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The Blind Trechines of the Subgenus *Pilosotrechiama* (Coleoptera, Trechinae) from Eastern Kyushu, Southwest Japan

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Abstract The blind trechine beetles belonging to the subgenus *Pilosotrechiama* of the genus *Rakantrechus* from eastern Kyushu, Southwest Japan, are revised on the basis of specimens taken at five different localities, and are classified into three taxa herewith regarded as three different species. Two of them, from a limestone cave in Usuki-shi and the Saganoseki Peninsula, are new to science, and are named *Rakantrechus* (*Pilosotrechiama*) *tenuis* and *R.* (*Pil.*) *fretensis*, respectively.

Pilosotrechiama was originally erected for *Rakantrechus mirabilis* S. UÉNO as a monotypical subgenus of the genus *Rakantrechus* (UÉNO, 1958, p. 199). Its type species was described on a pair of specimens collected in 1953 and 1955 at the bottom of a small pit opening at the innermost of a remnant of the small limestone cave called Tokura-no-ana lying at the eastern coast of Kyushu, which was completely excavated by a lime factory sometime in the 1960s. A second population of *Pilosotrechiama* was located in 1960 and examined again in 1962, but I was unable to determine its true taxonomical status due to the lack of additional topotypical males of *R. mirabilis* which became extinct (cf. UÉNO, 2006, p. 54).

Early in the winter of 2007, fifty-five years after the discovery of the holotype of *Rakantrechus mirabilis*, an undoubted new species of *Pilosotrechiama* was found out by Takao NAITÔ on the Sada-misaki Peninsula of western Shikoku, and was described under the name *Rakantrechus* (*Pil.*) *peninsularis* (UÉNO & NAITÔ, 2008, p. 220, figs. 5–7). It was considered to have been derived from an ancestor that invaded the Sada-misaki Peninsula of Shikoku from the Saganoseki Peninsula of Kyushu through the Hôyo land bridge that existed until twenty thousand years ago. To verify this hypothesis, NAITÔ made a trip to the coastal areas of eastern Kyushu in the spring of 2008, and succeded in finding out a specimen of *Pilosotrechiama* near the tip of the Saganoseki Peninsula. Three weeks later, Shinzaburo SONE and I also visited the same area, above all the Saganoseki, Nagamé and Youra Peninsulae, and finally located a habitat of *Pilosotrechiama* on the first one of the three. In the meantime, Ken ITO came across an upper hypogean habitat of another *Pilosotrechiama* near the type locality of *R. mirabilis*, though at an elevation much higher than the latter.

Thus, we are now aware of six localities of *Pilosotrechiama*, five in eastern Kyushu and one in western Shikoku. The trechines of this subgenus share extremely similar

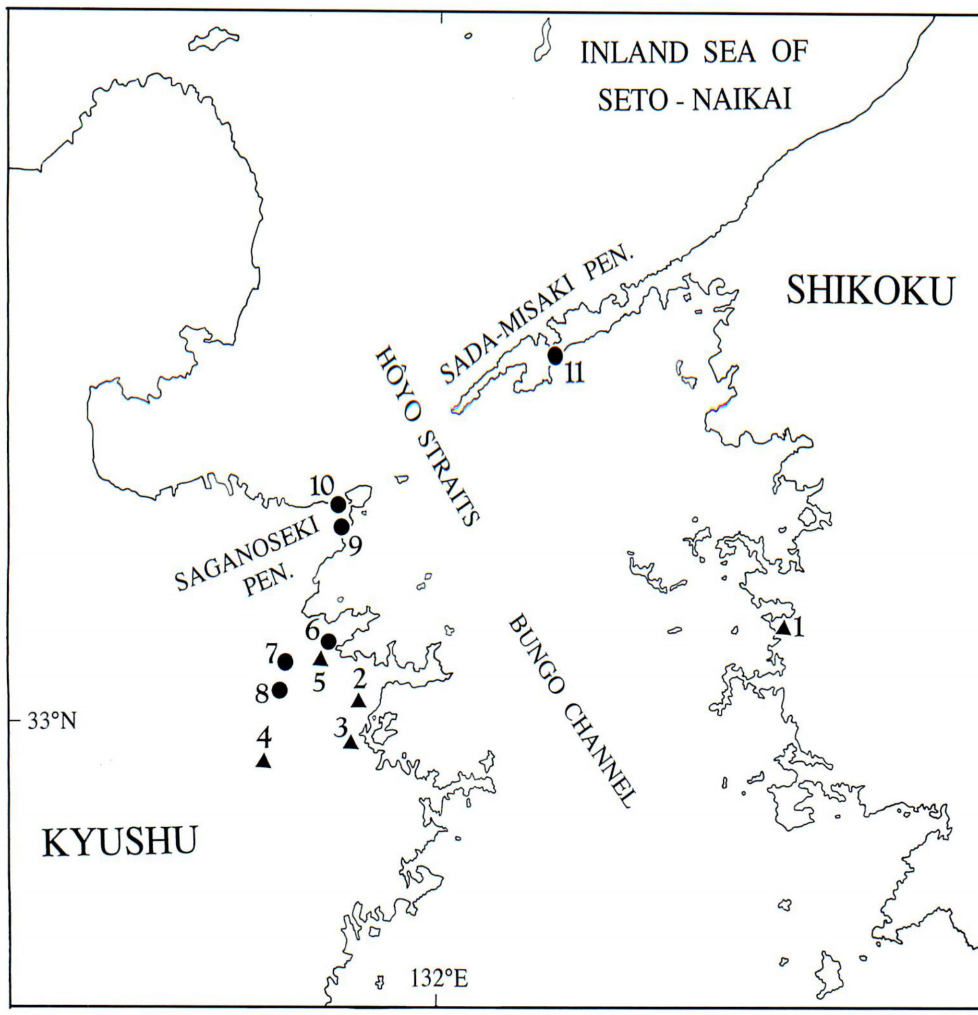


Fig. 1. Map showing the localities of *Pilosotrechiama* (black circles) and the *nomurai* group of *Paratrechiama* (black triangles) in eastern Kyushu and western Shikoku. —— 1, Odorokami (*Rakantrechus obscurus* S. UÉNO et NAITÔ); 2, Karyû-dô Cave (*R. nomurai nomurai* S. UÉNO); 3, Tsuruoka-kô Adit (*R. nomurai fodinarum* S. UÉNO); 4, Onagara-dô Cave (*R. nomurai humerosus* S. UÉNO); 5, Kozono-no-ana Cave (*R. elegans* S. UÉNO); 6, Tokura-no-ana Cave (*R. mirabilis* S. UÉNO); 7, Himé-daké (*R. mirabilis* S. UÉNO); 8, Hitoboshi-dô Cave (*R. tenuis* S. UÉNO); 9, Tanoura (*R. fretensis* S. UÉNO); 10, Furumiya (*R. fretensis* S. UÉNO); 11, Kamagi (*R. peninsularis* S. UÉNO et NAITÔ).

external morphology and even male genitalia are not greatly different in general appearance. However, inner armatures of the aedeagi exhibit stable difference, and the five known populations in eastern Kyushu can be classified into three forms, which are regarded in this paper as three different species.

The abbreviations employed in this paper are the same as those explained in

previous papers of mine.

Before going into further details, I wish to express my deep thanks to Dr. Shinzaburo SONE, Mr. Takao NAITÔ and Mr. Ken ITO. Without their invaluable support, this study could never have been completed.

Rakantrechus (*Pilosotrechiama*) *mirabilis* S. UÉNO, 1958

Rakantrechus (*Pilosotrechiama*) *mirabilis* S. UÉNO, 1958, Mem. Coll. Sci. Univ. Kyoto, (B), **25**, p. 201, figs. 1–2; type locality: Tokura-no-ana Cave in Tsukumi City; 1985, Coleopt. Japan. Col., Osaka, **2**, p. 78 [*partim*]; 2006, Threatened Wildlife of Japan — RDB 2nd ed. — , **5**, p. 54.

Additional specimens examined. 2♂♂, 1♀ [incl. teneral 1♂, 1♀], Himé-daké, 354 m alt. on SE slope, Kamiaoé, Tsukumi-shi, Ôita Pref., E. Kyushu, 10–VI–2007, K. ITO leg.; 1♂, same locality and collector, 1–VII–2007. All in NSMT.

Notes. The specimens recorded above (3.70–4.25 mm in body length) were dug out from the upper hypogean zone at the side of a narrow stream flowing down the southeastern slope of Himé-dake (620 m in height), which is 6.3 km distant to the west-southwest in a beeline from the lost type cave of *R. mirabilis,* and is 350 m higher in elevation than the latter. They agree perfectly with the type series of *R. mirabilis,* and exhibit the following standard ratios of body parts: PW/HW 1.37–1.38 (M 1.38), PW/PL 1.13–1.17 (M 1.15), PW/PA 1.43–1.47 (M 1.45), PW/PB 1.54–1.59 (M 1.56), PA/PB 1.07–1.08 (M 1.08), EW/PW 1.47–1.58 (M 1.52), EL/PL 2.78–3.04 (M 2.94), EL/EW 1.65–1.72 (M 1.68).

Rakantrechus (*Pilosotrechiama*) *tenuis* S. UÉNO, sp. nov.

(Fig. 2)

Rakantrechus (*Pilosotrechiama*) *mirabilis*: S. UÉNO, 1985, Coleopt. Japan Col., Osaka, **2**, p. 78, pl. 15, fig. 5 [*partim*].

Length: 3.95–4.40 mm (from apical margin of clypeus to apices of elytra).

Closely similar to *R. mirabilis* in external morphology, and hardly different from it after due consideration to individual variation. Antennae relatively short as in *R. mirabilis,* reaching apical third of elytra in ♂, reaching apical two-fifths of elytra or shorter than that in ♀.

Standard ratios of body parts as follows: PW/HW 1.29–1.42 (M 1.34), PW/PL 1.10–1.18 (M 1.12), PW/PA 1.44–1.53 (M 1.48), PW/PB 1.49–1.63 (M 1.56), PA/PB 0.98–1.09 (M 1.05), EW/PW 1.50–1.62 (M 1.56), EL/PL 2.85–3.13 (M 2.97), EL/EW 1.61–1.79 (M 1.69).

Definitely different from *R. mirabilis* in the slenderer male genitalia, with differently shaped aedeagal inner armature. Male genital organ relatively large, but lightly sclerotised. Aedeagus slender, about four-ninths as long as elytra, with elongate basal part and relatively narrow apical two-thirds, which is very slightly arcuate and in lateral

view, gradually tapered towards apical lobe; basal part rather lightly bent ventrad, with fairly large basal orifice, whose sides are shallowly emarginate; sagittal aileron small and narrow; viewed laterally, apical lobe narrow, slightly reflexed, and almost pointed at the extremity. Inner sac partially covered with minute teeth, particularly near apical orifice, and armed with an elongate copulatory piece, which is about one-third as long as aedeagus, narrow, gradually dilated towards narrowly rounded apex, and covered at the proximal part with a warped row of about a dozen, large, sclerotised teeth. Styles slender, left style a little longer than the right, each bearing three or four setae at the apex.

Type series. Holotype: ♂, allotype: ♀, 28–III–1962, S. UÉNO leg. Paratypes: 1 ♀, 5–IX–1960, S. UÉNO leg.; 3 ♂♂, 5 ♀♀, 28–III–1962, S. UÉNO leg. All deposited in the collection of the Department of Zoology, National Museum of Nature and Science, Tokyo.

Type locality. Limestone cave called Hitoboshi-dô, 250 m in altitude, at Miyamoto of Higashikôno in Usuki-shi of Ôita Prefecture, eastern Kyushu, Southwest Japan.

Notes. This new species has long been regarded as a mere local form of *R. mirabilis,* and was illustrated under that name on Plate 15 of "The Coleoptera of Japan in Color, Vol. II" (1985). Fortunately and thanks to Ken ITO, I was able to examine two mature males of a *Pilosotrechiama* from Himé-daké, which were perfectly identical with the type specimen of *R. mirabilis.* Since the Hitoboshi-dô specimens are apparently different from the Himé-daké specimens in details of the aedeagal inner armature, they must be different at the species level from the type specimen of the same species, and require a new specific name.

The limestone cave Hitoboshi-dô lies at the southwestern foot of Goban-ga-take (716 m in height) and only 3 km distant to the south-southwest in a beeline from the Himé-daké locality, so that the latter is much nearer to the type locality of *R. tenuis* than to that of *R. mirabilis.* It is difficult to elucidate the cause of speciation of *R. tenuis* within the possible past distributional range of *R. mirabilis,* but the genitalic differentiation between the two species seems more advanced than that between *R. mirabilis* and *R. fretensis* to be described on succeeding pages.

Rakantrechus (*Pilosotrechiama*) *fretensis* S. UÉNO, sp. nov.

(Fig. 3)

Length; 4.40–4.60 mm (from apical margin of clypeus to apices of elytra).

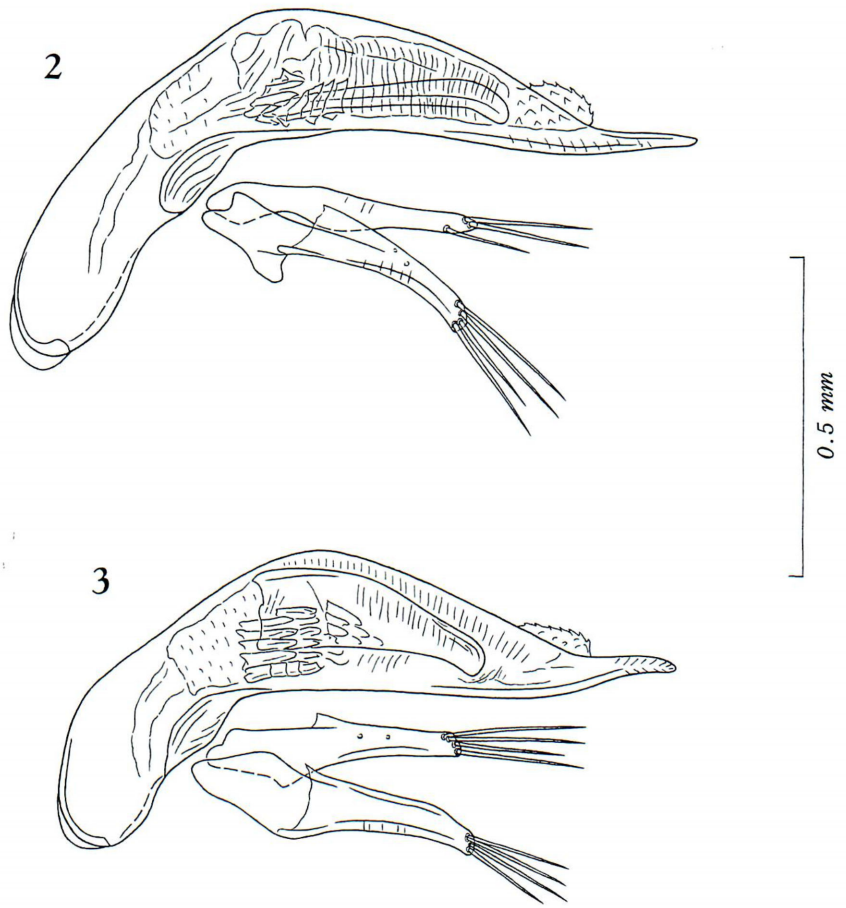
Similar in many respects to *R. peninsularis,* but smaller in size, with pronotum a little narrower on an average and a little less contracted at apex; pronotal sides less strongly arcuate in front, less deeply and more widely sinuate at about basal seventh, and usually subparallel in basal area; PW/HW 1.32–1.37 (M 1.35), PW/PL 1.04–1.08 (M 1.06), PW/PA 1.41–1.46 (M 1.43), PW/PB 1.53–1.60 (M 1.57), PA/PB 1.08–1.14 (M 1.10). Elytra as in *R. peninsularis*; EW/PW 1.54–1.60 (M 1.58), EL/PL 2.84–3.00

(M 2.93), EL/EW 1.70–1.78 (M 1.75); stria 3 with two setiferous dorsal pores at about 1/7 and 3/10 from base, respectively, stria 5 with a single setiferous dorsal pore at about 3/5 from base.

Standard ratios of body parts as follows: PW/HW 1.32–1.37 (M 1.35), PW/PL 1.04–1.08 (M 1.06), PW/PA 1.41–1.46 (M 1.43), PW/PB 1.53–1.60 (M 1.57), PA/PB 1.08–1.14 (M 1.10), EW/PW 1.54–1.60 (M 1.58), EL/PL 2.84–3.00 (M 2.93), EL/EW 1.70–1.78 (M 1.75).

Antennae relatively long, reaching apical fourth of elytra in ♂. Legs long and slender as in *R. peninsularis.*

Male genital organ markedly different from that of *R. peninsularis* and generally similar to that of *R. mirabilis,* fairly large, and moderately sclerotised. Aedeagus about



Figs. 2–3. Male genitalia of *Rakantrechus* (*Pilosotrechiama*) spp.; left lateral view. —— 2, *Rakantrechus* (*Pil.*) *tenuis* S. UÉNO, sp. nov., from Hitoboshi-dô Cave at Miyamoto of Higashikôno. —— 3, *Rakantrechus* (*Pil.*) *fretensis* S. UÉNO, sp. nov., from Tanoura on the Saganoseki Peninsula.

three-eighths as long as elytra, much narrower than in *R. peninsularis,* higher than wide at middle, with the dorsal margin in lateral view rather strongly arcuate at middle and nearly straight both towards basal part and towards apical lobe; basal part elongate, much narrower than in *R. peninsularis,* and moderately curved ventrad, with small basal orifice, whose sides are hardly emarginate; sagittal aileron very small and narrow; viewed laterally, apical lobe narrow, slightly reflexed at the base, very slightly sinuate, and almost pointed at the extremity; ventral margin nearly straight at middle in profile. Inner sac armed with a fairly large copulatory piece and a patch of large sclerotised teeth at the ventral side of the basal half of copulatory piece; copulatory piece nearly one-third as long as aedeagus, subspatulate, lamellar at the basal part, gradually narrowed towards apex which is slightly curved ventrad and narrowly rounded. Styles fairly slender, left style a little longer than the right, each bearing four apical setae.

Female unknown.

Type series. Holotype: ♂, Tanoura, 25–V–2008, S. UÉNO & S. SONE leg. Paratypes: 1 ♂, same collecting data as for the holotype; 1 ♂, Furumiya, 4–IV–2008, T. NAITÔ leg. All deposited in the collection of the Department of Zoology, National Museum of Nature and Science, Tokyo.

Localities of the type series. Tanoura, 110 m in altitude (type locality!), and Furumiya, 50 m in altitude, both in Saganoseki-chô of Ôita-shi, Ôita Prefecture, eastern Kyushu, Southwest Japan.

Notes. This new species is intermediate between *R. mirabilis* and *R. peninsularis* in the size of body, length of antennae, and configuration of the aedeagus. Its occurrence near the tip of the Saganoseki Peninsula is an indubitable proof of the eastward dispersal of ancestral *Pilosotrechiama* from eastern Kyushu through the Hôyo Straits to the Sada-misaki Peninsula of western Shikoku.

Of the two known localities of *R. fretensis,* Tanoura lies at the southeastern side of the Saganoseki Peninsula about 6.5 km removed from the tip. It is 14.8 km distant to the north by east beyond Usuki Bay from the lost type locality of *R. mirabilis,* and 18.7 km distant to the north-northeast beyond Usuki Bay from Himé-daké, the second known locality of the same species. The two known specimens from this locality were found from near the bottom of a colluvium of schistous detritus accumulated at the side of a narrow stream flowing through an evergreen broadleaved forest. They were dug out from a depth of about 50 cm, and were very agile when exposed.

The second locality, Furumiya, lies at 3.4 km north of Tanoura and near the northern coast of the Saganoseki Peninsula. Here again, the collecting site is located in an evergreen broadleaved forest, but the pile of schistous gravel is fed only by a seepage. The single known specimen of *R. fretensis* was found at the side of the seepage only 15 cm below the surface.

Etymology. The specific name is a Latin adjective *fretensis* meaning "of a strait." It is derived from the situation of the known localities of the new species, which look down the Hôyo Straits.

Key to the Species

1 (6) Smaller species, less than 4.60 mm in body length; aedeagus lower at middle, with narrow elongate basal part; inner sac armed with narrower copulatory piece bearing a small teeth-patch at the proximal part.

2 (3) Aedeagus slenderer; copulatory piece elongate, not dilated towards the proximal part, which is covered with a warped row of large teeth; (Hitoboshi-dô Cave in Usuki-shi) ..... *R.* (*Pil.*) *tenuis* S. UÉNO, sp. nov.

3 (2) Aedeagus less slender; copulatory piece dilated towards lamellar proximal part, which is covered with a relatively small patch of large teeth at the ventral side.

4 (5) Smaller species, 3.70–4.25 mm in body length, with relatively short antennae usually reaching apical third of elytra; pronotum a little wider; aedeagus lower at middle in profile; (Tokura-no-ana Cave, Himé-daké) ..... *R.* (*Pil.*) *mirabilis* S. UÉNO.

5 (4) Larger species, 4.40–4.60 mm in body length, with relatively long antennae reaching apical fourth of elytra; pronotum a little narrower; aedeagus higher at middle in profile; (Saganoseki Peninsula) ..... *R.* (*Pil.*) *fretensis* S. UÉNO, sp. nov.

6 (1) Larger species, more than 4.50 mm in body length, with long antennae reaching apical fourth of elytra; aedeagus much higher at middle, with large subglobose basal part; inner sac armed with large copulatory piece widely lamellar at the proximal part and large teeth-patch deeply curved proximally; (Sada-misaki Peninsula in western Shikoku) ..... *R.* (*Pil.*) *peninsularis* S. UÉNO et NAITÔ.

要　　約

上野俊一：九州東部に分布するウスケメクラチビゴミムシ類．――大分県津久見市の石灰洞から記載されたウスケメクラチビゴミムシ *Rakantrechus* (*Pilosotrechiama*) *mirabilis* S. UÉNO は，基準産地である徳浦の穴が石灰岩の採掘によって消滅した結果，少なくともその場所では絶滅したものと考えられ，ほかの生息地も見つからないまま，絶滅危惧種として環境省のレッドデータブックに登載されて現在にいたっている．1960年にこの亜属の第二の産地が発見されたが，亜属基準種の雄の同地基準標本を得る手だてがなかったので，種名を確定できずに現在まで放置されてきた．

2007年の暮れになって，同じ亜属の別種が四国の佐田岬で発見され，チビゴミムシ相における九州東部と四国西部との関係が改めて注目されるようになった．それで，九州東部，とくに佐賀関半島などの地下浅層を綿密に調べ直した結果，ウスケメクラチビゴミムシ類の新しい生息地が数カ所確認された．それらのうちのひとつ，姫岳南東面の地下浅層から得られたものは，亜属基準種そのものだと判定され，それとの比較研究の結果，長らく未解決のまま残されてきた第二産地（火灯洞）の個体群は，未記載の別種だという結論になった．また，佐賀関半島先端部近くの

2カ所で発見された新種は，佐田岬のサダメクラチビゴミムシ *R.* (*Pil.*) *peninsularis* に近いが，亜属基準種と共通する特徴も兼ねそなえているので，祖先種が佐賀関半島から豊予陸橋を通って佐田岬半島へ拡散したことを裏づける証拠のひとつになると考えられた．

本論文で記載命名した2新種の名称とその基準産地は下記のとおり．

ヒトボシメクラチビゴミムシ *Rakantrechus* (*Pilosotrechiama*) *tenuis* S. UÉNO（大分県臼杵市東神野宮本，火灯洞）．

サガノセキメクラチビゴミムシ *Rakantrechus* (*Pilosotrechiama*) *fretensis* S. UÉNO（大分県大分市佐賀関町田之浦；半島の北側の古宮でも発見された）．

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