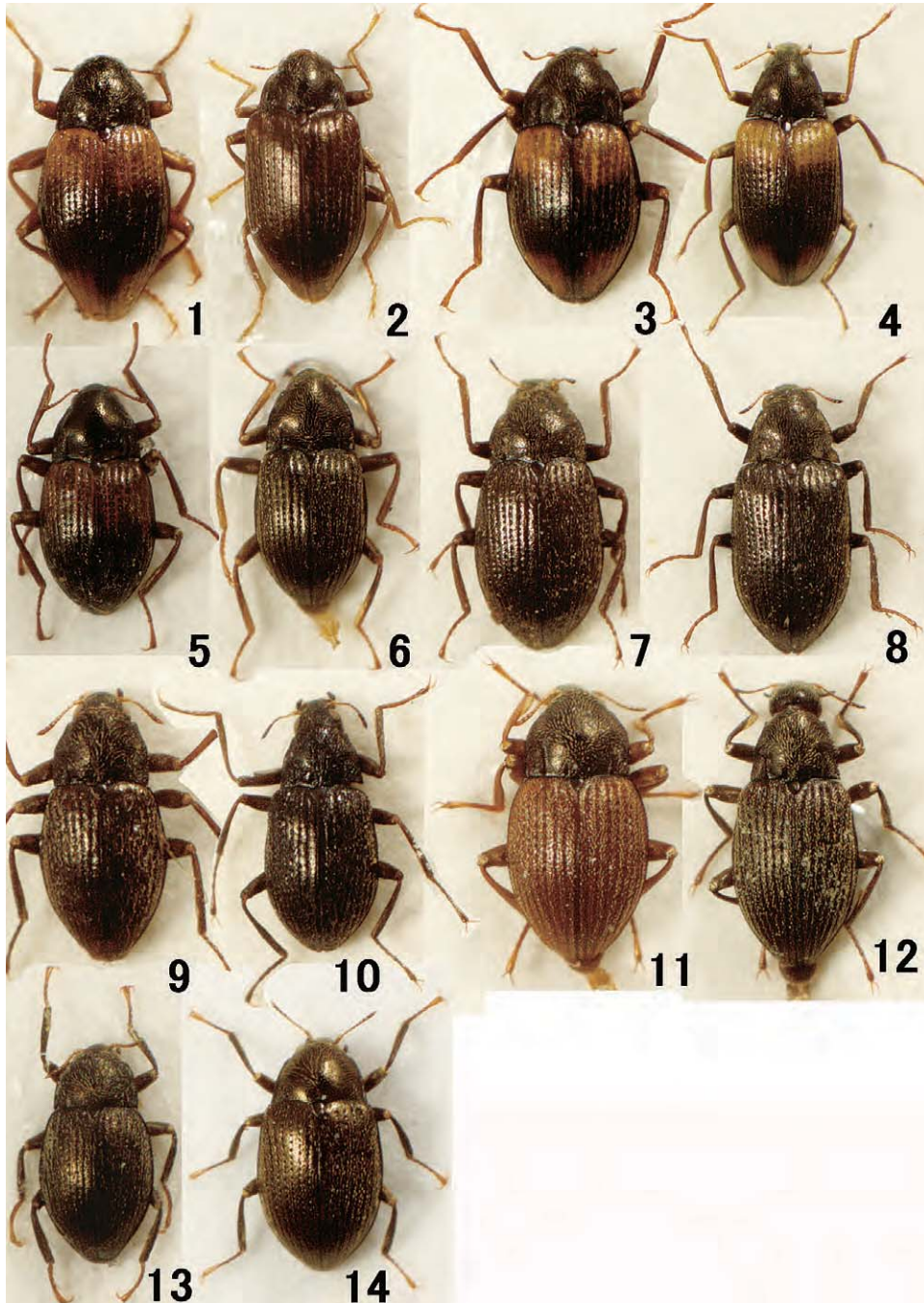
Pronotum convex, wider than long, widest at base, narrower than elytra; anterior angles slightly produced; anterior and lateral margins clearly sinuate (BF) or slightly sinuate (MF), not or feebly serrate (*H. corpulentus* somewhat strongly serrate); posterior margins more or less sinuate, not or feebly serrate, with sublateral carinae.

Scutellum visible, subtriangular, somewhat round at apex, but sometimes acute, devoid of punctures and setae.

Elytra convex dorsally, widest near middle, sparsely punctate and pubescent; with 10 punctate striae; intervals slightly or well convex; anterior part of 3rd interval wider than 4th or subequal in width, fused about apical third; lateral margins not or feebly serrate. Epipleura well developed, gradually narrowing from base to apex. Hind wings vestigial (BF) or fully developed (MF); in MF, radial cell incomplete, radius anterior (RA₃₊₄) short, radius posterior (RP) short, media posterior (MP₁₊₂) distinct and long, medial spur long, nearly reaching margins, cubito-anal cell elongate, medial field with 3 free veins nearly reaching margins (medial spur not included), MP₃ and MP₄ sometimes vestigial, cubitus anterior (CuA₁₊₂) indistinct, anal posterior (AP₃₊₄) unbranched, short, and apical field with 2 pigmented stripes.

Prosternum broad, sparsely and finely punctuate and pubescent; lateral carinae not reaching anterior margin; prosternal process almost as long as wide; narrowing behind and broadly rounded at apex (subparallel and somewhat truncate in *H. shepardi* sp. nov.).

Mesoventrite transverse, sparsely and finely punctuate and pubescent; middle of anterior portion grooved, with a row of coarse punctures around in front of mesocoxae, sometimes oblique.



Figs. 1–14. Habitus of *Heterlimnius* species. — 1–2, *H. corpulentus*; 3–4, *H. hasegawai*; 5–6, *H. ater*; 7–8, *H. emearthrus* sp. nov.; 9–10, *H. jaechi* sp. nov.; 11–12, *H. hisamatsui* sp. nov.; 13–14, *H. shepardi* sp. nov. — 1, 3, 5–6, 7, 9, 11, 13, BF; 2, 4, 8, 10, 12, 14, MF.



Figs. 15–20. Habitus of *Heterlimnius* species (larvae). — 15–16, *H. corpulentus*; 17–18, *H. hasegawai*; 19–20, *H. ater*. — 15, 17, 19, dorsal aspects; 16, 18, 20, lateral aspects.

Metaventrite long and broad, sparsely and finely punctuate and pubescent, not or shallowly grooved at median suture, with a row of coarse punctures behind mesocoxae and before metacoxae.

Legs moderately long; pro- and mesocoxae nearly globular; metacoxae transverse; trochanters small, subtriangular; femora clavate, widest near the middle; tibiae gradually wider to apex, ventral part with setal fringe; tarsomeres 1–4 short, subequal in length; tarsomere 5 almost as long as preceding tarsomeres combined; claws simple, with one subbasal tooth.

Abdomen with 5 ventrites; medial bare area of ventrites 1–4 sparsely and finely punctuate and pubescent; apex of intercoxal process of abdominal ventrite 1 relatively round, with a row of coarse punctures behind metacoxae, sometimes oblique; posterior margin of abdominal ventrite 3 weakly and ventrite 4 clearly tooth; ventrite 5 rugose, with apex emarginate or evenly rounded. Tergite 8 furnished pubescent and densely with microtrichia.

Aedeagus simple trilobate type; penis longer than parameres; parameres slender; phallobase moderately large.

Female. Ovipositor slender; valvifer longer than coxite; apico-lateral part of coxite produced outward; stylus short and curved outward.

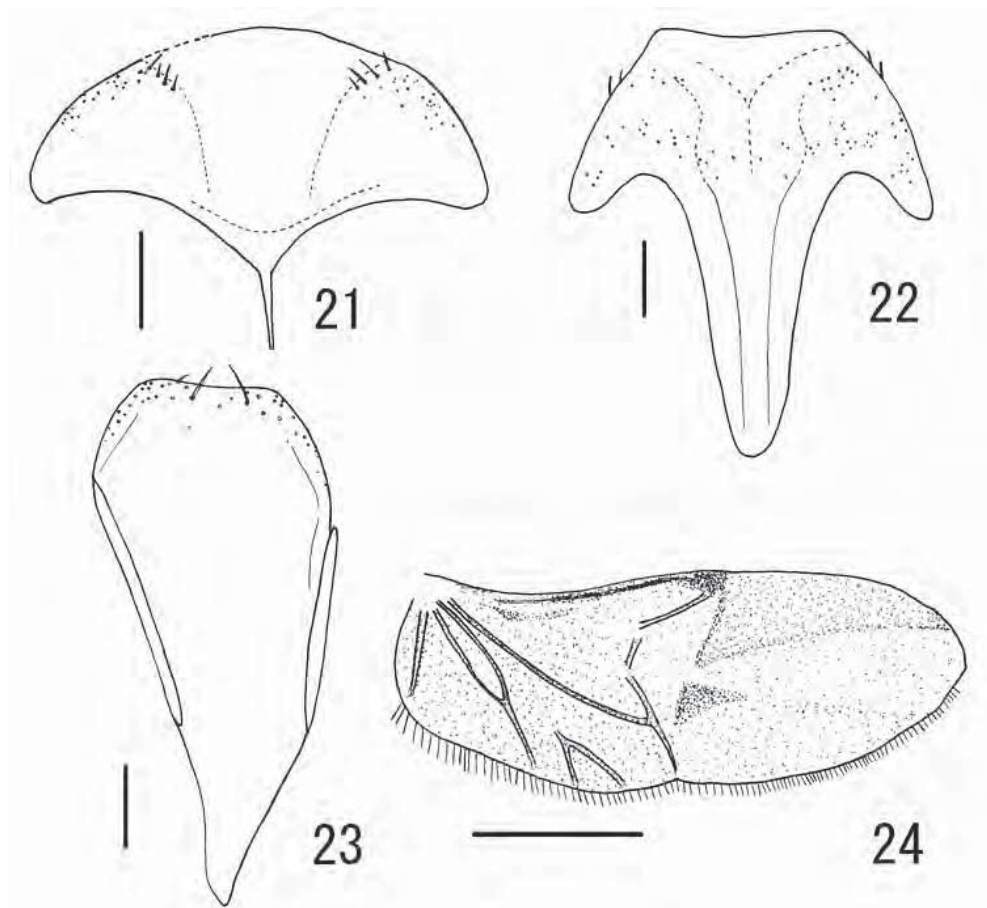
Larva. Body elongate, subtriangular in cross section, surface with setiferous tubercles.

Head subquadrate, visible from above, with short front tooth. Antennae slender, 3-segmented; antennomere 1 short, wide; antennomere 2 longest, with sensorial appendage; antennomere 3 slender, almost as long as antennomere 1 or sensorial appendage. Labrum transverse; branched scales straight on dorsal surface. Mandible falciform or subtriangular, with three oblique apical teeth; prostheca well developed; mola absent. Maxilla

slender; cardo small, transverse; galea oval, shorter than lacinia; maxillary palpomere 4-segmented, almost as long as lacinia; palpomeres 1 and 2 short; palpomere 3 almost as long as preceding segments combined; terminal palpomere almost as long as palpomere 3. Labium slender; prementum transverse; labial palpomere 2-segmented, short; basal palpomere almost as long as apical palpomere; ligula densely setose.

Thoraces wider than long, widest at base. Prothorax with 7 ventral sclerites; two anterior sclerites largest, transverse; two anterolateral sclerites triangular; two posterolateral sclerites subquadrate; one sclerite between coxae very small, arrowhead-shaped; posteromedial sclerite absent. Mesothorax and metathorax with 5 ventral sclerites; antero-medial sclerite transverse; lateral part with antero-lateral and postero-lateral sclerites; antero-lateral sclerite rectangular, slightly smaller than trapezoid postero-lateral sclerite.

Legs robust; coxa largest, trapezoid; trochanter smallest, subtriangular; femur and tibia transverse, subequal in length; claw about half length of tibia, moderately curved.



Figs. 21–24. *Heterlimnius* species. — 21–23, *H. ater*; 24, *H. corpulentus*. — 21, Sternite 8, male; 22, sternite 8, female; 23, spiculum gastrale and segment 9, male; 24, hind wing. Scales: 100 μ m for Figs. 21–23; 1000 μ m for Fig. 24.

Abdomen with pleural sclerites on segments 1–7; first 3 sclerites rectangular, subparallel; next 3 sclerites trapezoid, gradually narrowed to apex; terminal sclerite subtriangular. Terminal segment moderately long; apex slightly emarginated. Operculum pentagonal, reaching apex of terminal segment.

Remarks. In adult features, this genus closely resembles *Optioservus*, but is distinguishable from the latter by the following characteristics: radius posterior (RP) short; dorsal surface of head punctuate (granulate in *Optioservus*, except punctuate in *Optioservus* from the eastern Nearctic region); antennae 9 to 11-segmented, last 3 antennomeres enlarged (11-segmented in *Optioservus*); lateral margin of elytra not or feebly serrate (strongly serrate in some *Optioservus*); basal part of 3rd interval wider than 4th or subequal in width (basal part of 4th interval wider than 3rd or subequal in width in *Optioservus*); metaventrite not furnished with small process (males of Palaearctic *Optioservus* are furnished with a pair of small processes); apex of intercoxal process of abdominal ventrite 1 relatively round (relatively pointed in *Optioservus*, except relatively round in *Optioservus* from the eastern Nearctic region, especially striking in *O. immunis* (FALL)); ventrite 5 rugose (granulate in *Optioservus*, except rugose in *Optioservus* from the eastern Nearctic region); phallobase smooth (only Japanese *Optioservus* are squamous at lateral and ventral surface). This genus also resembles *Promoresia*, but is distinguishable from the latter by the following characteristics: radius posterior (RP) short (not examined in *P. elegans*); dorsal surface of head punctuate (granulate in *Promoresia*, but not examined in *P. elegans*); tarsi and claws not enlarged; abdominal ventrite 5 rugose (smooth in *Promoresia*, but not examined in *P. elegans*).

In larval features, *Heterlimnius* closely resembles *Optioservus* and *Promoresia*, but is easily distinguishable from them by the ventral sclerites of mesothorax and metathorax, which have 5 sclerites, while *Optioservus* and *Promoresia* have 3 sclerites.

Heterlimnius corpulentus (LECONTE)

(Figs. 1–2, 15–16, 24–42, 91–93)

Elmis corpulentus LECONTE, 1874, 52 (type locality: British Columbia; type material: MCZC, only pictures examined).

Elmis antennatus FALL, 1907, 227 (synonymized by FALL, 1925).

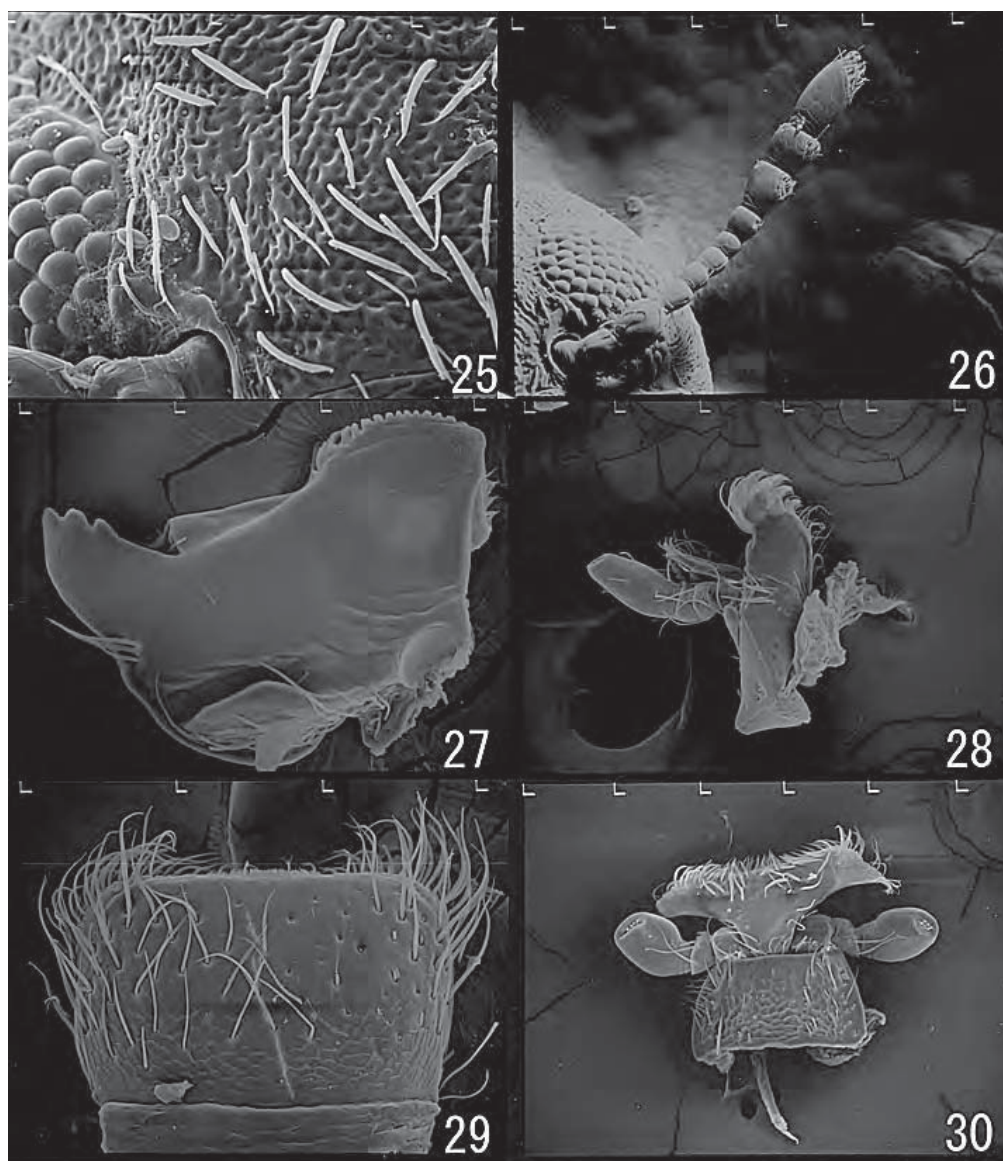
Helmis koebelei MARTIN, 1927, 68 (type locality: Easton, Washington; type material: CASC, not examined). **Syn. nov.**

Heterlimnius koebelei: HINTON, 1935, 178; COLLIER, 1969, 22 [key to species by adults]; BROWN, 1972, 43 [key to genera and species by adults]; BROWN, 1983, 6; SHEPARD, 1993, 4.

Heterlimnius corpulentus: SANDERSON, 1954, 11; COLLIER, 1969, 22 [key to species by adults]; BROWN, 1972, 43 [key to genera and species by adults]; BROWN, 1983, 6; SHEPARD, 1993, 4.

Adult. TL/EW 1.99–2.21 (2.07) in BF; TL/EW 2.18 in MF. Dorsal surface black, but mesoventrite blackish brown; metaventrite yellowish brown to brown; elytra reddish brown to black, sometimes with yellowish patches at humeral and apical area. Ventral surface, antennae, mouth parts and legs reddish brown to blackish brown, but antenna (sometimes last 3 segments darkened), tibiae and tarsi paler.

Head densely rugose and punctuated. Clypeus about 3.04 times as wide as long. Labrum about 1.65 times as wide as long. Antennae 10-segmented, sometimes 11-

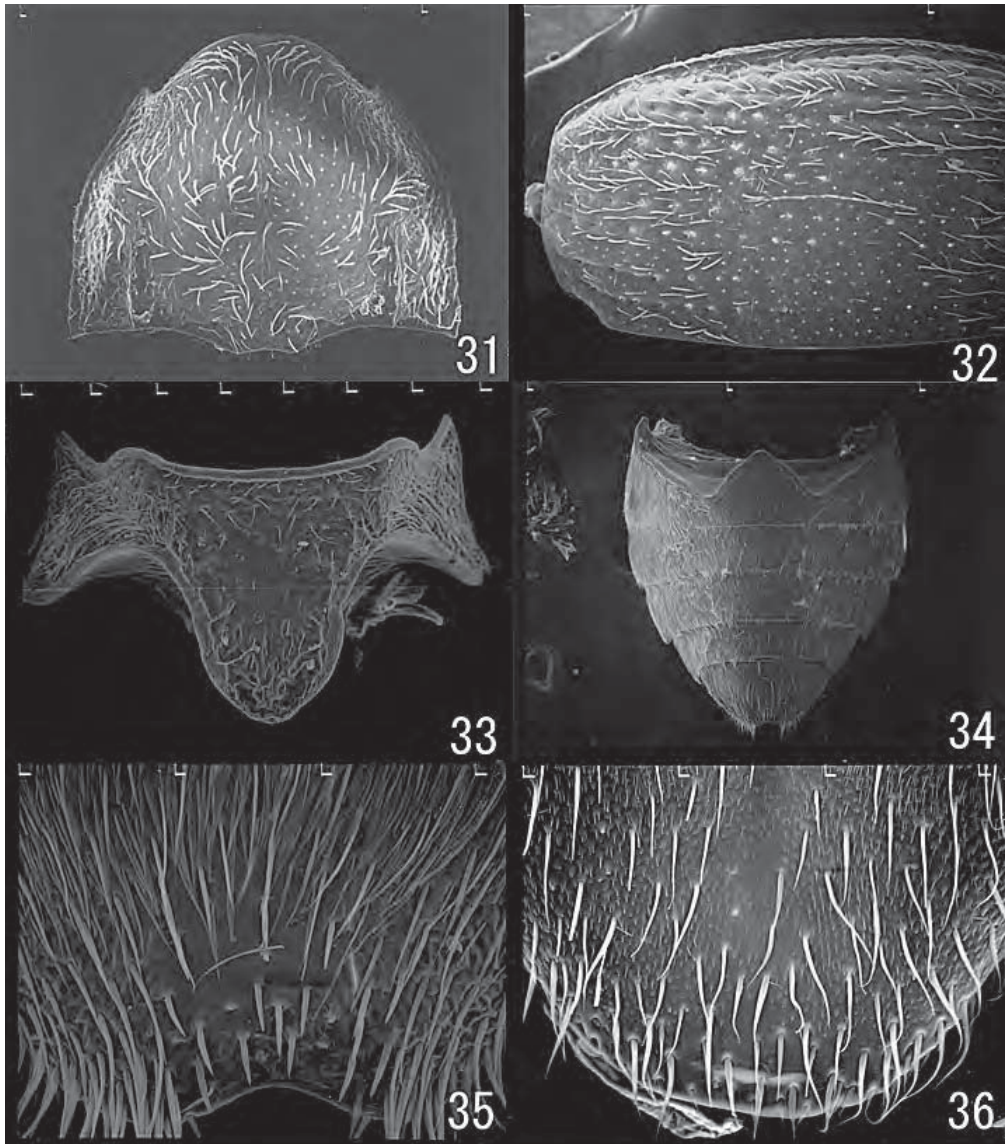


Figs. 25–30. *H. corpulentus*, adult. — 25, Head; 26, antenna; 27, mandible; 28, maxilla; 29, labrum; 30, labium. Scales: 100 μ m.

segmented, rarely one side 10-segmented and another 11-segmented. Central area of mandible somewhat wide.

Pronotum transverse, sparsely punctuated; lateral margins somewhat strongly serrate; not furnished with prescutellar pits; PW/PL 1.31–1.42 (1.36) in BF; sublateral carinae 0.29–0.36 ($n = 10$, 0.31) times as long as PL; PW/PL 1.40 in MF; sublateral carinae 0.25 ($n = 1$) times as long as PL.

Elytra elongate oval (BF) or oblong (MF); intervals somewhat rugose, well convex; strial punctures not so large, but somewhat deep; basal part of 3rd interval wider than 4th; in BF EL/EW 1.43–1.64 (1.52), EL/PL 2.56–2.90 (2.77), EW/PW 1.30–1.40 (1.34);



Figs. 31–36. *H. corpulentus*, adult. — 31, Pronotum; 32, elytra, basal part; 33, prosternum; 34, abdomen; 35, ventrite 5; 36, tergite 8. Scales: 100 μm for Figs. 33, 35–36; 1,000 μm for Figs. 31–32, 34.

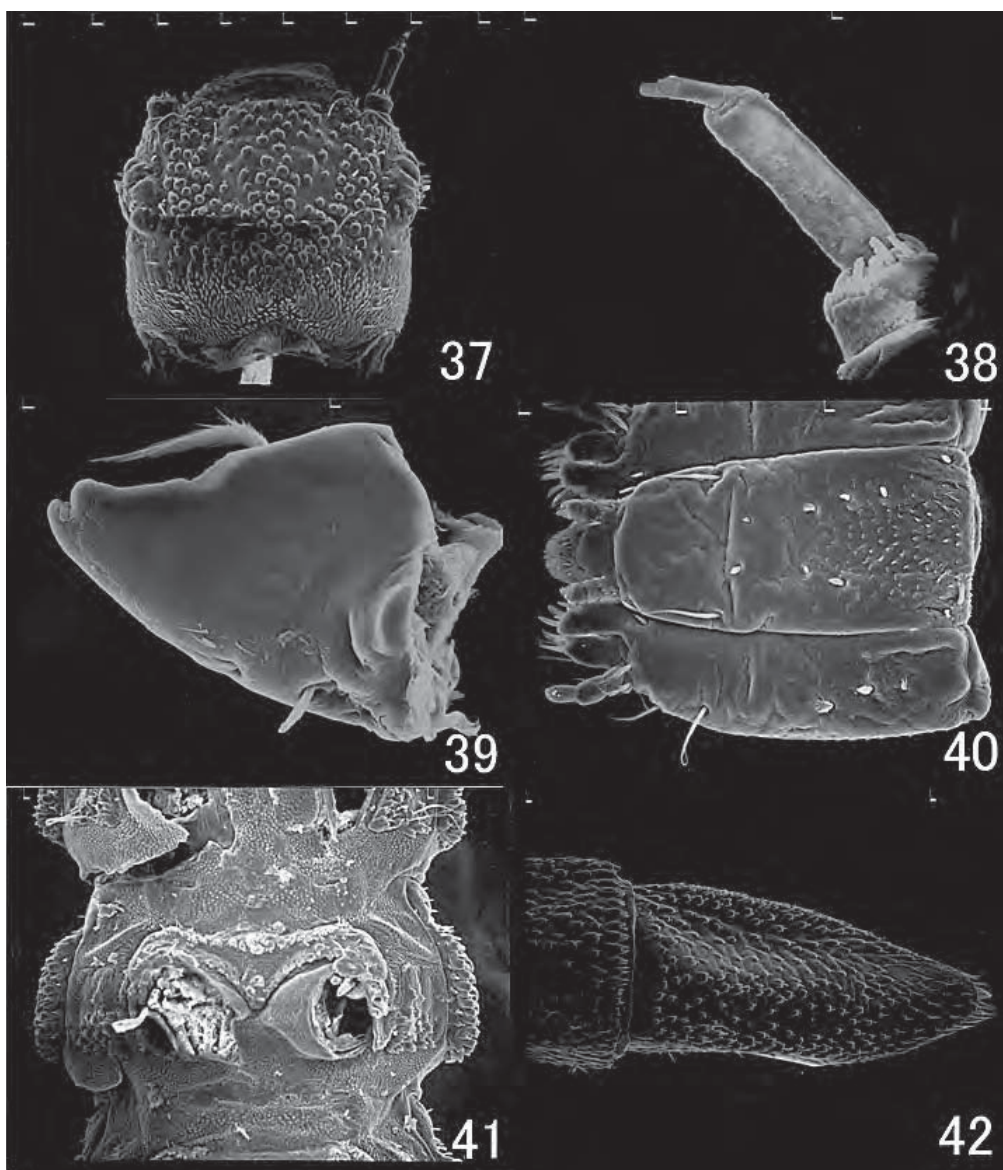
in MF EL/EW 1.64, EL/PL 3.08, EW/PW 1.34.

Prosternal process narrowing behind and broadly rounded at apex.

Apex of abdominal ventrite 5 clearly emarginated.

Aedeagus as illustrated (Figs. 91–92); penis long and slender, strongly dilated at base, narrowed apically; apical part dilated and curved ventrad in lateral aspect.

Ovipositor as illustrated (Fig. 93); coxite about 5.29 times as long as stylus; valvifer about 10.00 times as long as stylus.



Figs. 37–42. *H. corpulentus*, larva. — 37, Head; 38, antenna; 39, mandible; 40, maxilla and labium; 41, mesothorax, ventral view; 42, abdominal segment 9, lateral view. Scales: 100 μ m for Figs. 37–40; 1,000 μ m for Figs. 41–42.

Measurements. BF (n = 10): TL 2.50–3.00 (2.82) mm; PL 0.69–0.81 (0.75) mm; PW 0.94–1.11 (1.02) mm; EL 1.81–2.23 (2.07) mm; EW 1.23–1.45 (1.37) mm. MF (n = 1): TL 3.01 mm; PL 0.76 mm; PW 1.02 mm; EL 2.25 mm; EW 1.37 mm.

Specimens examined. Adults. [USA] 4 exs. (EUM), N. of Almont, 9500' Spring Creek Pass, Colorado, 6–VIII–1976, M. SATÔ leg.; 4 exs. (EUM), Nathrop, Ruby Hill, 7200' Colorado, 6–VIII–1976, M. SATÔ leg.; 2 exs. (EUM), Gothic, 9000' East River, Colorado, 6–VIII–1976, M. SATÔ leg.; 1ex. (EUM), Gothic, 9000' Small Stream, Colorado, 6–VIII–1976, M. SATÔ leg.; 6 exs. (EUM), Caddo River, Arkansas, 13–VIII–

1976, M. SATÔ leg.; 5 exs. (CKN), CA: Mendocino Co., 10 mi SW Stony ford, 15–X–2005 4500', Spring Run, W. D. SHEPARD leg.

Larva. Body cylindrical; TL/TW 5.41–7.43 (6.31). Colour dark brown or brown, head darker. Head about 1.02 times as wide as long. Mandible subtriangular, 1.47–1.55 (n=2, 1.51) times as long as wide. Labrum about twice as wide as long. Pronotum slightly wider than long; PW/PL 1.44–1.60 (1.54). Pronotum and abdomen not humped in middorsal and sublateral aspect. Lateral aspect of abdominal terminal segment not so polished, densely with setiferous tubercles.

Measurements of the larvae (n = 4). TL 5.52–6.98 (6.24) mm; HW 0.46–0.48 (0.48) mm; PL 0.58–0.63 (0.61) mm; PW 0.91–0.96 (0.93) mm; TW 0.94–1.02 (0.99) mm.

Specimens examined. Larvae. [USA] 6 mature larvae and 8 immature larvae (CKN), CO: Gunnison Co., 1 mi W Ohio, Quartz Creek, 18–V–1986, W. D. SHEPARD leg.; 166 immature larvae (CKN), CA: Plumas Co., Mohawk, 9–XII–1986, W. D. SHEPARD leg.

Distribution. USA (western states), Canada (western states).

Notes. Shepard (1993) discussed the antennal segments of *H. corpulentus* and *H. koebelei*. Usually, *H. corpulentus* is 10-segmented and *H. koebelei* is 11-segmented. But he indicated that a number of specimens having 10 segments on one side and 11 on the other side. *H. hasegawai* (NOMURA) usually has 11-segmented antennae, but some specimens are reduced into 10. Antennal segmentation is thus easily changeable and isn't a good character for distinguishing these species. Therefore, *H. koebelei* is a synonym of *H. corpulentus*.

Heterlimnius hasegawai (NOMURA), comb. nov.

(Figs. 3–4, 17–18, 43–54, 94–96)

Optioservus (s. str.) *hasegawai* NOMURA, 1958, 8 (type locality: Shiritori, Saghalien, Russia; type material: NSMT, examined). — JÄCH *et al.*, 2006, 436.

Optioservus (*Cyclolimnius*) *kubotai* NOMURA, 1958, 10 (type locality: Nikko, Tochigi Pref., Japan, type material: NSMT, examined). — SATÔ, 1977, 4; SATÔ, 1982, 391; SATÔ, 1985, 438, pl. 80, fig. 14; LEE and LEE, 1992, 63; JÄCH and KODADA, 1995, 290; JÄCH *et al.*, 2006, 436. **Syn. nov.**

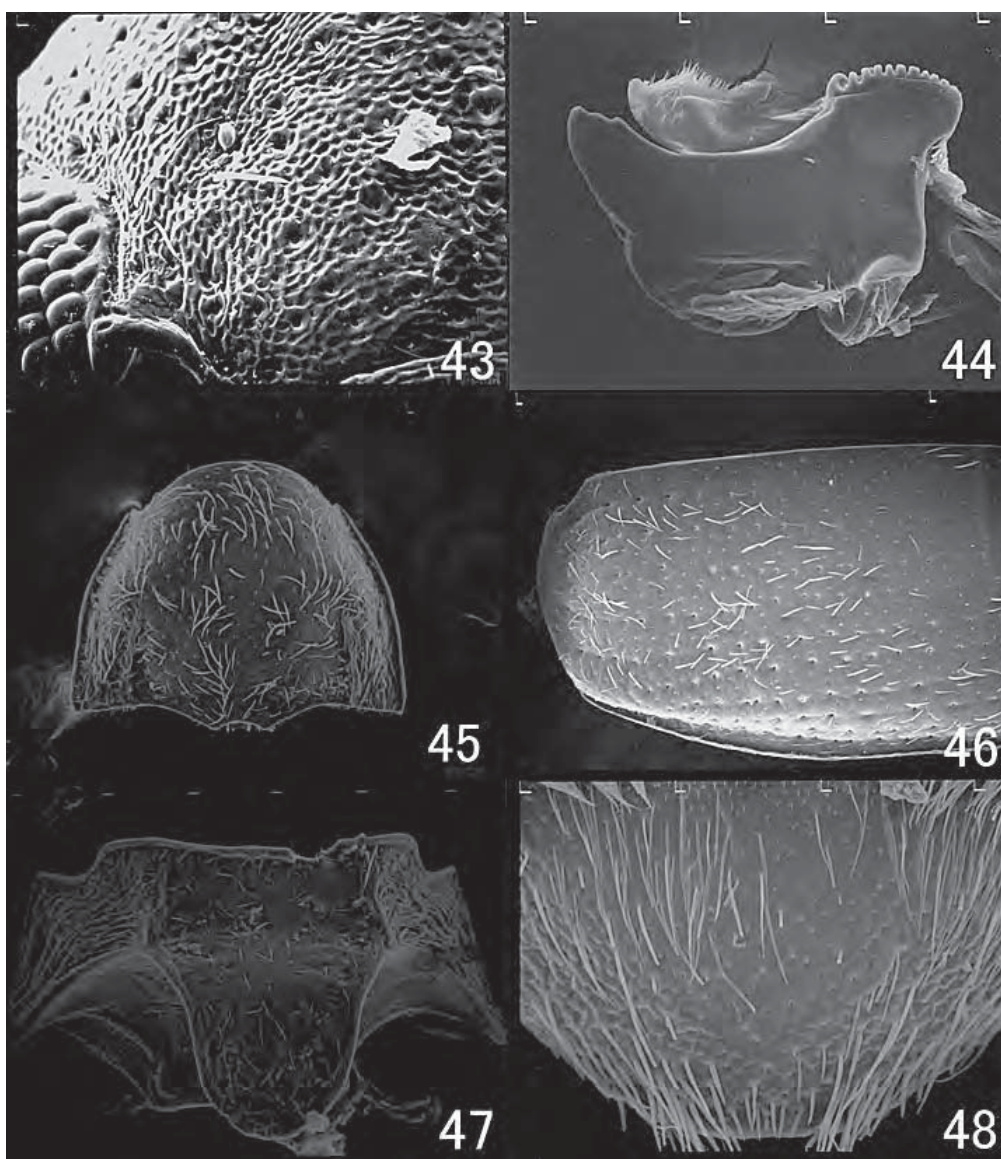
Optioservus (*Cyclolimnius*) *kubotai saghaliensis* NOMURA, 1958, 11 (type locality: Shiritori, Saghalien, Russia; type material: NSMT, examined). — JÄCH *et al.*, 2006, 436. **Syn. nov.**

Adult. TL/EW 1.97–2.09 (2.02) in BF; TL/EW 2.02–2.14 (2.07) in MF. Dorsal surface black, but meso- and metaventrites brown to blackish brown; elytra reddish brown to black, with yellowish patches at humeral and apical area, rarely almost blackish or yellowish. Ventral surface, antennae, mouth parts and legs reddish brown to blackish brown, but antenna (sometimes last 3 segments darkened), tibiae and tarsi paler.

Head densely rugose and punctuated. Clypeus about 2.96 times as wide as long. Labrum about 1.69 times as wide as long. Antennae 11-segmented, sometimes 10-segmented. Central area of mandible not so wide.

Pronotum transverse, sparsely punctuated; lateral margins not or feebly serrate; not furnished with prescutellar pits; PW/PL 1.21–1.38 (1.31) in BF; sublateral carinae 0.30–0.36 (n = 7, 0.33) times as long as PL; PW/PL 1.37–1.55 (1.45) in MF; sublateral carinae 0.27–0.34 (n = 10, 0.31) times as long as PL.

Elytra elongate oval (BF) or oblong (MF); intervals somewhat rugose, relatively flattened; striae punctures not so large, shallow; basal part of 3rd interval slightly wider



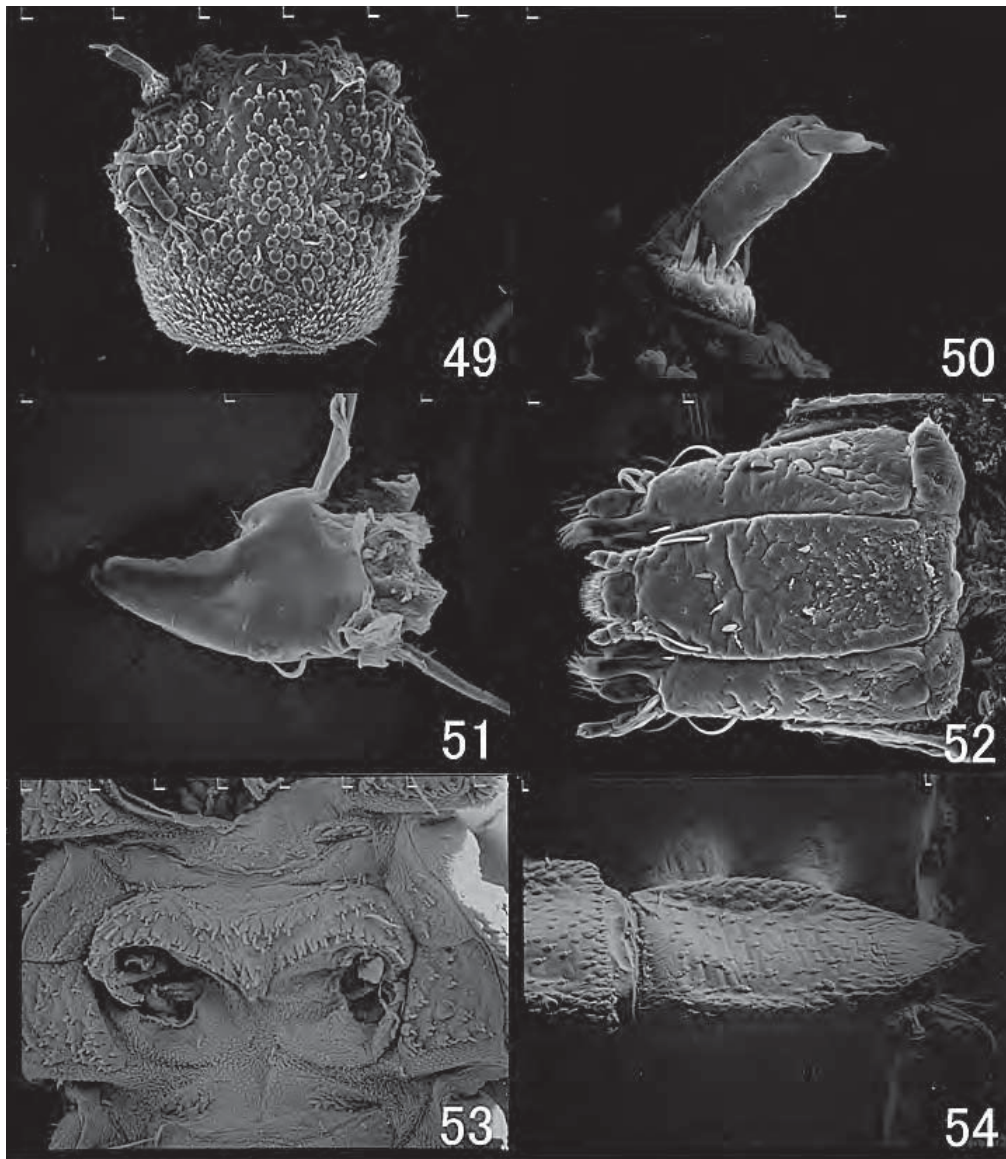
Figs. 43–48. *H. hasegawai*, adult. — 43, Head; 44, mandible; 45, pronotum; 46, elytron, basal part; 47, prosternum; 48, ventrite 5. Scales: 100 μm for Figs. 43–44, 47–48; 1,000 μm for Figs. 45–46.

than 4th or subequal width; in BF EL/EW 1.39–1.50 (1.45); EL/PL 2.31–2.90 (2.57); EW/PW 1.29–1.38 (1.35); in MF EL/EW 1.50–1.61 (1.54); EL/PL 2.70–3.20 (2.93); EW/PW 1.28–1.36 (1.31).

Prosternal process narrowing behind and broadly rounded at apex.

Caudal margin of abdominal ventrite 5 evenly rounded.

Aedeagus as illustrated (Figs. 94–95); penis long and slender, somewhat dilated at base, narrowed apically; apical part dilated and curved ventrad in lateral aspect.



Figs. 49–54. *H. hasegawai*, larva. — 49, Head; 50, antenna; 51, mandible; 52, maxilla and labium; 53, mesothorax, ventral view; 54, abdominal segment 9, lateral view. Scales: 100 μ m for Figs. 49–53; 1,000 μ m for Fig. 54.

Ovipositor as illustrated (Fig. 96); coxite about 6.09 times as long as stylus; valvifer about 11.09 times as long as stylus.

Measurements. BF (n = 10): TL 2.21–2.58 (2.38) mm; PL 0.60–0.78 (0.67) mm; PW 0.83–0.94 (0.87) mm; EL 1.60–1.82 (1.71) mm; EW 1.12–1.24 (1.18) mm. MF (n = 10): TL 2.31–2.95 (2.57) mm; PL 0.55–0.76 (0.65) mm; PW 0.85–1.05 (0.94) mm; EL 1.76–2.19 (1.91) mm; EW 1.09–1.41 (1.24) mm.

Type materials. *Optioservus hasegawai*: holotype ♀, Shiritori, Saghalien, 24–VII–1938, H. HASEGAWA leg. *Optioservus kubotai kubotai*: holotype ♂, allotype 1♀,

paratypes 7♂7♀ (NSMT), Nikko (temperature of water: 13°C), 22–VII–1947, M. KUBOTA leg.; *Optioservus kubotai saghaliensis*: holotype ♂, allotype 1♀, paratypes 1♂1♀ (NSMT): Shiritori, Saghalien, 24–VII–1938, H. HASEGAWA leg.

Additional materials. Adults. **[Japan]** <Hokkaido> 11 exs. (EUM), Oosawa-gawa, Is. Rebun, 10–VIII–1990, M. SATÔ leg.; 3 exs. (CKN), Naibetsu-gawa, Chitose, 10–IX–1987, T. ITO leg.; 1 ex. (CKN), ditto but 18–IX–1992, T. ITO & Y. NAGAYASU leg.; 2 exs. (CKN), R-Urashimauti-gawa, Ikutahara, Monbetsu-gun, 18–VII–1998, S. OHMOMO leg.; 9 exs. (CKN), Sarubetsu-gawa, Sarabetsu-mura, 1–VIII–2006, H. YOSHITOMI leg.; 4 exs. (EUM), Sekihoku-tôge, 5–VIII–1985, M. SATÔ leg.; 40 exs. (NSMT), Asahikawa, 27–VIII–1960, S. NOMURA leg.; 8 exs. (EUM), Nisshô-tôge, 8–VIII–1985, M. SATÔ leg.; 4 exs. (EUM), ditto but 23–VIII–1995, M. SATÔ leg.; 2 exs. (EUM), Kitami-Aioi, 16–VII–1976, M. SATÔ leg.; 4 exs. (EUM), Jozankei, 19–VII–1976, M. SATÔ leg. 2 exs. (EUM), Akkeshi, 18–VII–1976, M. SATÔ leg.; 4 exs. (NMW), Hoheikyo, 22–VIII–1977, M. SATÔ leg. <Aomori Pref.> 2 exs. (CKN), Ôtakisawa, Kaimori, Sannohe-machi, Sannehe-gun, alt. 420m, 15–VIII–1998, N. HIKIDA leg.; 2 exs. (CKN), Gonohe-gawa, Shingô-mura, Sannehe-gun, alt. 380m, 15–VIII–1998, N. HIKIDA leg.; 3 exs. (CKN), Myôgaeri-gawa, Hirakozawa, Shingô-mura, Sannehe-gun, alt. 450m, 14–VIII–1998, N. HIKIDA leg. <Akita Pref.> 4 exs. (EUM), Ohta-cho, 7–X–1990, F. HORI leg. <Iwate Pref.> 10 exs. (CKN), Ashinasawa-gawa, Maeda, Tamayama-mura, 25–IX–2004, T. OGATA leg.; 4 exs. (CKN), Komaga-mine, Jyobôji-machi, 24–IX–2004, T. OGATA leg.; 4 exs. (CKN), Jyobôji, 26–IX–2005, J. NAKAJIMA leg.; 3 exs. (CKN), Ekari, Kuzumaki-machi, Iwate-gun, 30–VII–1997, N. HIKIDA leg.; 73 exs. (CKN), Takko-gawa, Kamitakko, Kotsunagi, Ichinohe-machi, 17–VIII–1998, N. HIKIDA leg.; 15 exs. (CKN), Nishi-dake, Jyobôji-machi, 24–IX–2004, N. HIKIDA leg. <Tochigi Pref.> 17 exs. (CKN), Uramino-taki, Kiyotakiasawa-machi, Nikkô-shi, 11–VI–2006, Y. KAMITE leg.; 4 exs. (CKN), ditto but 23–V–1997, S. OHMOMO leg.; 3 exs. (CKN), ditto but 12–VII–1998, K. SATÔ leg.; 1 ex. (CKN), Sotoyamazawa, Okunikkô, 23–VIII–1996, K. SATÔ leg. <Gunma Pref.> 5 exs. (EUM), Ozegahara, 20–24–VIII–1979, M. SATÔ leg.; 4 exs. (NSMT), Nidoage, 20–VIII–1960, K. SAKUMA leg.; 10 exs. (NSMT), Near-nidoage, 21–VIII–1960, Y. SHIBATA leg. <Nagano Pref.> 1 ex. (EUM), Kisofukushima, 23–VIII–1972, M. SATÔ leg. **[Russia]** 8 exs. (EUM), Mt. Tumannaya, Primorskiy Kray, 20–22–VIII–1991, M. SATÔ leg.; 2 exs. (EUM), Mt. Krinichnaya, Primorskiy Kray, 22–VIII–1991, M. SATÔ leg.; 22 exs. (EUM), Mt. Chandalas, Primorskiy Kray, 23–24–VIII–1991, M. SATÔ leg.; 2 exs. (EUM), Polovinka, Ussuri, R. Russia, 15–VIII–1992, M. SATÔ leg.; 1 ex. (EUM), Mt. Pereval'naya, Vangou, V. Russia, 20–VIII–1992, M. SATÔ leg.; 14 exs. (EUM), Mokrusha, 19–VIII–1992, M. SATÔ leg.; 18 exs. (EUM), Monakino, Muldza River, 21–VIII–1992, M. SATÔ leg.; 1 ex. (EUM), Pnm. Terr. Biostation near Chuguevka, 26–29–VI–1999, Y. NOTSU leg.; 2 exs. (CKN), Vuisokogurunui, Khabarovsk krai, 22–VII–1999, K. HIRAI leg.; 2 exs. (EUM), Sakhalin, Anna River, Dolinksii Coun., 28–VII–1977, G. Lafer, on the stones in the water; 4 exs. (EUM), Sakhalin, Dagi. River, 9–IX–1979, Makartsenko; 4 exs. (NMW), Kuril Islands, Shikotan, 1994; 3 exs. (NMW), Kuril Islands, Iturup, 1994. **[China]** 11 exs. (NMW), Jilin, Changbaishan, 1,750 m, Erdao Baihe, 20–VIII–1994, JÄCH leg. (31); 2 exs. (NMW), Jilin, Env. Baihe City 15–VIII–1994, 700 m, Ji & WANG leg.(4); 22 exs. (NMW), Jilin, Env. Baihe, Changbaishan, 17–VIII–1994, Ji & WANG leg. (13–18); 17 exs. (NMW), Jilin, 30 km NE Baihe City nr. Hongsi, 650 m, 17–VIII–1994, Ji & WANG leg.(15); 2 exs. (NMW), Jilin, Near Baihe City, 650 m, Erdao Baihe, 15–VIII–1994, Ji & WANG leg.(2); 11 exs. (NMW), ditto but 17–VIII–1994, Ji & WANG leg.(18); 1 ex. (NMW), Jilin, 60 km NE Baihe City, 18–VIII–1994, 1,000 m, JÄCH

leg.(21); 34 exs. (NMW), Jilin, Near Baihe City, 700 m, Erdao Baihe, 19–VIII–1994, Ji & WANG leg. (28); 12 exs. (NMW), Jilin, Changbaishan, 16–VIII–1994, 1,700 m, Ji & WANG leg. (6); 1ex. (NMW), ditto, JÄCH leg.; 5 exs. (NMW), Jilin, Changbaishan, 16–VIII–1994, 1,650 m, Ji & WANG leg.(7); 1ex. (NMW), ditto, JÄCH leg.; 2 exs. (NMW), Liaoning (159), 35 km NE Kuandian, 520 m, Baishila N.R., 30–VIII–1995, Ji & WANG leg.

Larva. Body cylindrical; TL/TW 6.43–6.91 (6.72). Colour dark brown, ventral aspect, antennae, mouth parts and legs paler. Head about 1.06 times as wide as long. Mandible subtriangular, 1.61–1.67 (n = 2, 1.64) times as long as wide. Labrum about twice as wide as long. Pronotum slightly wider than long; PW/PL 1.33–1.42 (1.37); not humped in middorsal and sublateral aspect. Abdomen slightly humped in middorsal aspect, not humped in sublateral aspect, lateral aspect of terminal segment not so polished, densely with setiferous tubercles.

Measurements of the larvae (n = 3). TL 5.08–5.72 (5.30) mm; HW 0.36–0.39 (0.38) mm; PL 0.52–0.60 (0.55) mm; PW 0.70–0.80 (0.75) mm; TW 0.74–0.84 (0.79) mm.

Specimens examined. Larvae. **[Japan]** 2 immature larvae (CKN), Sotoyama-zawa, Nikko-shi, 11–VI–2006, Y. KAMITE leg.; 2 mature (?) larvae and 9 immature larvae (CKN), Uramino-taki, Kiyotakiasawa-machi, Nikkô-shi, 11–VI–2006, Y. KAMITE leg. **[China]** 1 immature larva (NMW), Jilin, Changbaishan, 1,750 m, Erdao Baihe, 20–VIII–1994, leg. JÄCH (31).

Distribution. Japan (Hokkaido, Honshû), Far East Russia, China (Jilin, Liaoning), Korea?.

Notes. Both *O. kubotai kubotai* and *O. k. saghaliensis* are distinguishable from *H. hasegawai* in the general appearance of pronotum and elytra. But these features are due to a brachypterous or macropterous condition, and are not specific features. Therefore, *O. kubotai kubotai* and *O. k. saghaliensis* are synonyms of *H. hasegawai*. SATÔ (1992) synonymized *O. kubotai* with *O. maculatus* NOMURA in his doctoral thesis, but is distinguishable from the latter by the following characteristics: radius posterior (RP) short; dorsal surface of head punctuate; apex of intercoxal process of abdominal ventrite 1 relatively round; ventrite 5 rugose; phallobase smooth; penis slender.

Remarks. In adult features, this species resembles *H. corpulentus*, but *H. hasegawai* is distinguishable from the latter by the following characteristics: body small; intervals of elytra relatively flattened; apex of abdominal sternite 5 evenly rounded; penis long and slender. In larval features, this species also resembles *H. corpulentus*, but is distinguishable from the latter by the following characteristics: mandible not so stout; abdomen slightly humped in middorsal aspect.

***Heterlimnius ater* (NOMURA), comb. nov.**

(Figs. 5–6, 19–23, 55–66, 97–99)

Optioservus (*Cyclolimnius*) *ater* NOMURA, 1958, 12 (type locality: Bôhira [correct: Bôdaira], Yamagata Pref., Japan; type material: NSMT, examined). — SATÔ, 1977, 4; Satô, 1985, 438, pl. 80, fig. 17; SATÔ, 1992, 183; JÄCH *et al.*, 2006, 436.

Optioservus (s. str.) *hayashii* NOMURA, 1960, 34 (type locality: Yachi Spa, Aomori Pref., Japan; type material: NSMT, examined). — SATÔ, 1977, 4; JÄCH *et al.*, 2006, 436. **Syn. nov.**

Adult. TL/EW 1.95–2.10 (2.02). Dorsal surface black, but meso- and metaventrites brown to blackish brown; elytra black or with yellowish patches at humeral area,

sometimes somewhat reddish at humeral patches. Ventral surface, antennae, mouth parts and legs reddish brown to blackish brown, but antenna, abdomen, tibiae and tarsi paler.

Head sparsely punctuated, not rugose. Clypeus about 3.02 times as wide as long. Labrum about 1.63 times as wide as long. Antennae 11-segmented. Central area of mandible not so wide.

Pronotum transverse, sparsely punctuated; lateral margins not or feebly serrate; not furnished with prescutellar pits; PW/PL 1.15–1.37 (1.25); sublateral carinae 0.32–0.34 ($n = 4$, 0.33) times as long as PL.

Elytra elongate oval (only BF); intervals not rugose, well convex; striae punctures somewhat large and deep; basal part of 3rd interval wider than 4th; EL/EW 1.37–1.44 (1.41); EL/PL 2.14–2.52 (2.31); EW/PW 1.26–1.39 (1.31).

Prosternal process narrowing behind and broadly rounded at apex.

Apex of abdominal ventrite 5 evenly rounded.

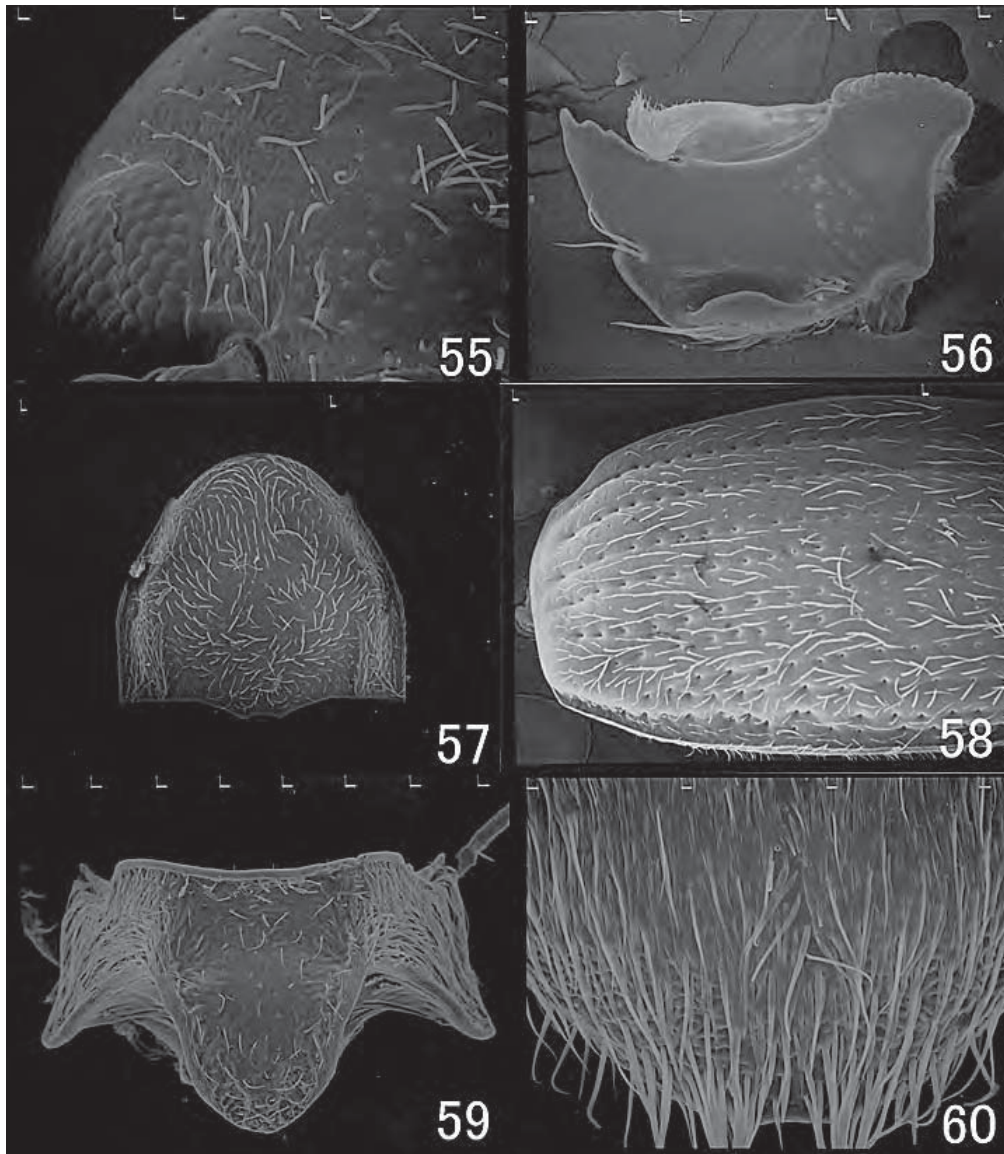
Aedeagus as illustrated (Figs. 97–98); penis long and slender, somewhat dilated at base, narrowed apically, apical part slender and curved ventrad in lateral aspect.

Ovipositor as illustrated (Fig. 99); coxite about 6.78 times as long as stylus; valvifer about 11.30 times as long as stylus.

Measurements. BF ($n = 10$): TL 2.41–2.72 (2.54) mm; PL 0.71–0.83 (0.77) mm; PW 0.92–1.04 (0.96) mm; EL 1.68–1.89 (1.77) mm; EW 1.17–1.32 (1.25) mm.

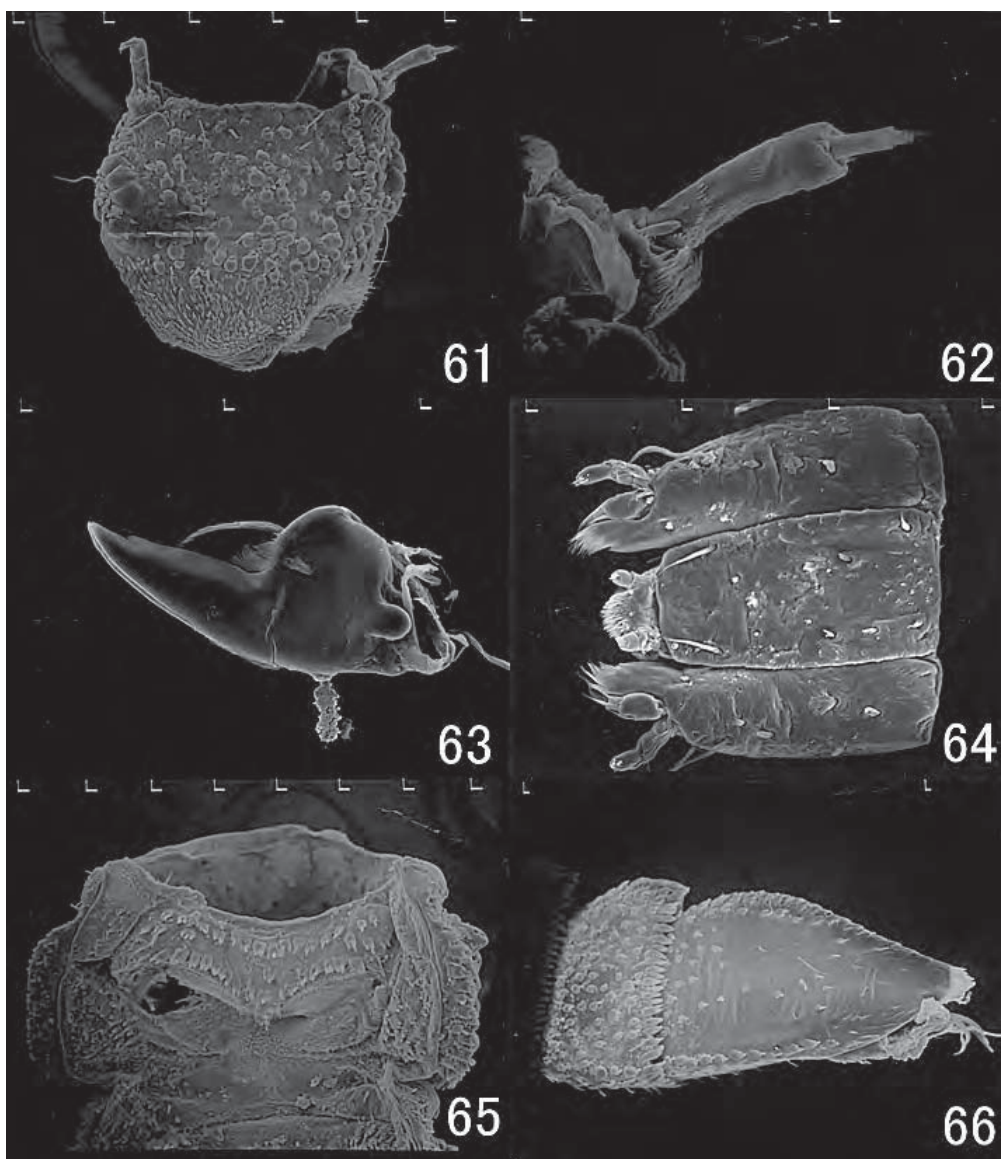
Type materials. *Optioservus ater*: holotype ♀ (NSMT), Bôhira [correct: Bôdaira], Yamagata Pref., 18–X–1931, K. SHIRAHATA leg. *Optioservus hayashii*: holotype ♂, allotype 1♀, and paratype 1♀ (NSMT), Yachi Spa, Aomori Pref., 24–VII–1959, Nonaka HAYASHI leg.; paratypes 2 exs. (NSMT), Tsukiyama, Yamagata Pref., 18–VI–1960, K. SHIRAHATA leg.

Additional materials. Adults. [**Japan**] <Aomori Pref.> 18 exs. (CKN), Oibe-gawa, Obuchi, Rokkasyo-mura, 5–IX–2006, N. YAGAGIDA leg.; 3 exs. (NSMT), Tsuta, 20–VI–1965, A. FUKUDA leg. <Akita Pref.> 17 exs. (CKN), Chôkai-kôgen, Yurihonjyô-shi, 16–IX–2007, Y. KAMITE leg. <Iwate Pref.> 5 exs. (CKN), Yoriki, Matsuo-mura, 24–IX–2004, T. OGATA leg.; 4 exs. (CKN), Hachimantai, 26–IX–2005, J. NAKAJIMA leg.; 13 exs. (CKN), R–Guntarigawa, Matsuo-mura, Iwate-gun, alt. 800m, 16–VIII–1998, N. HIKIDA leg.; 1 ex. (CKN), Takko-gawa, Kamitakko, Kotsunagi, Ichinohe-machi, 17–VIII–1998, N. HIKIDA leg.; 2 exs. (CKN), Nishi-dake, Jyobôji-machi, 24–IX–2004, N. HIKIDA leg.; 13 exs. (CKN), Kanazawa, Kashiwadai, Matsuo-mura, 24–IX–2004, N. HIKIDA leg. <Yamagata Pref.> 1 ex. (NSMT), Mt. Chokai Sobuyachi, 18–VIII–1962, K. SHIRAHATA leg.; 4 exs. (CKN), Iwano, Yuza-machi, 21–IX–2004, J. NAKAJIMA leg.; 48 exs. (CKN), ditto but 16–IX–2007, Y. KAMITE leg.; 30 exs. (CKN), Hijimagari, Yuza-machi, 16–IX–2007, Y. KAMITE leg.; 15 exs. (CKN), Suguse, Yuza-machi, 15–VIII–2008, T. IKEDA leg.; 4 exs. (CKN), Takatani, Tsuruoka-shi, 14–IX–2007, Y. KAMITE leg.; 6 exs. (CKN), Tsukiyama-guchi, Tsukiyama-zawa, Nishikawa-machi, 23–IX–2004, N. HIKIDA leg.; 9 exs. (CKN), Tsukiyama-zawa, Nishikawa-machi, 14–IX–2007, Y. KAMITE leg.; 1 ex. (CKN), Shidu, Nishikawa-machi, 14–IX–2007, Y. KAMITE leg.; 3 exs. (CKN), Zaôsarukura, Kaminoyama-shi, 15–IX–2007, Y. KAMITE leg.; 8 exs. (CKN), Bôdaira-kôgen, Kaminoyama-shi, 15–IX–2007, Y. KAMITE leg.; 2 exs. (NSMT), Bôhira, Yamagata Pref., 2–VII–1955, K. SHIRAHATA leg.; 1 ex. (NSMT), ditto but 2–IX–1955, K. SHIRAHATA leg. <Miyagi Pref.> 2 exs. (CKN), Ôtaki-gawa, Onoda-machi, 27–IX–2005, J. NAKAJIMA leg.; 4 exs. (EUM), Shironuma, 19–VIII–1978, M. Satô leg.; 4 exs. (EUM), Yutori-numa, 18–VIII–1978, M. SATÔ leg.



Figs. 55–60. *H. ater*, adult. — 55, Head; 56, mandible; 57, pronotum; 58, elytron, basal part; 59, prosternum; 60, ventrite 5. Scales: 100 μm for Figs. 55–56, 59–60; 1,000 μm for Figs. 57–58.

Larva. Body cylindrical; TL/TW 6.12–6.84 (6.51). Colour dark brown, ventral aspect, antennae, mouth parts and legs paler. Head about 1.16 times as wide as long. Mandible falciform, 1.82–1.94 ($n = 2$, 1.88) times as long as wide. Labrum about 2.17 times as wide as long. Pronotum slightly wider than long; PW/PL 1.32–1.40 (1.36); slightly humped in middorsal and sublateral aspect. Abdomen clearly humped in middorsal aspect; latter segments more humped; slightly humped in sublateral aspect; lateral aspect of terminal segment polished, sparsely with setiferous tubercles.



Figs. 61–66. *H. ater*, larva. — 61, Head; 62, antenna; 63, mandible; 64, maxilla and labium; 65, mesothorax, ventral view; 66, abdominal segment 9, lateral view. Scales: 100 μm for Figs. 61–65; 1,000 μm for Fig. 66.

Measurements of the larvae (n = 3). TL 5.26–5.47 (5.38) mm; HW 0.39–0.43 (0.41) mm; PL 0.52–0.60 (0.57) mm; PW 0.73–0.79 (0.77) mm; TW 0.79–0.86 (0.83) mm.

Specimens examined. Larvae. [Japan] <Iwate Pref.> 3 immature larvae (CKN), Guntari-sawa, Yoriki, Matsuo-mura, 24-IX-2004, T. OGATA leg. <Yamagata Pref.> 4 immature larvae (CKN), Hijimagari, Yuza-machi, 16-IX-2007, Y. KAMITE leg.; 6 mature larvae and 5 immature larvae (CKN), Tsukiyama-zawa, Nishikawa-machi, 14-IX-2007, Y. KAMITE leg.

Distribution. Japan (Honshû).

Notes. SATÔ (1992) already synonymized *O. hayashii* with *O. ater* in his doctoral thesis. But unfortunately, his thesis wasn't published. Type material of *O. hayashii* is strongly convex at basal part of 3rd and 7th intervals of elytra, but this feature is easily variable. These two species can't distinguish any other characteristics. Therefore, *O. hayashii* is junior synonym of *H. ater*.

Remarks. In adult features, this species resembles *H. corpulentus*, but is distinguishable from the latter by the following characteristics: body small; head sparsely punctuated; antennae stability 11-segmented; apex of abdominal sternite 5 evenly rounded. Within the Japanese fauna, this species resembles *H. hasegawai*, but is distinguishable from the latter by the following characteristics: body somewhat large; head sparsely punctuated; antennae stability 11-segmented; intervals of elytra convex; apical part of penis not so dilated in lateral aspect. In larval features, this species somewhat resembles *H. hasegawai*, but is distinguishable from the latter by the following characteristics: mandible falciform; abdomen clearly humped in middorsal aspect.

***Heterlimnius ennearthrus* sp. nov.**

(Figs. 7–8, 67–72, 100–102)

Adult. TL/EW 2.11–2.26 (2.17) in BF; TL/EW 2.12–2.21 (2.18) in MF. Dorsal surface black, but meso- and metaventrites blackish brown; elytra blackish brown to black. Ventral surface, antennae, mouth parts and legs reddish brown to blackish brown, but antennal segments 1–6, tibiae and tarsi paler.

Head densely rugose and punctuated. Clypeus about 3.05 times as wide as long. Labrum about 1.91 times as wide as long. Antennae 9-segmented. Central area of mandible clearly wide.

Pronotum transverse, sparsely punctuated; lateral margins not or feebly serrate; not furnished with prescutellar pits; PW/PL 1.24–1.38 (1.32) in BF; sublateral carinae 0.29–0.35 (n = 9, 0.33) times as long as PL; PW/PL 1.38–1.45 (1.42) in MF; sublateral carinae 0.31–0.32 (n = 3, 0.31) times as long as PL.

Elytra elongate oval (BF) or oblong (MF); intervals not rugose, relatively flattened; striae punctures somewhat large and deep; basal part of 3rd interval almost as wide as 4th; in BF EL/EW 1.52–1.61 (1.56); EL/PL 2.47–2.78 (2.62); EW/PW 1.23–1.33 (1.27); in MF EL/EW 1.57–1.66 (1.62); EL/PL 2.84–3.00 (2.92); EW/PW 1.25–1.28 (1.27).

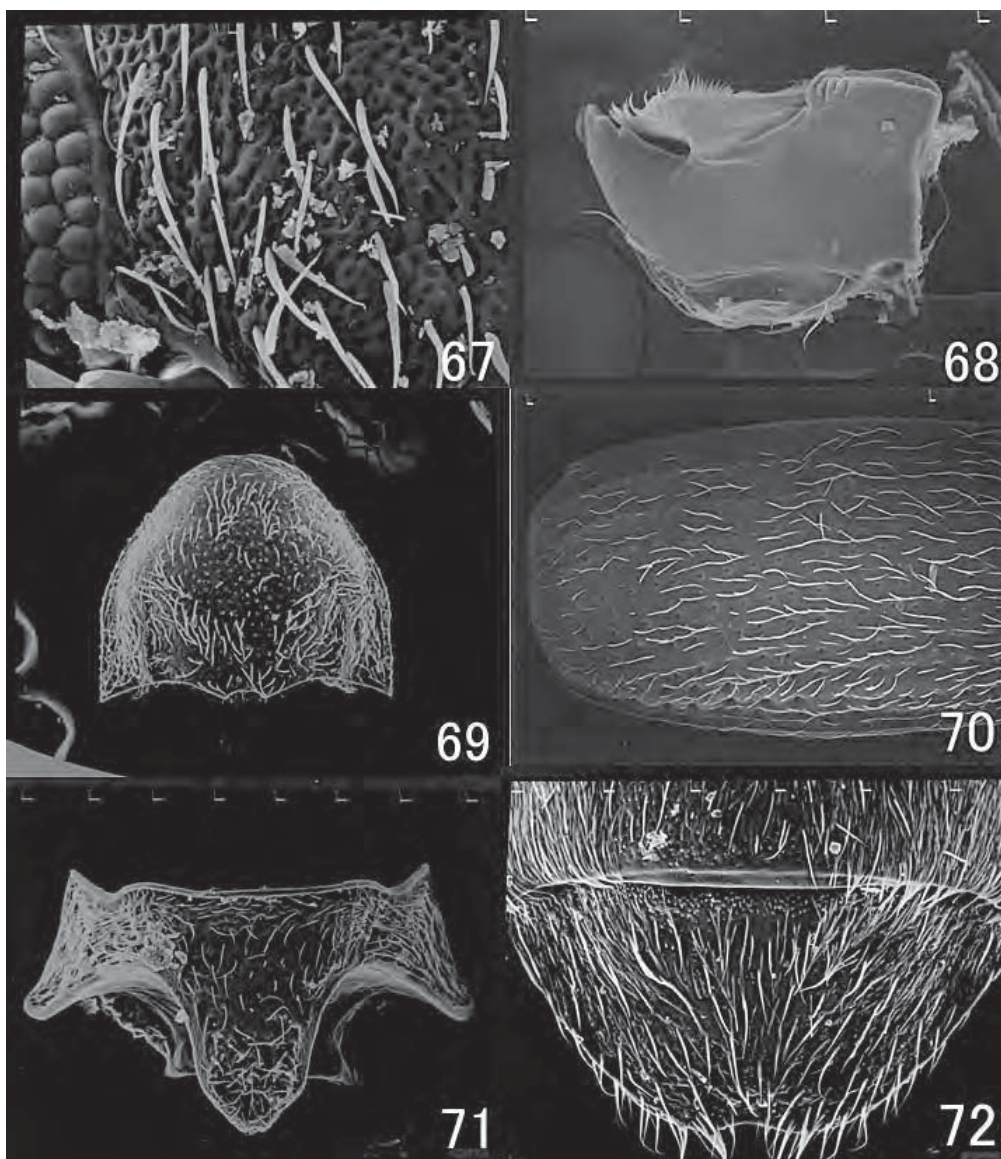
Prosternal process narrowing behind and broadly rounded at apex.

Apex of abdominal ventrite 5 slightly emarginated.

Aedeagus as illustrated (Figs. 100–101); penis long and slender, dilated at base, gradually narrowed to apex; apical 7th slightly dented and curved ventrad in lateral aspect.

Ovipositor as illustrated (Fig. 102); coxite about 5.07 times as long as stylus; valvifer about 9.64 times as long as stylus.

Measurements. BF (n = 9): TL 2.54–2.98 (2.74) mm; PL 0.68–0.86 (0.76) mm; PW 0.93–1.07 (1.00) mm; EL 1.86–2.12 (1.98) mm; EW 1.17–1.37 (1.27) mm. MF (n = 3): TL 2.65–2.92 (2.82) mm; PL 0.69–0.74 (0.72) mm; PW 0.98–1.06 (1.02) mm; EL 1.96–2.19 (2.10) mm; EW 1.25–1.32 (1.29) mm.



Figs. 67–72. *H. ennearthrus* sp. nov., adult — 67, Head; 68, mandible; 69, pronotum; 70, elytron, basal part; 71, prosternum; 72, ventrite 5. Scales: 100 μm for Figs. 67–68, 71–72; 1,000 μm for Figs. 69–70.

Type material. Holotype: ♂ (NMW), [Kazakhstan] S-Altaj Ustj Kamenogorsk Sewernoje env., 26–30–VIII–1995, DOLIN leg.(26). Paratypes: 16 exs. (NMW), same data as for the holotype.

Distribution. Kazakhstan.

Remarks. This new species is easily distinguishable from the other species by the following characteristics: antennae stability 9-segmented; penis slender, gradually narrowed to apex.

Etymology. The specific name refers to the 9-segmented antennae of this species.

Heterlimnius jaechi sp. nov.

(Figs. 9–10, 73–78, 103–105)

Adult. TL/EW 1.92–2.05 (2.00) in BF; TL/EW 2.00–2.12 (2.05) in MF. Dorsal surface black, but mesothorax and metathorax brown to blackish brown; elytra blackish brown to black. Ventral surface, antennae, mouth parts and legs reddish brown to blackish brown, but antennal segments 1–8, tibiae and tarsi paler.

Head sparsely punctuated, not rugose. Clypeus about 3.04 times as wide as long. Labrum about 1.71 times as wide as long. Antennae 11-segmented. Central area of mandible not so wide.

Pronotum transverse, sparsely punctuated; lateral margins not or feebly serrate; furnished with prescutellar pits; PW/PL 1.20–1.35 (1.27) in BF; sublateral carinae 0.30–0.36 (n = 10, 0.33) times as long as PL; PW/PL 1.19–1.38 (1.30) in MF; sublateral carinae 0.29–0.34 (n = 10, 0.31) times as long as PL.

Elytra elongate oval (BF) or oblong (MF); intervals not rugose, relatively flattened; striae punctures large and deep; basal part of 3rd interval wider than 4th; in BF EL/EW 1.38–1.46 (1.43); EL/PL 2.39–2.63 (2.50); EW/PW 1.35–1.41 (1.38); in MF EL/EW 1.45–1.60 (1.52); EL/PL 2.65–3.10 (2.85); EW/PW 1.41–1.50 (1.44).

Prosternal process narrowing behind and broadly rounded at apex.

Apex of abdominal ventrite 5 evenly rounded.

Aedeagus as illustrated (Figs 103–104); penis stout, dilated at base, narrowed apically; apical part slender and curved ventrad in lateral aspect.

Ovipositor as illustrated (Fig. 105); coxite about 6.63 times as long as stylus; valvifer about 10.38 times as long as stylus.

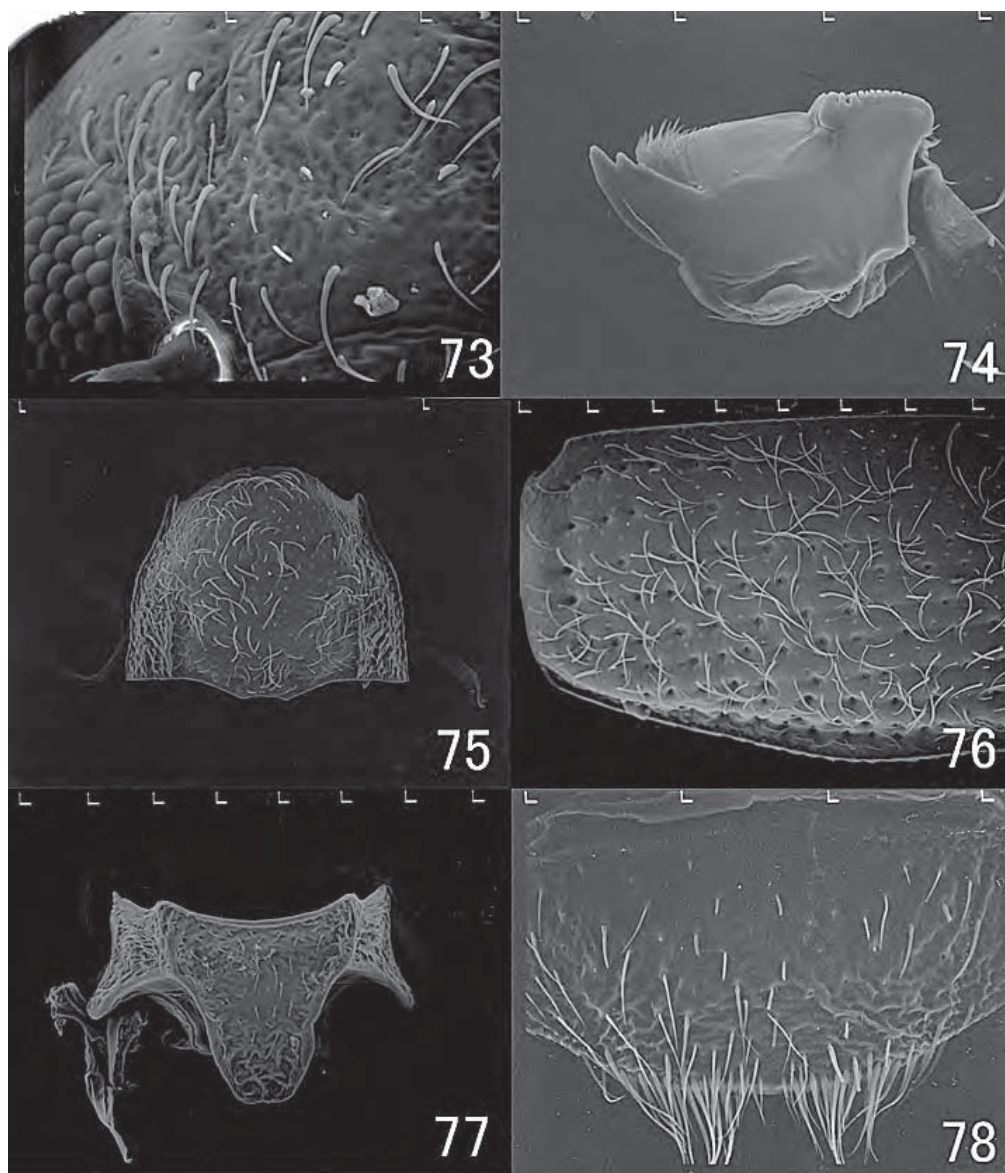
Measurements. BF (n = 10): TL 1.73–2.04 (1.88) mm; PL 0.51–0.58 (0.54) mm; PW 0.63–0.74 (0.68) mm; EL 1.22–1.46 (1.34) mm; EW 0.88–1.02 (0.94) mm. MF (n = 10): TL 1.98–2.28 (2.09) mm; PL 0.50–0.61 (0.55) mm; PW 0.67–0.77 (0.71) mm; EL 1.44–1.67 (1.55) mm; EW 0.97–1.11 (1.02) mm.

Type material. Holotype: ♂ (NMW), [India] Himachal Pradesh, J97–316, A. STAUDER leg. Paratypes: 23 exs. (NMW), same data as for the holotype.; 1 ex. (NMW), Himachal Pradesh, 2,000 m, 24–VIII–1995, Kullu Valley, Nr. 288–8, A. STAUDER leg. [Bhutan] 28 exs. (NMW), 2,500 m, Timphu Prov., Taba, 15–20–VII–1990, HOLZSCHUH leg.; 4 exs. (NMW), Timphu Prov., Camina, 2,500–2,800 m, HOLZSCHUH leg.

Distribution. Bhutan (western), India (northwest).

Remarks. This new species resembles *H. hasegawai*, but is distinguishable from the latter by the following characteristics: body small; head sparsely punctuated; antennae stability 11-segmented; pronotum furnished with prescutellar pits; elytra immaculate; penis stout.

Etymology. The specific name is dedicated to Dr. Manfred A. JÄCH who offered many interesting specimens and helped in many ways.

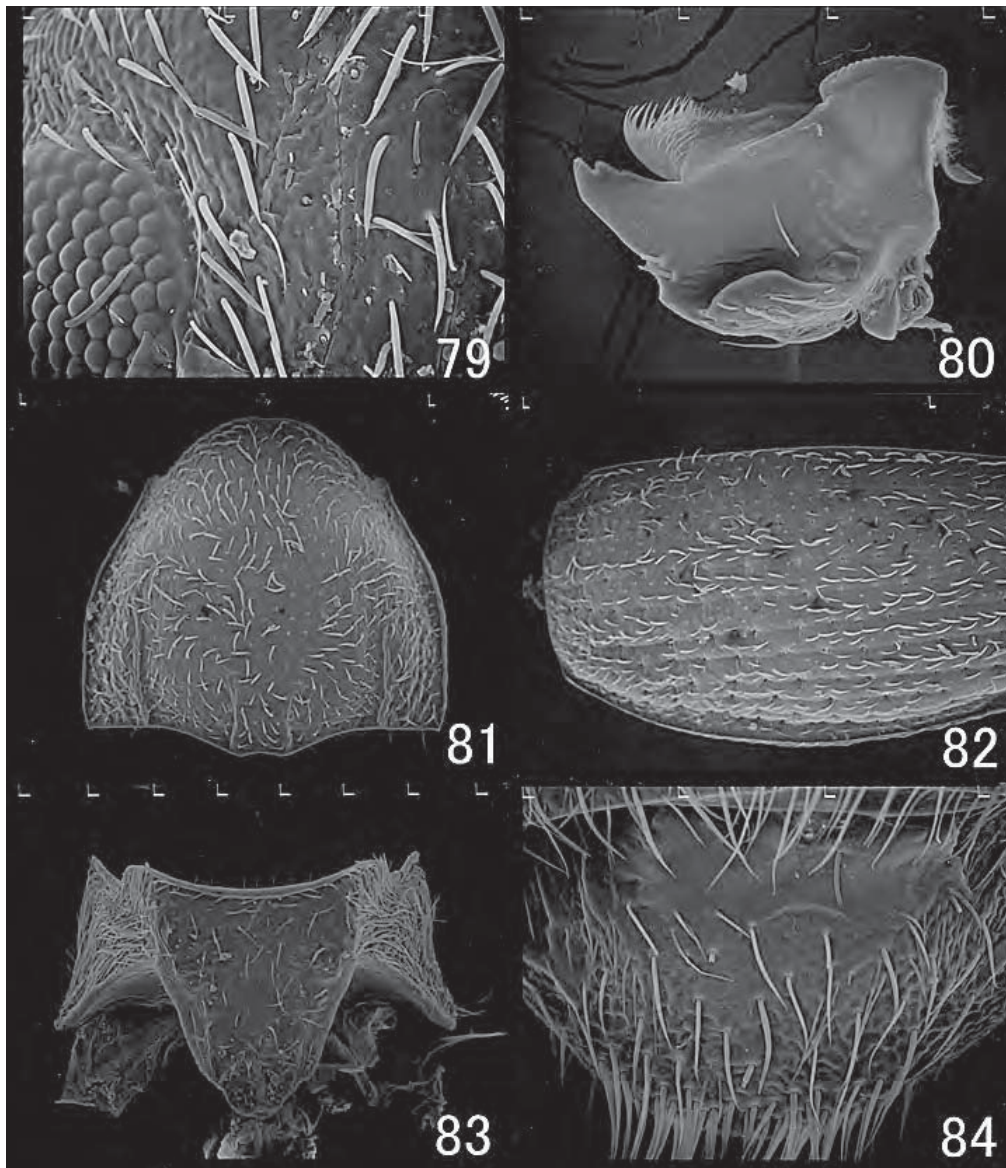


Figs. 73–78. *H. jaechi* sp. nov., adult. — 73, Head; 74, mandible; 75, pronotum; 76, elytron, basal part; 77, prosternum; 78, ventrite 5. Scales: 100 μm for Figs. 73–74, 76–78; 1,000 μm for Fig. 75.

***Heterlimnius hisamatsui* sp. nov.**

(Figs. 11–12, 79–84, 106–108)

Adult. TL/EW 1.93–2.04 (1.97) in BF; TL/EW 2.03–2.14 (2.09) in MF. Dorsal surface black, but meso- and metaventrites brown to blackish brown; elytra reddish brown to black. Ventral surface, antennae, mouth parts and legs reddish brown to blackish brown, but antennal segments 1–8, tibiae and tarsi paler.



Figs. 79–84. *H. hisamatsui* sp. nov., adult. — 79, Head; 80, mandible; 81, pronotum; 82, elytron, basal part; 83, prosternum; 84, ventrite 5. Scales: 100 μm for Figs. 79–80, 83–84; 1,000 μm for Figs. 81–82.

Head sparsely punctuated, not rugose. Clypeus about 2.94 times as wide as long. Labrum about 1.76 times as wide as long. Antennae 11-segmented. Central area of mandible somewhat wide.

Pronotum transverse, sparsely punctuated; lateral margins not or feebly serrate; furnished with prescutellar pits; PW/PL 1.17–1.40 (1.27) in BF; sublateral carinae 0.27–0.35 ($n = 8$, 0.31) times as long as PL; PW/PL 1.19–1.33 (1.28) in MF; sublateral carinae 0.29–0.33 ($n = 10$, 0.31) times as long as PL.

Elytra elongate oval (BF) or oblong (MF); intervals somewhat rugose, well convex; striae punctures not so large, shallow; basal part of 3rd interval wider than 4th; in BF EL/EW 1.31–1.46 (1.42); EL/PL 2.14–2.85 (2.55); EW/PW 1.35–1.47 (1.41); in MF EL/EW 1.50–1.56 (1.53); EL/PL 2.66–2.86 (2.75); EW/PW 1.36–1.47 (1.41).

Prosternal process narrowing behind and broadly rounded at apex.

Apex of abdominal ventrite 5 evenly rounded.

Aedeagus as illustrated (Figs. 106–107); penis somewhat stout, dilated at base, narrowed apically; apical part slender and curved ventrad in lateral aspect.

Ovipositor as illustrated (Fig. 108); coxite about 4.43 times as long as stylus; valvifer about 8.00 times as long as stylus.

Measurements. BF (n = 10): TL 1.94–2.35 (2.20) mm; PL 0.53–0.71 (0.62) mm; PW 0.68–0.84 (0.79) mm; EL 1.41–1.71 (1.58) mm; EW 1.00–1.19 (1.12) mm. MF (n = 10): TL 2.06–2.53 (2.35) mm; PL 0.54–0.68 (0.63) mm; PW 0.70–0.87 (0.80) mm; EL 1.52–1.85 (1.72) mm; EW 1.00–1.21 (1.12) mm.

Type material. Holotype: ♂ (EUM), [China] Mt. Niba Shan, 2320m, Yingzing Xian, Sichuan, 26–X–1996, M. SATÔ leg. Paratypes: 40 exs. (CKN, EUM), same data as for the holotype.; 32 exs. (EUM), Dagou, 1,860 m, Mao Xian, Sichuan, 21–IX–1996, M. SATÔ leg.; 16 exs. (EUM), Galong Chi, 2,500 m, Mt. Jiuding Shan, Sichuan, 23–IX–1996, M. SATÔ leg.; 4 exs. (NMW), Sichuan, Emeishan 160 km SSW Chengdu, 1,530 m (4a), 22–VI–1994, SCHILLHAMMER leg.; 2 exs. (NMW), Sichuan, Emeishan 160 km SSW Chengdu, 1,230 m (5a), 22–VI–1994, SCHILLHAMMER leg.; 10 exs. (NMW), Yunnan, LUGU LAKE – Luo Shui, 27°45' N 100°45' E, 8–9–VII–1992, E. JENDEK leg.; 1 ex. (NMW), NW–Yunnan, Yulongxueshan NP near Baishui ca 30 km N Lijiang, 2,900–3,200 m, 7–11–VII–1994, SCHILLHAMMER leg.(17); 1 ex. (NMW), NW–Yunnan, ca 100 km NW Lijiang, Hengduanshan Jiduan – Weixi Jiduan – Ludie, 2,100 m (9), 30–VI–1994, SCHILLHAMMER leg.; 1 ex. (NMW), NW–Yunnan, ca 100 km NW Lijiang, Hengduanshan Jiduan – Weixi ca 5 km W Jiduan, 2,100 m (11), 3–VII–1994, SCHILLHAMMER leg.

Distribution. China (Sichuan, Yunnan).

Remarks. This new species resembles *H. jaechi*, but is distinguishable from the latter by the following characteristics: body large; intervals of elytra convex; penis relatively slender.

Etymology. The specific name is dedicated to the late Dr. Sadanari HISAMATSU.

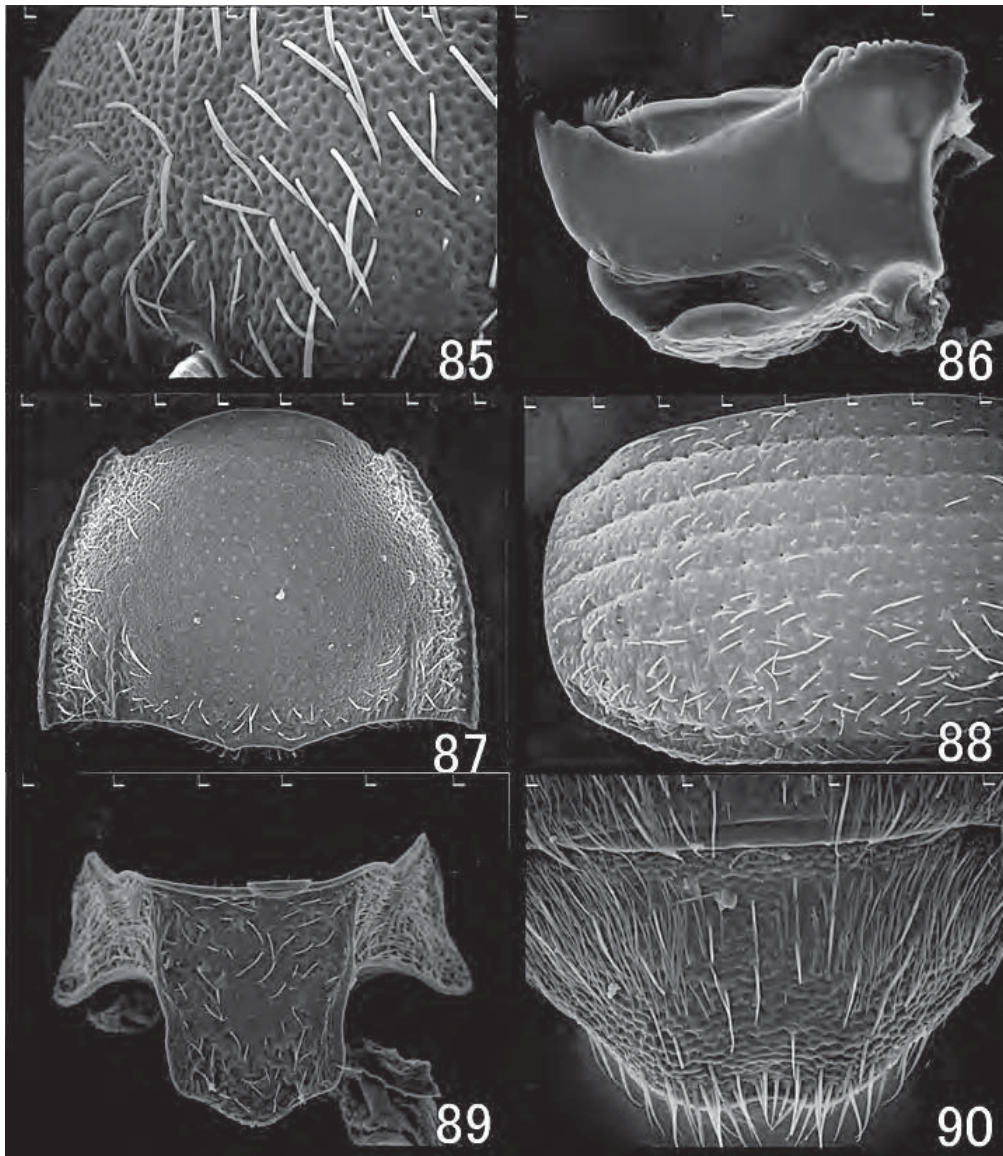
Heterlimnius shepardi sp. nov.

(Figs. 13–14, 85–90, 109–111)

Adult. TL/EW 1.84–2.06 (1.93) in BF; TL/EW 1.89–2.00 (1.95) in MF. Dorsal surface black, but meso- and metaventrites brown to blackish brown; elytra blackish brown to black. Ventral surface, antennae, mouth parts and legs reddish brown to blackish brown, but antennal segments 1–8 and tarsi paler.

Head densely punctuated, not rugose. Clypeus about 2.76 times as wide as long. Labrum about 1.81 times as wide as long. Antennae 11-segmented. Central area of mandible somewhat wide.

Pronotum transverse, densely punctuated; lateral margins not or feebly serrate; not furnished with prescutellar pits; PW/PL 1.29–1.49 (1.42) in BF; sublateral carinae 0.23–0.29 (n = 7, 0.26) times as long as PL; PW/PL 1.49–1.66 (1.61) in MF; sublateral carinae



Figs. 85–90. *H. shepardi* sp. nov., adult. — 85, Head; 86, mandible; 87, pronotum; 88, elytron, basal part; 89, prosternum; 90, ventrite 5. Scales: 100 μ m.

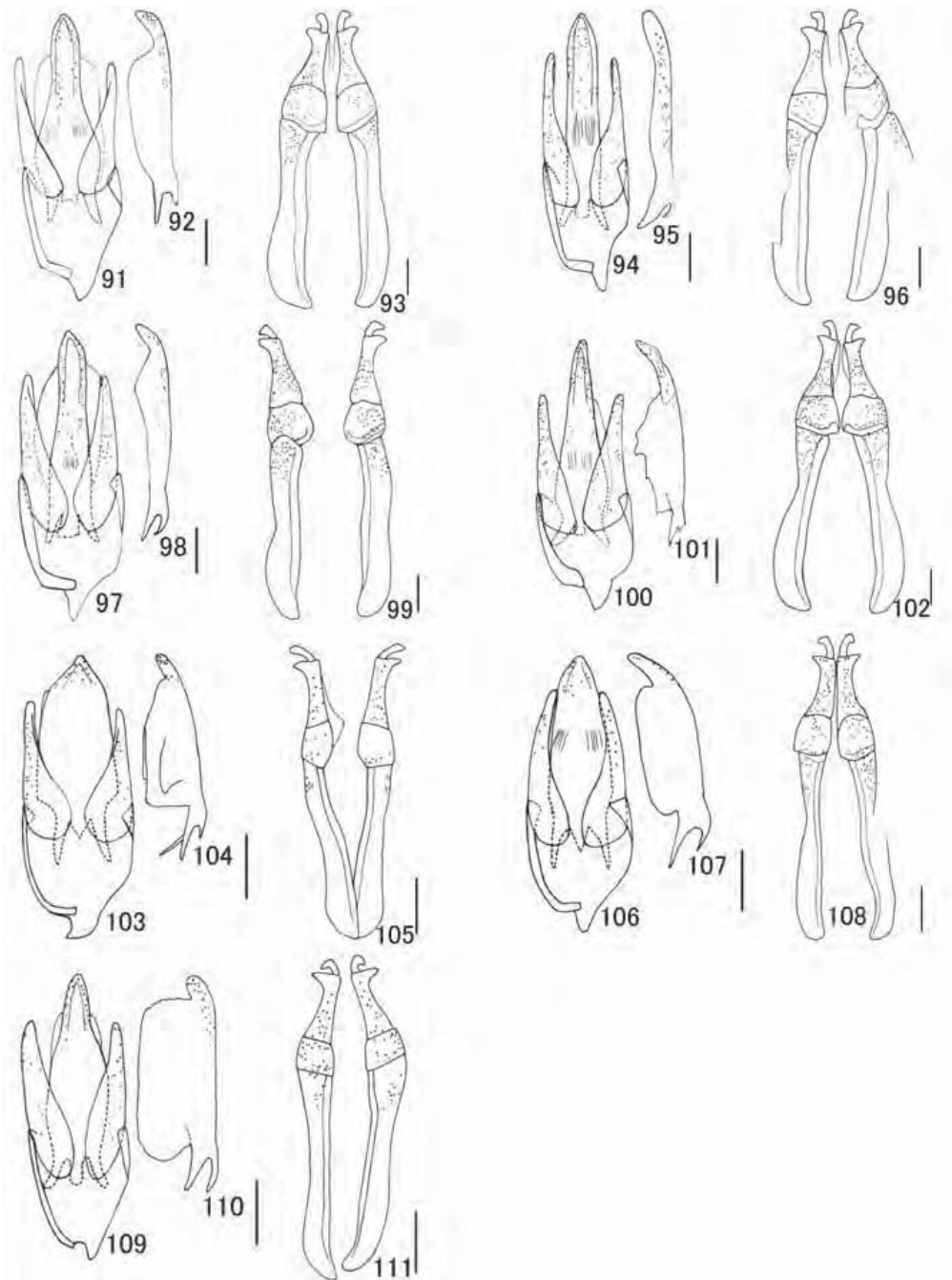
0.23–0.32 ($n = 10$, 0.27) times as long as PL.

Elytra elongate oval (BF) or oblong (MF); intervals not rugose relatively flattened; striae punctures somewhat large and deep; basal part of 3rd interval wider than 4th; in BF EL/EW 1.32–1.48 (1.40); EL/PL 2.52–2.78 (2.65); EW/PW 1.31–1.37 (1.33); in MF EL/EW 1.40–1.52 (1.46); EL/PL 2.78–3.20 (3.02); EW/PW 1.24–1.33 (1.28).

Sides of prosternal process subparallel and apex somewhat truncate.

Apex of abdominal ventrite 5 slightly emarginated or evenly rounded.

Aedeagus as illustrated (Figs. 109–110); penis somewhat stout, abruptly narrowed at apical 3.5; apical part dilated and curved ventrad in lateral aspect.



Figs. 91–111. *Heterlimnius* species. — 91–93, *H. corpulentus*; 94–96, *H. hasegawai*; 97–99, *H. ater*; 100–102, *H. emearthrus* sp. nov.; 103–105, *H. jaechi* sp. nov.; 106–108, *H. hisamatsui* sp. nov.; 109–111, *H. shepardii* sp. nov. — 91, 94, 97, 100, 103, 106, 109, aedeagus in dorsal view; 92, 95, 98, 101, 104, 107, 110, penis in lateral view; 93, 96, 99, 102, 105, 108, 111, ovipositor. Scales: 100 μ m.

Ovipositor as illustrated (Fig. 111); coxite about 5.73 times as long as stylus; valvifer about 12.27 times as long as stylus.

Measurements. BF (n = 9): TL 1.69–2.01 (1.89) mm; PL 0.45–0.56 (0.52) mm; PW 0.67–0.78 (0.74) mm; EL 1.21–1.47 (1.37) mm; EW 0.92–1.03 (0.98) mm. MF (n = 10): TL 1.76–1.92 (1.82) mm; PL 0.43–0.50 (0.45) mm; PW 0.70–0.78 (0.73) mm; EL 1.31–1.42 (1.37) mm; EW 0.88–0.98 (0.93) mm.

Type material. Holotype (EUM): ♂, [China] Baishi He River Anhuai, Shaanxi, 13–VI–2004, M. SATÔ leg. Paratypes: 5 exs. (EUM), same data as for the holotype.; 1 ex. (EUM), Fushui He R, 510 m, Yundou, Shiquan, Shaanxi, 15–VI–2004, M. SATÔ leg.; 1 ex. (EUM), Yunwu Shan, 850 m, Shiquan, Shaanxi, 16–VI–2004, M. SATÔ leg.; 4 exs. (EUM), Fuxing 1370m, Wnag He River, Sichuan, 24–VI–2004, M. SATÔ leg.; 3 exs. (NMW), Sichuan, Emeishan, 160 km SSW Chengdu, 860 m, 23–VI–1994, Ji leg. (6); 39 exs. (NMW), Guizhou NE, 30 km NW Jiangkou, Fanjing Shan–Kuaichang, 500 m, a. s. l., 9–V–2000.

Distribution. China (Sichuan, Guizhou, Shaanxi).

Remarks. This new species resembles *H. jaechi*, but is distinguishable from the latter by the following characteristics: head densely punctuated; pronotum not furnished with prescutellar pits; sublateral carinae short; penis relatively slender.

Etymology. The specific name is dedicated to Dr. William D. SHEPARD who offered many interesting Nearctic specimens and helped in many ways.

Key to the species of the genus *Heterlimnius* (Adults)

1. Antennae 9-segmented. Central area of mandible clearly wide. Labrum wide, about 1.91 times as wide as long. Penis slender. Kazakhstan. *H. ennearthrus* sp. nov.
- Antennae 10 or 11-segmented. Central area of mandible not so wide. Labrum not so wide, about 1.63–1.81 times as wide as long. Penis more stout. 2
2. Lateral margins of pronotum somewhat strongly serrate. Caudal margin of abdominal ventrite 5 clearly emarginate. Nearctic. *H. corpulentus* (LECONTE)
- Lateral margins of pronotum not or feebly serrate. Caudal margin of abdominal ventrite 5 not or slightly emarginate. Palearctic. 3
3. Pronotum not having prescutellar pits. 4
- Pronotum having prescutellar pits. 6
4. Sides of prosternal process subparallel and apex somewhat truncate. TL 1.69–2.01 mm in BF, 1.76–1.92 mm in MF. China. *H. shepardi* sp. nov.
- Prosternal process narrowing behind and broadly rounded at apex. TL 2.21–2.72 mm in BF, 2.31–2.95 mm in MF. 5
5. Head densely rugose and punctuated. Antennae 10 or 11-segmented. Intervals of elytra relatively flattened; basal part of 3rd interval slightly wider than 4th or subequal width. Apical part of penis clearly dilated in lateral aspect. Japan, Far East Russia, China, Korea (?). *H. hasegawai* (NOMURA)
- Head sparsely not rugose punctuated. Antennae 11-segmented. Intervals of elytra convex; basal part of 3rd interval clearly wider than 4th. Apical part of penis not so dilated in lateral aspect. Japan. *H. ater* (NOMURA)
6. Intervals of elytra relatively flattened, not rugose; striae punctures clearly large and deep. Penis stout. Bhutan, India. *H. jaechi* sp. nov.

- Intervals of elytra convex, somewhat rugose; striae punctures not so large, shallow. Penis relatively slender. China. *H. hisamatsui* sp. nov.

Acknowledgements

I wish to express my sincere gratitude to Dr. Nobuo OHBAYASHI and Dr. Masahiro SAKAI (EUM) for their continuous encouragement. I would also like to acknowledge to late Dr. Masataka SATÔ, Dr. William D. SHEPARD (CASC), Dr. Manfred A. JÄCH (NMW), Mr. Takeshi OGATA, Dr. Masakazu HAYASHI and Dr. Hiroyuki YOSHITOMI (EUM). They lent or offered specimens and provided many useful comments in this revision. Thanks are also due to Dr. Masahiro SAKAI, Dr. William D. SHEPARD, Dr. Manfred A. JÄCH, Mr. Takeshi OGATA and Dr. Hiroyuki YOSHITOMI, for reading the manuscript of this paper. I would like to acknowledge my indebtedness to following persons for their help in various ways: Mr. Naoyuki HIKIDA, Mr. Toshiya IKEDA, Mr. Toshiyuki KATÔ, Dr. Jun NAKAJIMA, Dr. Yoshiaki NISHIKAWA, Dr. Shûhei NOMURA (NSMT), Mr. Kôichi SATÔ, Dr. Shun-Ichi UENO (NSMT) and Mr. Hiroaki YOKOI.

References

- BERTRAND, H. P. I., 1972. Dryopidae. In: BERTRAND, H. P. I., *Larves et nymphes des Coléoptères aquatiques du Globe*, pp. 470–597. F. Paillart, Paris.
- BROWN, H. P., 1972. Aquatic dryopoid beetles (Coleoptera) of the United States. Biota of Freshwater Ecosystems identification Manual No. 6. Water Pollution Control Research Series, Environmental Protection Agency, Washington, D.C., 82 pp.
- BROWN, H. P., 1983. A catalog of the Coleoptera of America north of Mexico. Agriculture Handbook, USDA, Washington, 529–50: 1–23.
- BROWN, H. P., and D. S. WHITE, 1978. Notes on separation and identification of North American riffle beetles (Coleoptera: Dryopoidea: Elmidae). *Entomological News*, **89**(1 and 2): 1–13.
- COLLIER, J. E., 1969. A taxonomic revision of the genus *Optioservus* (Coleoptera: Elmidae) in the nearctic region, 59 pp., 5 pls. Doctoral thesis of University of Minnesota.
- FALL, H. C., 1907. Descriptions of new species. In: H. C. FALL and T. D. A. COCKERELL: The Coleoptera of New Mexico. *Transactions of the American Entomological Society*, **33**: 218–272.
- FALL, H. C., 1925. New species of *Helmis* (Coleoptera). *Journal of the New York Entomological Society*, **33**: 177–181.
- HINTON, H. E., 1935. Notes on the Dryopidae. *Stylops*, **4**: 169–179.
- JÄCH, M. A., and J. KODADA, 1995. Elmidae: 1. Check list and bibliography of the Elmidae of China (Coleoptera), p. 289–298. In: JÄCH, M. A., and Ji, L. (eds.), *Water Beetles of China*, Vol. I, pp. 289–298. – Wien: Zoologisch–Botanische Gesellschaft in Österreich and Wiener Coleopterologenverein, 410 pp.
- JÄCH, M. A., J. KODADA and F. CIAMPOR, 2006. Elmidae, pp. 432–440. – In: I. LÖBL and A. SMETANA (ed.): *Catalogue of Palaearctic Coleoptera*, Vol. 3. Stenstrup: Apollo Books, 690 pp.
- KODADA, J., and M. A. JÄCH, 2005. Elmidae. In: BEUTEL, R. G., and R. A. B. LESCHEN (eds.), *Handbook of Zoology*, **4** (Part 38): Coleoptera, Beetles, 1: 471–496. Morphology and Systematics (Archostemata, Adephaga, Myxophaga, Polyphaga partim). Berlin/New York, Walter de Gruyter (XI+567 pp).
- LECONTE, J. L., 1874. Descriptions of new Coleoptera chiefly from the Pacific slope of North America. *Transactions of the American Entomological Society*, **5**: 43–72.
- LEE, S. H., and C. E. LEE, 1992. Notes on *Optioservus kubotai* NOMURA from Korea (Coleoptera, Elmidae). *Nature and Life (Korea)*, **22**(2): 63–64. (In Korean, with English title and abstract.)
- MARTIN, J. O., 1927. A new *Helmis* (Coleoptera–Helmidae) from the Northwest. *The Pan-Pacific Entomologist*, **4**(2): 68.

- NOMURA, S., 1958. Notes on the Japanese Dryopoidea (Coleoptera), with two species from Saghalien. *Tôhō-Gakuhô, Tokyo*, **8**: 45–60, 2 pls.
- NOMURA, S., 1960. Notes on the Japanese Dryopoidea (Coleoptera) III. *Akitu, Kyoto*, **9**(2): 34–36.
- SANDERSON, M. W., 1953. A revision of the Nearctic genera of Elmidae (Coleoptera). *Journal of the Kansas Entomological Society*, **26**(4): 148–163.
- SANDERSON, M. W., 1954. A revision of the Nearctic genera of Elmidae (Coleoptera). *Journal of the Kansas Entomological Society*, **27**(1): 1–13.
- SATÔ, M., 1977. Elminthidae. *Check-list of Coleoptera of Japan*, (9): 1–6. The Coleopterists' Association of Japan. (In Japanese, with English title.)
- SATÔ, M., 1982. The Coleoptera of Ozegahara Moor. *Ozegahara, Scientific researches of the highmoor in central Japan*, 379–408.
- SATÔ, M., 1985. Elmidae. In: UENO, S-I., *et al.* (eds.), *Coleoptera of Japan in Color*, **2**: 434–440 [incl. pls. 79–80]. Hoikusha, Osaka. (In Japanese, with English book title)
- SATÔ, M., 1992. A revisional study on the Superfamily Dryopoidea (Coleoptera) of Japan. 239 pp+12 tables+52 figs. Doctoral thesis of Kyoto University.
- SHEPARD, W. D., 1993. An annotated checklist of the aquatic and semiaquatic dryopoid Coleoptera of California. *The Pan-Pacific Entomologist*, **69**(1): 1–11.
- SHEPARD, W. D., 2002. Family 43. Elmidae. In: ARNETT, R. H., *et al.* (eds.), *American beetles*, **2**: 117–120. CRC Press, Boca Raton, Florida, 861 pp.
- WHITE, D. S., and R. E. ROUGHLEY, 2008. Chapter 20. Aquatic Coleoptera. In: MERRITT, R. W., *et al.* (eds.), *An introduction to the aquatic insects of North America (Fourth edition)*, 571–671. Kendall/Hunt Publishing Company, Dubuque, Iowa, 1,158 pp.

[Received May 25, 2009; accepted June 10, 2009]