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The Taiwanese Species of the Ant Genus *Smithistruma* (Hymenoptera, Formicidae)

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Abstract The Taiwanese species of the ant genus *Smithistruma* BROWN are revised. Seven species are recognized: *S. benten* sp. nov., *S. elegantula* TERAYAMA & KUBOTA, *S. formosimonticola* sp. nov., *S. japonica* (ITO), *S. kichijo* sp. nov., *S. leptothrix* (WHEELER) and *S. mazu* sp. nov. Of these, *S. benten*, *kichijo*, and *mazu* are also recorded from Japan. A key to the species is provided.

Key words: Hymenoptera; Formicidae; *Smithistruma*; Taiwan; Japan; new species.

Introduction

The ant genus *Smithistruma* BROWN, 1948, belonging to the tribe Dacetonini of the subfamily Myrmicinae, is represented by about 100 described species of the world, including 17 species from the Indo-Australian and Oriental Regions (BOLTON, 1983; TERAYAMA & KUBOTA, 1989). This genus is distinguished from the other ant genera by the following combination of characteristics: 1) antennae with 6 segments, the funiclus ending in a 2-segmented club; 2) pedicel consisting of two segments; 3) spongiform appendages present on propodeum, petiole and postpetiole; 4) mandibles triangular or subtriangular and short, the midlength not downcurved; 5) ten or more teeth or denticles present at masticatory margin of mandibles; 6) fully closed mandibles without a strongly defined basal margin; 7) standing hairs present on the head, alitrunk, or both.

In 1929, WHEELER described *Smithistruma leptothrix* originally as *Strumigenys leptothrix* from Fenchihu, Chiayi Hsien in Taiwan. Later, TERAYAMA & KUBOTA (1989) added *Smithistruma elegantula* from Puli, Nantou Hsien. Thus two species of *Smithistruma* have hitherto been found in Taiwan.

In the course of our study on the ant fauna of Taiwan, we have examined a

series of specimens of the genus (LIN, 1993; TERAYAMA & INOUE, 1994). As a results, we recognized seven species and confirmed that four of them, of which three are also occurred in Japan, are new to science and one is new to the Taiwanese fauna. In this paper, we briefly review the Taiwanese species of the genus *Smithistruma* with descriptions of four new species.

The measurements and indices used in this paper follow those in TERAYAMA & KUBOTA (1989). The name of institutions are abbreviated as follows:
MNHA: Museum of Nature and Human Activities, Hyogo, Japan.
NSMT: National Science Museum, Tokyo, Japan.
NIAES: National Institute of Agro-Environmental Sciences, Tsukuba, Japan.
NTU: National Taiwan University, Taipei, R.O.C.
TARI: Taiwan Agricultural Research Institute, Taichung, R.O.C.

Key to the Taiwanese Species of *Smithistruma*

(Worker)

1. Anterior border of clypeus transverse (Fig. 26); dorsum of alitrunk strongly convex, arching from anteriormost of pronotum to posteriormost of propodeum (Fig. 27) ..... *S. mazu* sp. nov.
— Anterior border of clypeus convex; dorsum of alitrunk almost straight or weakly convex at most 2
2. Upper border of propodeal lamellae dully angulate, not forming an acute tooth (Fig. 29); cephalic dorsum with many long flagellat hairs (Fig. 23) ..... *S. kichijo* sp. nov.
— Upper border of propodeal lamellae forming an acute tooth (Figs. 3, 8, 14); cephalic dorsum without long flagellate hairs 3
3. Dorsa of head and pronotum abundant with long erect hairs (Figs. 12, 14, 15) 4
— Dorsa of head and pronotum without long erect hairs (Figs. 1, 3) 5
4. Anterior half of cephalic dorsum with long erect hairs (Fig. 22); anterior border of antennal scapes each with 3 long erect hairs (Fig. 17); tibiae and tarsi with long erect hairs also (Fig. 19) ..... *S. leptothrix* (WHEELER)
— Anterior half of cephalic dorsum without long erect hairs (Fig. 21); anterior border of antennal scapes without long elect hairs (Fig. 16); tibiae and tarsi without erect hairs (Fig. 18) ..... *S. formosimonticola* sp. nov.
5. Cephalic dorsum covered with decumbent squamate hairs densely (Fig. 10) ..... *S. japonica* (ITO)
— Cephalic dorsum without distinct squamate hairs 6
6. Propodeal spines developed, longer than basal width; propodeal lamellae also well developed (Fig. 8); posterolateral borders of head distinctly angulate in frontal view (Fig. 6); basal lobe of mandibles broadly rounded

(Fig. 7) .....*S. elegantula* TERAYAMA & KUBOTA

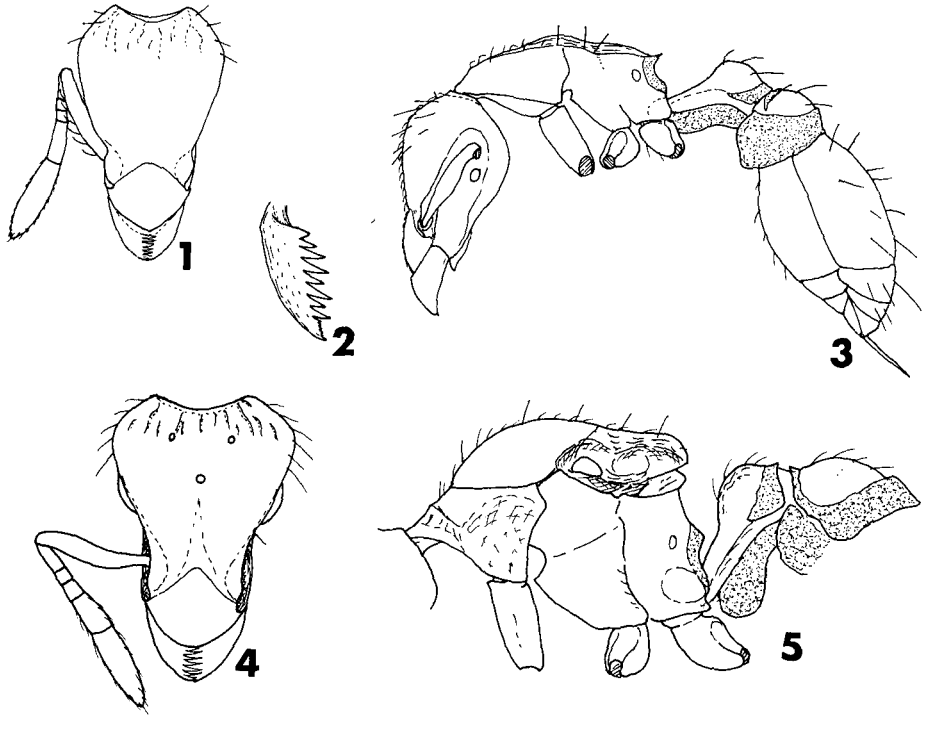
— Propodeal spines smaller, as long as basal width; propodeal lamellae weakly developed (Fig. 3); posterolateral borders of head rounded, not forming a distinct angle in frontal view (Fig. 1); basal lobe of mandibles relatively small and acutely triangular (Fig. 2) .....*S. benten* sp. nov.

Smithistruma benten sp. nov.

(Figs. 1–5, 20)

Holotype. Worker. HL 0.60 mm; HW 0.44 mm; SL 0.26 mm; ML 0.13 mm; CI 73; SI 59; MI 21; WL 0.65 mm; PW 0.26 mm; TL 2.1 mm.

Head as in Figs. 1 and 20, microreticulate, with convex lateral borders; posterolateral borders not forming a distinct angle in frontal view; head width 1.79× clypeal width. Ground-pilosity of cephalic dorsum short curved spatulate hairs; posterior 1/3 with short erect or suberect hairs sparsely. Mandibles with an acute triangular basal lobe and 7 acute median teeth, and 4 minute subapical



Figs. 1–5. *Smithistruma benten* sp. nov. —— 1, Head, frontal view, worker; 2, right mandible, worker; 3, body, lateral view, worker; 4, head, frontal view, queen; 5, alitrunk, lateral view, queen.

denticles and an actue apical tooth. Clypeus wider than long, with convex anterior border; dorsum with short decumbent hairs coarsely. Antennal segments in a ratio of 11 : 4 : 1.5 : 1.5 : 4 : 10 in length from the base; scape microreticulate, anterior border with a row of decumbent hairs; 2nd segment 2.2× as long as wide; 3rd and 4th segments each as long as wide; 5th 2.0× as long as wide; apical segment 3.6× as long as wide. Eyes small, 0.05 mm in diameter, almost as long as the maximum width of antennal scape.

Dorsum of promesonotum flat, smooth and shining, with a median ruga and short erect hairs sparsely; dorsolateral margins of pronotum with a row of short curved hairs; pronotal humeri with a erect hair; lateral surfaces of pronotum microreticulate. Dorsolateral margins of mesonotum and propodeum with 3 pairs of relatively short erect hairs. Mesopleura smooth and shining in most part. Propodeum smooth and shining with acute short spines; lamellae weakly developed.

Petiole long and low, dorsal border of node broadly rounded in lateral view; disc smooth, but slightly microreticulate, 1.27× as long as wide in dorsal view, with suberect hairs. Postpetiolar disc smooth and shining, 1.6× as wide as long, with suberect hairs.

First gastral tergite with erect or suberect hairs.

Body reddish brown.

Paratype workers. Ten paratype workers with the following measurements and indices: HL 0.61–0.65 mm; HW 0.46–0.50 mm; SL 0.31–0.32 mm; ML 0.16–0.17 mm; CI 71–82; SI 62–67; MI 25–28; WL 0.70–0.72 mm; PW 0.30–0.33 mm; TL 2.2–2.6 mm.

Paratype queens. Three paratype queens with the following measurements and indices: HL 0.72–0.76 mm; HW 0.53–0.55 mm; SL 0.38–0.40 mm; ML 0.16–0.18 mm; CI 70–76; SI 69–75; MI 21–25; WL 0.91–0.93 mm; PW 0.40–0.42 mm; TL 3.1–3.3 mm.

General shape of head and alitrunk shown as in Figs. 4 and 5 respectively. Cephalic dorsum with short curved spatulate hairs, posterior 1/3 with short erect or suberect hairs sparsely. Clypeus with short decumbent hairs coarsely. Compound eyes 0.15–0.16 mm in diameter. Dorsum of alitrunk with suberect hairs sparsely and short curved hairs moderately.

Holotype. Worker, Lienhuachih, Nantou Hsien, Taiwan, 12.XI.1992, C.-C. LIN leg.

Paratypes. 1 queen, 30 workers, same data as holotype; 2 queens, same data; 3 workers, Taping-Meitzulin (alt. ca. 510 m), Nantou Hsien, Taiwan, 30. VII.1988; 6 workers, Iriomote-jima I., Ryukyus, Okinawa Pref., Japan, 30.III. 1991, M. TERAYAMA leg.; 1 queen, 4 workers, Yokkaichi-shi, Mie Pref., Japan, 21.IV.1987, A. AMAGASU leg.; 1 queen, 4 workers, Komono-machi, Mie Pref., Japan, XII.1989; 1 queen, 11 workers, Komaba, Meguro-ku, Tokyo, Japan, 30.

VI.1986, M. TERAYAMA leg.; 2 workers, Nakano-ku, Tokyo, Japan, 19.VIII. 1980, S. KUBOTA leg.

Type depository. The holotype is preserved in NIAES, and paratypes in NIAES, NSMT, NTU, and TARI.

Distribution. Taiwan, Japan.

Etymology. The specific name is the Japanese noun benten, which is the name of a beautiful goddess of Japan.

Remarks. This species is at first sight similar to *leptothrix*, *formosimonticola*, and *elegantula*, but is easily distinguished from them by the short erect hairs on cephalic dorsum and the weakly developed propodeal lamellae of propodeum.

Smithistruma elegantula TERAYAMA & KUBOTA

(Figs. 6–9)

Smithistruma elegantula TERAYAMA & KUBOTA, 1989. *Jpn. J. Ent.*, **57**: 788.

Distribution. Taiwan.

Remarks. This species is easily distinguished from the other Taiwanese congeners by the well developed propodeal lamellae and long acute propodeal spines.

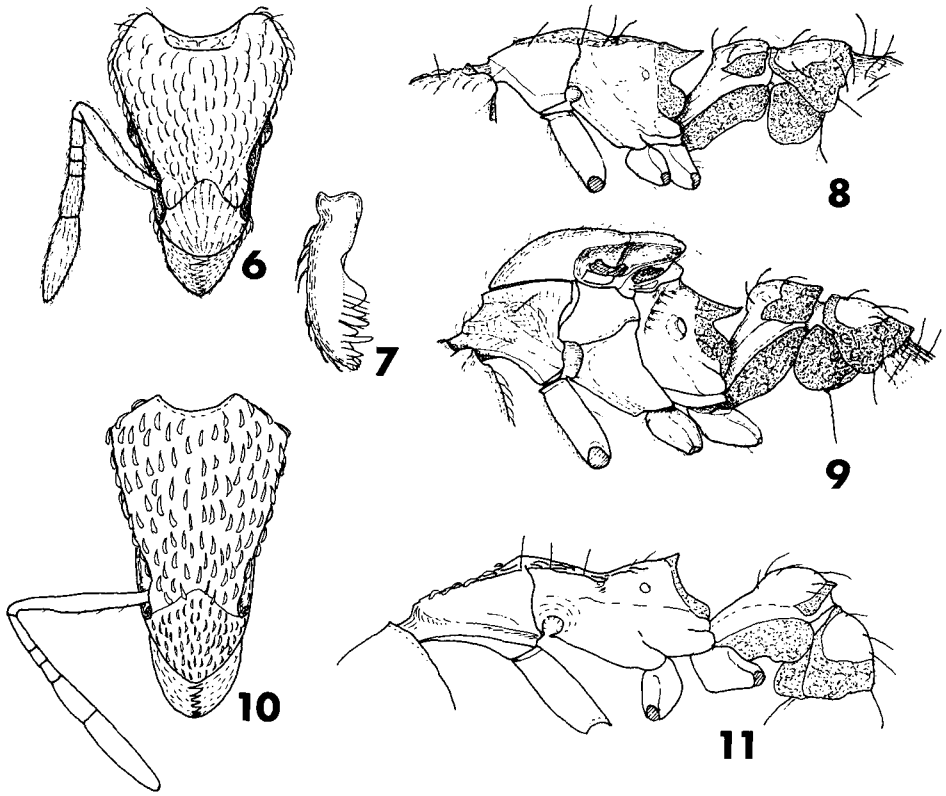
Smithistruma formosimonticola sp. nov.

(Figs. 12–14, 16, 18, 21)

Holotype. Worker. HL 0.74 mm; HW 0.48 mm; SL 0.35 mm; ML 0.13 mm; CI 65; SI 73; MI 18; WL 0.80 mm; PW 0.30 mm; TL 2.0 mm.

Head relatively slender, microreticulate, with convex lateral borders in frontal view; posterolateral borders not forming an angle; posterior 1/3 of cephalic dorsum with rather irregular longitudinal rugae and long erect hairs; anterior 2/3 with short suberect and spatulate suberect hairs moderately; head width 1.6× clypeal width. Mandibles with a series of acute teeth. Clypeus slightly wider than long, with convex anterior border; dorsum with short decumbent hairs. Antennal segments in a ratio of 14 : 4.5 : 2 : 2 : 5 : 11 in length from the base; scape with short decumbent hairs only; 2nd segment 3.0× as long as wide; 3rd and 4th segments each wider than long; 5th 2.5× as long as wide; terminal segment 3.7× as long as wide. Eyes 0.07 mm in length, larger than the maximum width of antennal scape.

Dorsum of promesonotum smooth and shining, with a median ruga and more than 10 long erect hairs; lateral surfaces of pronotum smooth and shining. Mesopleura and lateral surfaces of propodeum smooth and shining. Propodeal dorsum weakly microreticulate, without hairs. Propodeal lamellae short, with an



Figs. 6–9. *Smithistruma elegantula* TERAYAMA & KUBOTA; 10–11, *S. japonica* (ITO). —— 6, Head, frontal view, worker; 7, right mandible, worker; 8, alitrunk, petiole and postpetiole, lateral view, worker; 9, ditto, queen; 10, head, frontal view, worker; 11, alitrunk, petiole and postpetiole, lateral view, worker.

acute spine dorsolaterally.

Petiole and postpetiole each with long suberect hairs; petiolar disc 1.33× as long as wide, with transverse rugae as seen from above; postpetiolar disc smooth, 1.29× as wide as long.

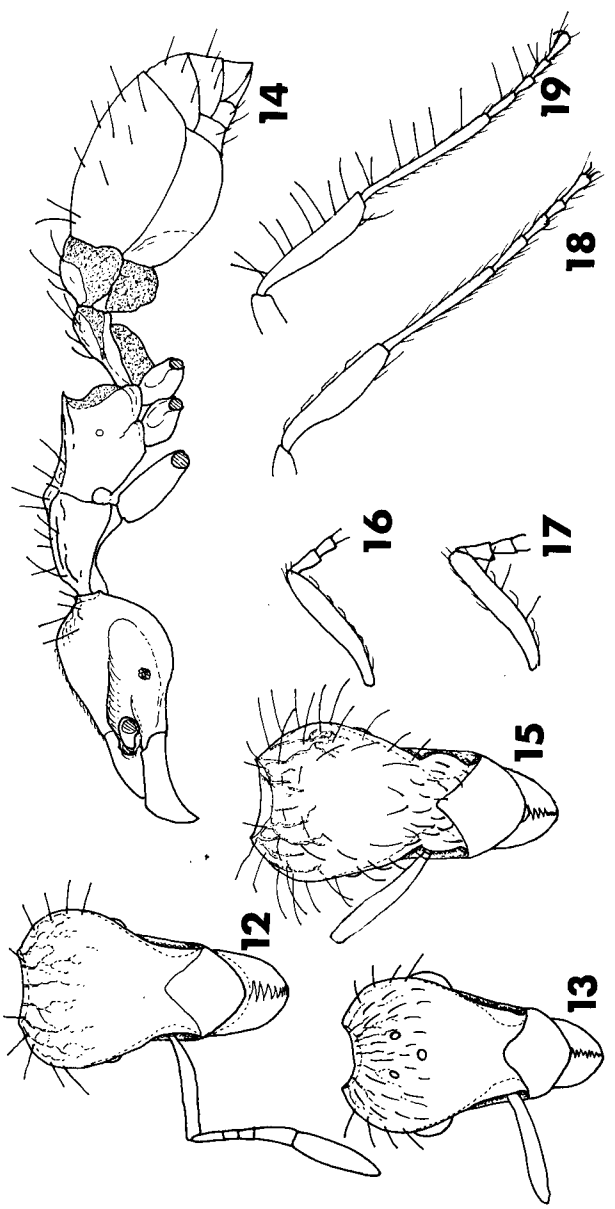
First gastral tergite with many suberect hairs of which the longest is 0.11 mm.

Legs slender, tibiae and tarsi without long erect hairs.

Body reddish brown.

Paratype workers. Ten paratype workers with the following measurements and indices. HL 0.75–0.79 mm; HW 0.53–0.55 mm; SL 0.45–0.46 mm; ML 0.12–0.13 mm; CI 67–73; SI 82–87; MI 15–17; WL 0.89–0.92 mm; PW 0.35–0.37 mm; TL 2.8–3.0 mm.

Paratype queens. Five paratype queens with the following measurements



Figs. 12–14, 16, 18. *Smithistruma formosimonticola* sp. nov.; 15, 17, 19, *S. leptothrix* (WHEELER) —— 12, Head, frontal view, worker; 13, ditto, queen; 14, body, lateral view, worker; 15, head, frontal view, worker; 16–17, antennal scape, worker; 18–19, hind tibia and tarsus, worker.

and indices. HL 0.86–0.89 mm; HW 0.58–0.60 mm; SL 0.44–0.45 mm; CI 65–70; SI 73–78; MI 11–14; WL 1.05–1.09 mm; PW 0.44–0.46 mm; TL 3.3–3.4 mm.

General shape of head as in Fig. 13. Posterior 1/3 of caphalic dorsum with more than 10 long erect hairs; anterior boreder of antennal scapes without long erect hairs. Pro- and mesonotal dorsum with more than 20 long erect hairs. Tibiae and tarsi without long erect hairs.

Holotype. Worker, Yenping, Taitung Hisen, 29. VII. 1992, C.-C. LIN leg.

Paratypes. 13 queens, 32 workers, same data as holotype; 33 workers, same locality, 30.VII.1992, C.-C. LIN leg.

Type depository. The holotype is preserved in NIAES, and paratypes in NTU and TARI.

Distribution. Taiwan.

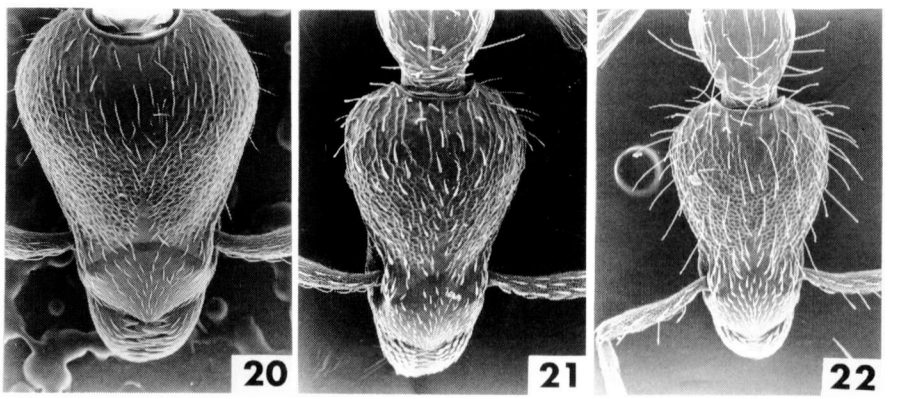
Etymology. The specific name referes to the area of distribution.

Remarks. This species is resembling to *leptothrix*. However it is easily distinguished from the latter by the absence of long erect hairs on antennal scapes, tibiae, and tarsi in worker and female. All the specimens were collected at the mountainous region (ca. 1700 m alt.) of southern Taiwan and the colonies were found nesting in the stony soil.

Smithistruma japonica (ITO)

(Figs. 10–11)

Strumigenys japonica ITO, 1914. *Ann. Soc. ent. Belg.*, **58**: 40.
Strumigenys (*Cephaloxys*) *japonica*; EMERY, 1922. Gen. Ins. Fasc. **174**: 325.
Smithistruma (*Smithistruma*) *japonica*; BROWN, 1948. *Trans. Amer. ent. Soc.*, **74**: 105.
Weberistruma japonica; BROWN, 1953. *Amer. Midl. Matur.*, **50**: 27.
Smithistruma japonica; BROWN, 1973. *J. Kansas ent. Soc.*, **46**: 35.



Figs. 20–22. SEM micrographs of heads, *Smithistruma* workers. —— 20, *S. benten* sp. nov.; 21, *S. formosimonticola* sp. nov.; 22, *S. leptothrix* (WHEELER).

Material examined. 1 worker, Kending, Pintung Hsien, 15.VIII.1991, C.-C. LIN leg.

Distribution. Japan, Taiwan, Korea.

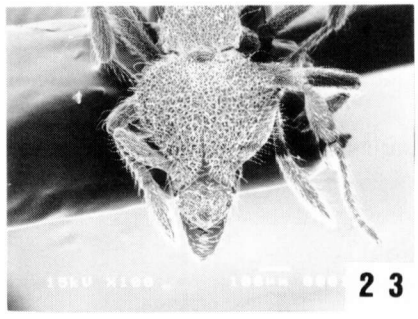
Remarks. Although the propodeal spines are shorter in the Taiwanese specimen, there is no significant morphological differences between the Taiwanese and the Japanese specimens. We concluded that the Taiwanese one is *S. japonica*. This is the first record of the species from Taiwan.

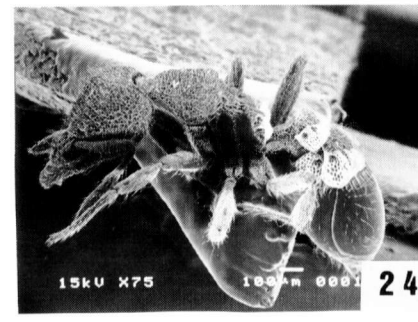
Smithistruma kichijo sp. nov.

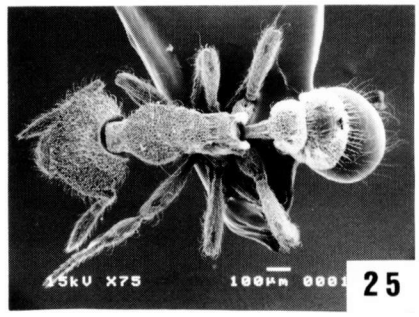
(Figs. 23–25, 28, 29)

Holotype. Worker. HL 0.60 mm; HW 0.47 mm; SL 0.25 mm; ML 0.15 mm; CI 78; SI 53; MI 25; WL 0.65 mm; PW 0.30 mm; TL 2.0 mm.

Head as in Figs. 23 and 28, microreticulate with large irregular punctures coarsely; head width 2.3× clypeal width; dorsum with long flagellate hairs abundantly. Mandibles with 10 teeth except for basal lobe; princepal dental row with 4 relatively acute and large teeth followed by 2 smaller teeth and 4 minute denticles; basal lobe broadly rounded. Clypeus slightly wider than long, with strongly convex anterior border; surface microreticulate with large punctures;







Figs. 23–25. SEM micrographs of *Smithistruma kichijo* sp. nov., worker. —— 23, Head, frontal view; 24, body, dorsolateral view; 25, ditto, dorsal view.

flagellate hairs present. Eyes small, 0.04 mm in diameter, smaller than the maximum width of antennal scape. Antennal segments in a ratio of 10 : 3 : 1.2 : 1.2 : 3.5 : 11 in length from the base; scape microreticulate, broadest at posterior 1/3, with flagellate hairs; 2nd segment longer than wide; 3rd and 4th segments each wider than long; 5th as long as wide; apical segment 3.7× as long as wide.

Alitrunk in profile with pronotum straight, and mesonotum and propodeum slightly concave. Pronotum microreticulate, with large irregular punctures coarsely; dorsum with many long erect flagellate hairs and short ones; pronotal humeri with a long flagellate hair. Dorsolateral margins of mesonotum convex in dorsal view, with a long flagellate hair which is ca. 0.08 mm in length. Mesopleura and lateral surfaces of propodeum smooth and shining in most part. Propodeal lamellae developed, upper posterior corner dully angulate, not forming an distinct spine.

Petiolar disc in dorsal view 1.67× as wide as long; postpetiolar disc 1.60× as wide as long; discs of petiole and postpetiole with subdecumbent curved hairs. Spongiform appendages of pedicelled segments well developed.

First gastral tergite with flagellate hairs of which the longest is ca. 0.18 mm.

Body reddish brown.

Paratype workers. Five paratype workers with the following measurements and indices: HL 0.55–0.57 mm; HW 0.42–0.43 mm; SL 0.25–0.28 mm; ML 0.10–0.13 mm; CI 75–76; SI 59–65; MI 18–22; WL 0.58–0.60 mm; PW 0.27–0.28 mm; TL 2.0 mm.

Holotype. Worker, Kukuan (alt. 1060 m), Taichung Hsien, Taiwan, 30. VII. 1988.

Paratypes. 8 workers, Yamada, Onna-son, Okinawa-jima I., Okinawa Pref., Japan, 20. VIII. 1994, M. TERAYAMA, S. KUBOTA & H. TAKAMINE leg.

Type depository. The holotype and some paratypes are preserved in NIAES and the other paratypes in MNHA and NSMT.

Distribution. Taiwan, Japan (Ryukyus).

Etymology. The specific name is the Japanese noun kichijo, which is the name of a goddess.

Remarks. This species is easily separated from the other Asian congeners by the presence of the numerous long flagellate hairs on dorsa of head and alitrunk.

Smithistruma leptothrix (WHEELER)

(Figs. 15, 17, 19, 22)

Strumigenys (Cephaloxys) leptothrix WHEELER, 1929, *Boll. Lab. Zool. gen. Agrar. Portici*, **24**: 55.
Smithistruma (Weberistruma) leptothrix; BROWN, 1948, *Trans. Amer. ent. Soc.*, **74**: 106.
Weberistruma leptothrix; BROWN, 1949, *Mushi, Fukuoka*, **20**: 8.

Weberistruma leptothrix; BROWN, 1953, *Amer. Midl. Natur.*, **50**: 24.
Smithistruma leptothrix; TARAYAMA & KUBOTA, 1989, *Jpn. J. Ent.*, **57**: 787.

Additional material examined. 1 worker, Huisunlinchang, Nantou Hsien,; 1 worker, same locality, 14.XI.1992, C.-C. LIN leg.; 1 female, Lienhuachih, Nan tou Hsien, 10.VII.1992, C.-C. LIN leg.

Distribution. Taiwan, Japan (Ryukyus).

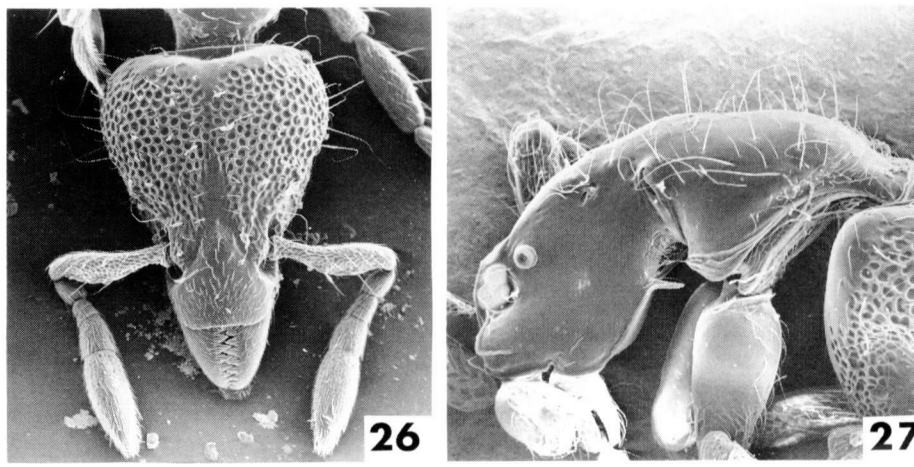
Remarks. This species is easily separated from the other Taiwanese congeners by the presence of long erect hairs on dorsa of head and alitrunk, antennal scapes, and legs in worker and queen.

Smithistruma mazu sp. nov.

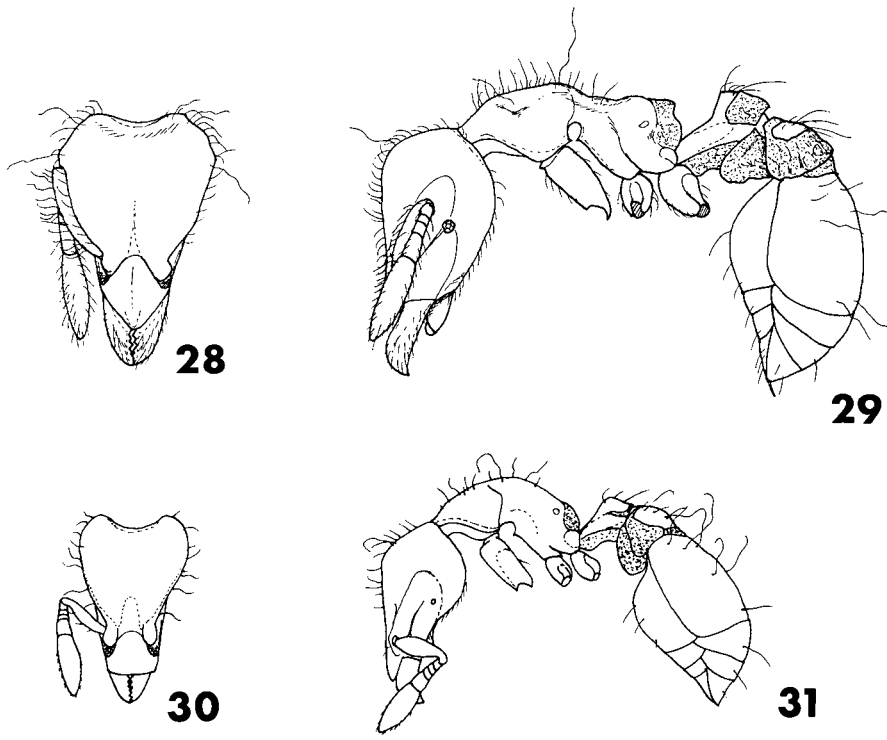
(Figs. 26–27, 30, 31)

Holotype. Worker. HL 0.43 mm; HW 0.30 mm; SL 0.18 mm; ML 0.08 mm; CI 70; SI 60; MI 18; WL 0.20 mm; PW 0.43 mm; TL 1.3 mm.

Head as in Figs. 26 and 30; posterolateral borders not forming an angle in frontal view; head width 2.0× clypeal width; vertex largely microreticulate; occiput smooth and shining; dorsum with flagellate hairs moderately. Mandibles not dissected. Clypeus as long as wide, with transverse anterior border; dorsum smooth and shining, with short decumbent hairs. Antennal segments in a ratio of 6.5 : 2.1.1.2.6 in length from the base; scape thick and short, 0.6× as long as head width; 2nd segment slightly longer than wide; 3rd and 4th segments each wider than long; 5th slightly longer than wide; apical segment 3.0× as long as wide. Eyes extremely small, consisting of a single omatidium.



Figs. 26–27. SEM micrographs of *Smithistruma mazu* sp. nov., worker. —— 26, Head, frontal view; 27, alitrunk, lateral view.



Figs. 28–29, *Smithistruma kichijo* sp. nov., worker; 30–31, *S. mazu* sp. nov., worker. —— 28, 30, Head, frontal view; 29, 31, body, lateral view.

Dorsal outline of alitrunk strongly convex in profile, arching from the anteriormost of pronotum to the posteriormost of propodeum; dorsum of promesonotum with numerous flagellate hairs; lateral surfaces of alitrunk smooth and shining in most part.

Petiole short; disc smooth, 1.6× as wide as long in dorsal view. Postpetiolar disc smooth, 1.6× as wide as long.

Gastral tergites with erect hairs which are ca. 0.07–0.08 mm in length.

Body brown.

Paratype workers. Three paratypes exhibit only minor variation in size, color, and general shape.

Holotype. Worker, Chilan, Yilan Hsien, Taiwan, 28.VII.1988.

Paratypes. 3 workers, Henza-jima I., Okinawa Is., Okinawa Pref., Japan, 2. IX.1959, H. TAKAMINE leg.

Type depository. The holotype preserved in NIAES, and paratypes in MNHA.

Distribution. Taiwan, Japan.

Etymology. This species named in honor of the famous Taiwanese goddess

mazu.

Remarks. This species is easily separated from the other Asian congeners by the truncated anterior border of clypeus, strongly convex truncal dorsum, and small body size (TL ca. 1.3 mm).

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