

A Taxonomic Study on the Genus *Strumigenys* Smith, 1860 (Hymenoptera: Formicidae) from Korea with a description of new species

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ABSTRACT. Korean species of the genus *Strumigenys* Smith, 1860 are revised. One new species, *Strumigenys calvus* sp. nov. and two newly recorded species are presented in this study. The records of *Strumigenys* sp. in Choi (1995) are here identified as *S. kumadori* based on the examination of the description and taxonomic key provided by Choi (1995). In order to facilitate proper identification of Korean *Strumigenys* species, we provide a taxonomic key for all known South Korean *Strumigenys* species, with detailed descriptions and photographs for the newly recorded species. Diagnoses with short descriptions for two species (*S. alecto* and *S. solifontis*) are provided to clarify their identification. Brief ecological information and distribution maps for each species are also given. Overall, thirteen *Strumigenys* species have been recorded from South Korea.

Keywords Myrmicinae, new record, new species, *Strumigenys*, Taxonomy

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INTRODUCTION

Species of the genus *Strumigenys* Smith, 1860 are small ants usually found in the leaf litter from forest floors of tropical and temperate regions worldwide (Bolton 2000, Janicki *et al.* 2016, Guénard *et al.* 2017, Tang *et al.* 2019). This genus is notably known for its remarkable morphological characters such as highly modified mandibles, reduction of antennal segments and petiolar spongiform tissue (Baroni Urbani & De Andrade 1994). The majority of species in this genus possesses elongated and linear mandibles, also considered to be a distinguishing characteristic. Many of these ants predate on small soil arthropods such

as Acari, Araneae, Chilopoda, Collembola, Isopoda, and Pseudoscorpions (Wilson 1953, Masuko 1984, Dejean 1987a, b, Masuko 2009).

Despite the difficulties in taxonomic studies due to their small body size and morphological similarities, 850 extant species are reported globally (Antwiki 2020). The genus *Strumigenys* is the third most diverse ant genus after both *Camponotus* and *Pheidole* (Bolton 2018, Tang *et al.* 2019) and is further subdivided into 116 subordinate species groups (Bolton 2000). This genus was previously divided into numerous genera (e.g. *Epitritus*, *Pentastruma*, *Quadristruma*, *Smithistruma*, *Trichoscapa*... etc.), however, after extensive taxonomic revision on the Dacetine

ants by Bolton (2000), only two genera, *Strumigenys* Smith, 1860 and *Pyramica* Roger, 1862 remained; the latter of which has relatively a short mandibles contrary to the elongated mandibles observed in *Strumigenys*; but the genus *Pyramica* was synonymized and is currently considered invalid (Baroni Urbani & De Andrade 2007).

In South Korea, Choi (1995), Lyu *et al.* (2001), and Lyu (2007), revised the genus and recognized 8 species, *viz.* *S. canina*, *S. choii*, *S. hexamera*, *S. incerta*, *S. japonica*, *S. lewisi*, *S. mutica*, and *Strumigenys* sp. of Choi (1995), an undescribed species. Recently, Shin & Lyu (2020) reported two unrecorded species *viz.* *S. alecto* and *S. solifontis*, from southern provinces of Korea. In total, ten species of *Strumigenys* have been recorded from South Korea, while for comparison about 30 species and 50 species have been recorded from Japan (Yoshimura & Onoyama 2007, Kitahiro *et al.* 2014) and China, respectively (Guénard & Dunn 2012, Liu *et al.* 2015, Tang *et al.* 2019).

In this study, a checklist of *Strumigenys* species from South Korea is presented, including the first record of two new species for the country and the description of a new species, *Strumigenys calvus* sp. nov. Moreover, the unidentified species presented as *Strumigenys* sp. by Choi (1955) is here reassigned to *S. kumadori*. Finally, to facilitate future identification and taxonomic work on *Strumigenys* species in the region, the descriptions for a couple of undescribed species and the taxonomic key for all 13 species recorded from South Korea are here updated.

MATERIALS AND METHODS

Typical ant collecting techniques were used to collect samples; including hand collecting, sifting, berlese traps and pitfall traps. Samples were mainly collected from mountainous sites, but some species such as a new species and *S. membranifera* were collected from isolated island and opened area, respectively. The majority of the samples were stored in 80% EtOH, and some of them, including type materials, were dried and pinned for photography, measurements and descriptions.

The materials in this study were examined using a Leica S8 APO (Leica, Wetzlar, Germany) dissecting microscope; and photographs of the specimens were obtained by using a DSLR camera (Canon 800D, Canon, Japan) equipped with a microscopic lens (PLAN 10X/0.25, Nikon, Japan). Over 200 consecutive digital images in different focal planes were stacked using the Helicon Focus® software (Helicon Soft Ltd., Ukraine). All processed images were further adjusted by using Photoshop CS6 (Adobe, U.S.). Paint Tool SAI (Systemax, version 1.1.0, Japan) was used for line drawings. Distribution maps were drawn based on our collections and previous studies (Choi 1995, Lyu *et al.* 2001, Lyu 2007 and Shin & Lyu 2020). All measurements were given in millimeters (0.01mm) and measured by analytical software (Leica Application Suite; Leica, Germany); morphological analyses and indices mainly followed Bolton (2000), Latke *et al.* (2018), and Tang *et al.* (2019). Terms for micro sculpture and pilosity on the body followed Harris (1979) and Sarnat *et al.* (2019), respectively.

Total Length (TL). The total length from the mandibular apex to the posterior margin of abdomen (gaster). Sum of MandL + HL + ML + PL + PPL + GL.

Head Length (HL). The length of the head except the mandibles, measured in full-face view in a straight line from the midpoint of the anterior clypeal margin to the midpoint of the occipital margin. In species where one or both of these margins is concave, the measurement is taken from the midpoint of a transverse line that spans the apices of the projecting portions.

Head Width (HW). The maximum width of the head in full-face view, excluding the eyes.

Mandible Length (MandL). The straight-line length of the mandible in full-face view, from the mandibular apex to the anterior clypeal margin, or to the transverse line connecting the anteriormost points when the margin is concave medially.

Scape Length (SL). The maximum straight-line length of the scape, excluding the basal constriction or neck that occurs just distal of the condylar bulb. (In species with a hypertrophied subbasal lobe on the scape, SL is measured from the tip of the subbasal lobe to the scape apex.)

Eye Length (EL). The maximum diameter of the eye.

Pronotal Width (PNW). The maximum width of the pronotum in dorsal view. Projecting tubercles or other cuticular prominences at the pronotal humeral angles, if present, are ignored.

Mesosoma Length (ML) (= Weber's Length). The diagonal length of the mesosoma in profile from the point at which the pronotum meets the cervical shield to the posterior basal angle of the metapleuron.

Petiolar Length (PL). The maximum length of the petiole from the posterior petiolar margin to the point it is obscured by the posteroventral lobes of the propodeum in profile. Spongiform tissues are ignored.

Petiolar Height (PH). The maximum distance measured between two parallel lines, one tangent with the node apex and the other tangent with the ventral-most point of the petiole in profile. When the ventral margin is concave upward, then the lower line tangent to the uppermost portion of the curve. Spongiform tissues, if present, are ignored.

Petiolar Width (PW). The maximum width of the petiolar node in dorsal view.

Postpetiole Length (PPL). The maximum length of the postpetiole in profile view, from the anterior margin to the posterior margin. Spongiform tissues, if present, are ignored.

Gaster Length (GL). The maximum length of the gaster in profile view, from the anterior margin to the posterior margin. Spongiform tissues and sting, if present, are ignored.

Cephalic Index (CI). $HW / HL \times 100$

Mandibular Index (MI). $MandL / HL \times 100$

Scape Index (SI). $SL / HW \times 100$

Ocular Index (OI). $EL / HW \times 100$

Lateral Petiolar Index (LPI). $PH / PL \times 100$

Dorsal Petiolar Index (DPI). $PW / PL \times 100$

All materials used in this study were deposited in Arthropod collection in Kangwon National University (KNU).

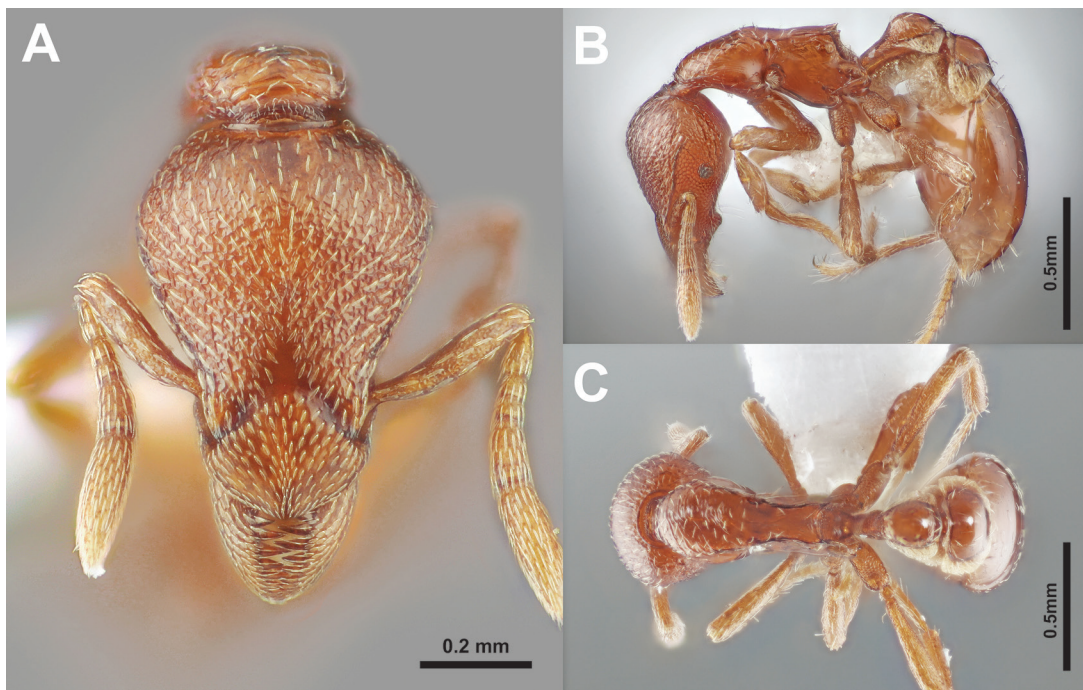


Fig. 1. Holotype worker (KADB230-01) of *Strumigenys calvus* sp. nov. **A.** Full-face view. **B.** Profile view. **C.** Dorsal view.

Systematic accounts

Order: Hymenoptera Linnaeus, 1758

Family: Formicidae Latreille, 1809

Subfamily: Myrmicinae Lepeletier de Saint-Far-
geau, 1835

Tribe: Attini Smith, 1858

Genus: *Strumigenys* Smith, 1860

Type-species: *Strumigenys mandibularis* Smith,
1860

***Strumigenys calvus* sp. nov. Zoobank code:
urn:lsid:zoobank.org:act:C6732E2C-2F0A-
4256-9A50-C1EA95D359A5 (Figs. 1–3)**

Diagnosis

Following Bolton (2000), this species belongs to the *Strumigenys leptothrix*-group, and can be distinguished from other similar species by the combination of the following characteristics: In full-face view, head entirely areolate-rugose excluding cephalic vertex and epistomal sulcus. Occipital margin straight or slightly concave, without projecting erect simple hairs. Lack of laterally projecting hairs along the dorsolateral margin of head in full-face view. Apicoscrobial hair absent. Antennae entirely with short appressed hairs on antennal scape and funiculus, without suberect or erect hairs. Mandibles densely covered with appressed spatulate hairs in full-face view. Pronotal humeral hair usually absent, rarely short and erect, not flagelliform. Pronotum and mesonotum with short appressed hairs, without erect hairs in profile view. Propodeal spines acute, not elongated. Post-ventral propodeal lamella broad. Mesosoma largely smooth excluding propodeum in profile view. Distinct blackish spot on 3rd abdominal sternite (1st gastral segment).

Type material

Holotype worker (KADB230-01): REPUBLIC OF KOREA: near Mt. Hallasan, Haean-dong, Jeju-si, Jeju-do Is., 33.403031, 126.461783, alt. 668

m, 11. Aug. 2018. Coll. M.S. Dong, Hand collecting. **Paratype workers (n=32)**: same data as holotype worker. **Paratype queen** (KADB230-02): same data as holotype worker. **Paratype gynes (n=15)**: same data as holotype worker.

Non-type material

REPUBLIC OF KOREA: 5 workers, Soya-do Is., Ongjin-gun, Incheon-si, 37.226392, 126.168897, alt. 30m, 26. May. 2018. Coll. M.S. Dong, Sifting; 17 workers, 18 gynes, near Mt. Hallasan, Haean-dong, Jeju-si, Jeju-do Is., 33.403617, 126.462833, alt. 669m, 11. August. 2018. Coll. M.S. Dong, Hand Collecting; 22 workers, near Seogwipo Natural Recreation Forest, Daepo-dong, Seogwipo-si, Jeju-do Is., 33.312083, 126.457278, alt. 705m, 14. Jul. 2018. Coll. J.H. Park, Hand Collecting; 4 workers, near Mt. Hallasan, Sogil-ri, Aewol-eup, Jeju-si, Jeju-do Is., 33.389222, 126.410250, alt. 766m, 13. Jul. 2018. Coll. J.H. Park, Sifting; 8 workers, Cheongsapo, Haeundae-gu, Busan-si, 35.163250, 129.191008, alt. 55m, 2. May. 2020. Coll. M.S. Dong, Berlese trap.

Measurements

Holotype worker (KADB230-01): TL 2.70, HL 0.66, HW 0.48, MandL 0.12, SL 0.32, EL 0.04, PW 0.27, ML 0.71, PL 0.32, PH 0.15, PW 0.15, PPL 0.21, GL 0.68, CI 79, MI 18, SI 58, OI 12, LPI 41, DPI 40. **Paratype workers (n=26)**: TL 2.58–2.96, HL 0.64–0.74, HW 0.46–0.54, MandL 0.11–0.13, SL 0.30–0.34, EL 0.04–0.05, PW 0.24–0.28, ML 0.65–0.84, PL 0.31–0.38, PH 0.15–0.17, PW 0.14–0.16, PPL 0.19–0.22, GL 0.67–0.72, CI 71–79, MI 17–18, SI 58–65, OI 8–12, LPI 44–48, DPI 37–42. **Paratype queen** (KADB230-02): TL 3.25, HL 0.71, HW 0.54, MandL 0.13, SL 0.32, EL 0.16, PNW 0.40, ML 0.89, PL 0.39, PH 0.22, PW 0.20, PPL 0.22, GL 0.91, CI 76, MI 18, SI 59, OI 29, LPI 56, DPI 51. **Paratype gynes (n=6)**: TL 3.10–3.29, HL 0.68–0.72, HW 0.52–0.54, MandL 0.12–0.14, SL 0.32–0.33, EL 0.16, PNW 0.39–0.42, ML 0.87–0.90, PL 0.38–0.39, PH 0.20–0.22, PW 0.19–0.20, PPL 0.19–0.22, GL 0.86–0.92, CI 75–77, MI 18–19, SI 61, OI 29–30, LPI 52–56, DPI 50–51.

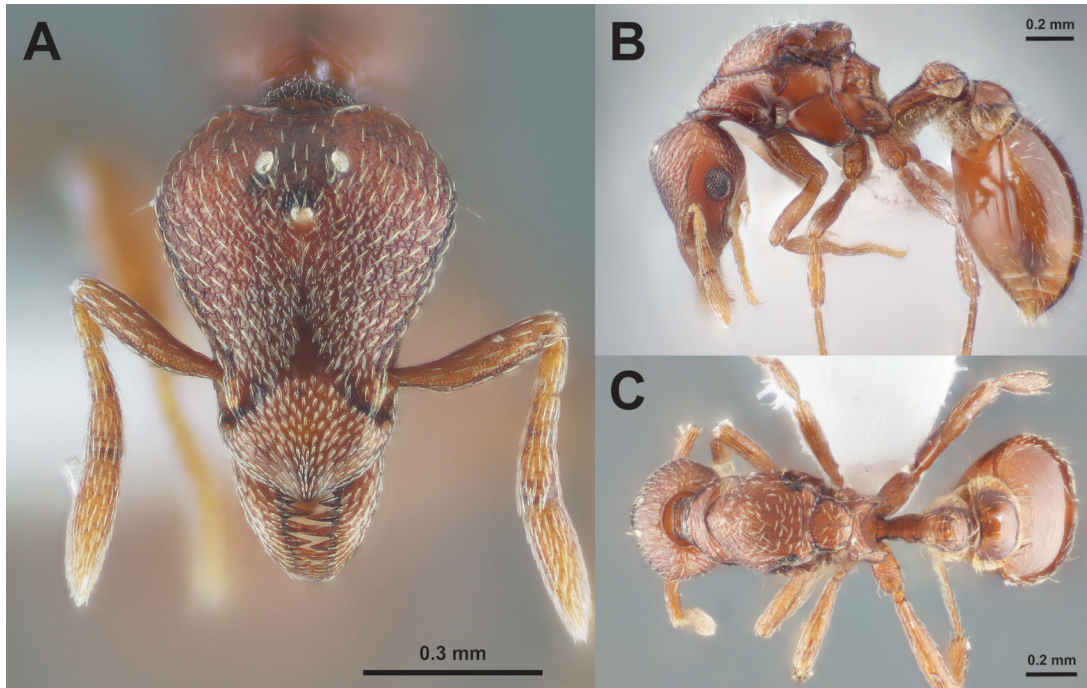


Fig. 2. Paratype queen (KADB230-02) of *Strumigenys calvus* sp. nov. **A.** Full-face view. **B.** Profile view. **C.** Dorsal view.

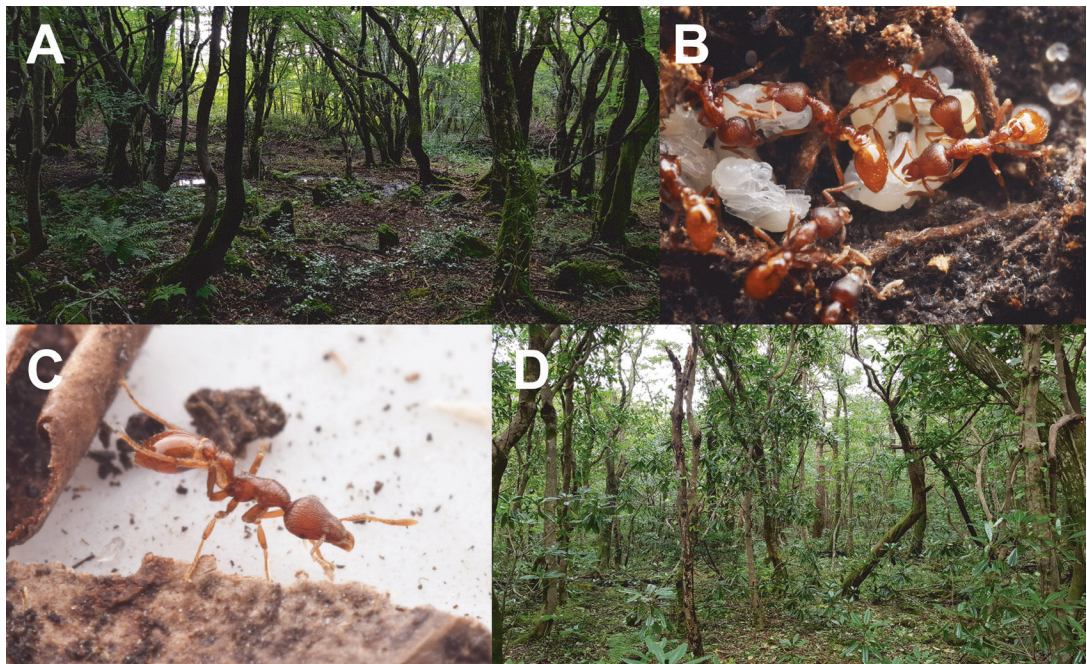


Fig. 3. Habitus and field images of *Strumigenys calvus* sp. nov. **A.** Forest in Jeju-do Is., where the two ant colonies have been found. **B.** Nest of *S. calvus* sp. nov. **C.** Single worker collected by sifting in Incheon. **D.** Forest in Soya-do Is., Incheon, where the foraging workers have been collected by sifting.

Worker (Fig. 1)

Coloration: Body entirely rust orange ground color.

Head (Fig. 1A, B): Head longer than wide (CI: 71–79). Occipital margin straight or slightly concave, not deeply concave. Cephalic posterolateral margin roundly convex. Cephalic frons posteromedially convex in profile view. Eyes small and circular, completely invisible in full-face view. Antennae 6-segmented, scape cylindrical-shaped, basally thin. Clypeus diamond-shaped, anterior clypeal margin convex, converged at frontal apex. Mandibles triangular shaped in full-face view, fully closed without diastema. Mandibular external margin evenly curved, masticatory margin with well-developed 8–9 triangular teeth, basal tooth acute but distinctly smaller (c.a. 1/2) than other typical tooth. Second and third tooth distinctly longer, almost half the length of the basal margin of mandible.

Mesosoma (Fig. 1B, C): In profile view, pronotum anteriorly curved, not angulated. Dorsum of pronotum flat. Promesonotal suture gently raised, not distinctly concave. Dorsum of mesonotum also flat. Metanotal groove indistinct. Dorsum of propodeum flat or slightly raised. Pronotal humeral angle absent in dorsal view. Propodeal spines short, acute, not elongated in profile view. Propodeal spines parallel, not convergent in dorsal view. Sparse spongiform tissue (propodeal lamella) post-ventrally attached between propodeal spine and propodeal lobe. Propodeal declivity evenly concave.

Metasoma (Fig. 1B): Petiolar peduncle long and elongated, as long as petiolar node. Petiolar node round, evenly convex, not angulated in lateral view. In dorsal view, petiolar node longer than wide. Postpetiole gently convex when seen in lateral view. Petiole lateroventrally covered with stretched semicircular spongiform tissue. Broad spongiform tissue attached on the antero-ventral portion of the petiole. Stretched semicircular spongiform tissue attached on postpetiole lateroventrally, but much more extensive than tissue on petiole. Gaster oval shaped, black round spot on 3rd abdominal sternite (1st gastral segment) remarkably visible in lateral and ventral view.

Pilosity: Head covered with short appressed hairs except malar area (gena) in lateral view. Occipital margin without projected erect hairs in full-face view. Frons and clypeus densely covered with short hairs, less densely covered in vertex. Lack of laterally projecting hairs along the dorsolateral margin of head in full-face view. Antennal scape and funiculus entirely covered with short appressed hairs. Hairs on antennal funiculus denser than hairs on the antennal scape. Mandibles densely covered with ovate to subspatulate hairs, long fine hairs on posterior side. Pronotum and mesonotum with fine appressed hairs, lacking erect hairs. Propodeum with fine appressed hairs as well. Pronotal humeral hair usually clearly absent, but rarely seen in dorsal view. Petiole and postpetiole covered with appressed to suberect hairs. Gaster covered with fine appressed hairs and erect hairs.

Sculpture: Head densely areolate-rugose. Cephalic vertex weakly rugose or smooth. Epistomal sulcus smooth. Clypeus smooth without punctation. Gena (malar area) distinctly alveolate in lateral view. Antennal scape densely but weakly verrucose. Dorsum and side surface of pronotum weakly costate anteriorly. Mesonotum including mesopleuron, metathorax smooth and shiny. Propodeum irregularly wrinkled, but some specimens seem smooth. Dorsum of petiolar peduncle densely areolate-rugose. Side surface of petiolar node weakly rugose while dorsum is shiny. Dorsum of postpetiole entirely shiny. Gaster also entirely smooth and shiny excluding relatively short basigastral costulae.

Queen (Fig. 2)

Morphologically similar to worker except following characteristics; presence of a pair of erect apicoscrobal hair and distinct pronotal humeral hairs in dorsal view, presence of 3 ocelli, and extremely enlarged compound eyes and thorax.

Coloration: Body entirely rust orange ground color, slightly darker than worker.

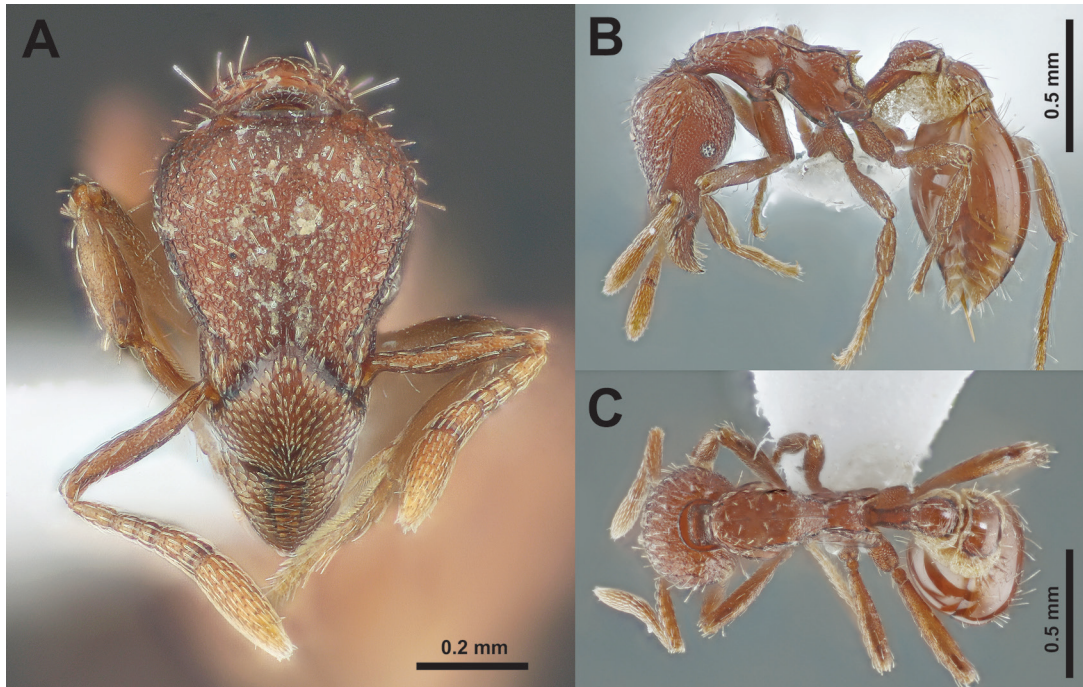


Fig. 4. Worker of *Strumigenys alecto* (Bolton, 2000) A. Full-face view. B. Profile view. C. Dorsal view.

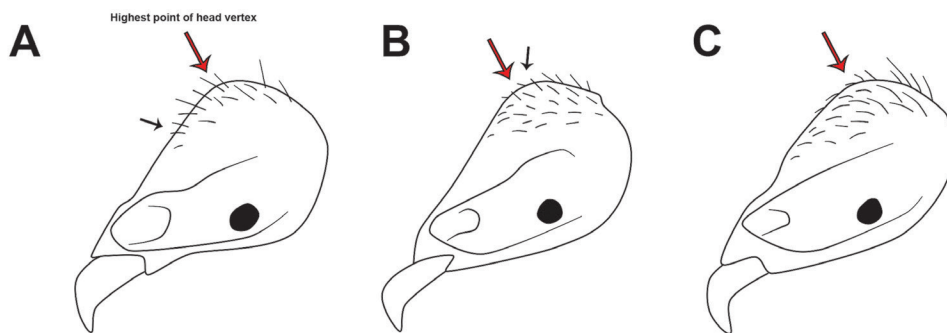


Fig. 5. Differences in distribution of standing hairs on head of 3 resembling species. A. *Strumigenys alecto*. B. *S. benten* (ANTWEB: CASENT0280705). C. *S. formosimonticola* (ANTWEB: CASENT0900131).

Wing venation: Both forewing and hindwing entirely covered with short fine hairs densely. Posterior margin of forewing with distinctly long hairs. Forewing venation vestigial, not developed, even almost invisible excluding pterostigma, costal (C) vein, radial (R1) veins and thick r-rs cross vein.

Distribution Republic of Korea (New record: Busan, Incheon, Jeju) (Fig. 12)

Remarks

We were able to collect the colonies of this species twice, and both of them made their nest under the stone of broad-leaved humid forest in mountainous area (alt. 600~700m) (Fig. 3). Both colonies were collected at August and consisted of more than 70 workers (72, 86) and about 20 alate gynes (18, 7) with a single queen. A couple

of foraging workers were collected through sifting from broad-leaved humid forest in the island (alt. ca. 60m) as well.

Etymology

Specific epithet “*calvus*” means “bald” in Latin, referring to the absence of laterally projecting hairs along the dorsolateral margin of head.

Strumigenys alecto (Bolton, 2000) (Fig. 4)

Pyramica alecto Bolton, 2000: 429. Type locality: Japan (Kyoto)

Diagnosis

Strumigenys alecto belongs to a member of the *Strumigenys leptothrix*-group. This species can be separated from other Korean *Strumigenys* spp. by the combination of the following characteristics: In full-face view, Occipital margin straight or slightly concave without erect hairs. Numerous laterally projecting hairs present along the dorsolateral margin of head. Frons sparsely covered with short hairs. In lateral view, erect hairs present from occipital margin to in front of vertex. Laterally projecting hairs along the dorsolateral margin of head in full-face view. Apicoscrobial hair short, erected. Dorsum of clypeus and entire mandibles covered with appressed spatulate hairs. Pronotal humeral hair present. Pronotum and mesonotum moderately covered with erect filiform and appressed hairs.

Material examined

REPUBLIC OF KOREA: 2 workers, Mt. Nojasan, Geoje-do Is., Gyeongsangnam-do, 34.784367, 128.629528, alt. 158m, 26. May. 2018. Coll. M.S. Dong, Berlese trap.

Description

Worker (Fig. 4)

Body: Total body length 2.6–2.7mm, dark orange ground color.

Head (Fig. 4A, B): Head longer than wide. Occipital margin slightly concave. Cephalic posterolateral margin roundly convex. Cephalic frons posteromedially convex in profile view. Eyes small and circular. Antennae 6-segmented, scape cylindrical-shaped, basally thin. Clypeus diamond-shaped, anterior clypeal margin convex, converged at frontal apex. Mandibles triangular shaped in full-face view, fully closed without diastema. Mandibular external margin evenly curved, masticatory margin with well-developed 8~9 triangular teeth, basal tooth acute but distinctly smaller (c.a. 1/2) than other typical teeth. Second and third tooth distinctly longer, almost half the length of the basal margin of mandible.

Mesosoma (Fig. 4B, C): Pronotum anteriorly curved, not angulated. Dorsum of pronotum flat. Promesonotal suture gently raised, not distinctly concave. Dorsum of mesonotum also flat. Metanotal groove indistinct. Dorsum of propodeum slightly raised. Pronotal humeral angle absent in dorsal view. Propodeal spines short, acute, not elongated in profile view. Each spine parallel, not convergent in dorsal view. Sparse spongiform tissue (propodeal lamella) post-ventrally developed between propodeal spine and propodeal lobe. Propodeal declivity evenly curved, not concave.

Metasoma (Fig. 4B): Petiolar peduncle long and elongated, as long as petiolar node. Petiolar node round, evenly convex, not angulated in lateral view. In dorsal view, petiolar node slightly longer than wide. Postpetiole gently convex when seen in lateral view. Anteroventrally broad spongiform tissue attached under petiole. Stretched semicircular spongiform tissue attached on post-petiole lateroventrally, much more extensive than tissue attached on petiole. Gaster oval shaped.

Pilosity: Head covered with short appressed, suberect and erect hairs except malar area (gena). Occipital margin without projected erect hairs in full-face view. Numerous laterally projecting hairs present along the dorsolateral margin of head in full-face view. Frons and clype-

eus densely covered with short hairs, less densely covered in vertex. In profile view, standing simple hairs present on head from occipital margin to in front of the highest point of the vertex. Antennal scape and funiculus entirely covered with short appressed hairs. Hairs on antennal funiculus denser than hairs on the antennal scape. Mandibles densely covered with ovate to subspatulate hairs, long fine hairs on posterior side. Pronotum and mesonotum with filiform standing hairs. Pronotal humeral hair short and erect, not flagelliform in dorsal view. Petiole and postpetiole dorsally covered with a couple of filiform hairs. Gaster covered with fine appressed hairs and erect hairs.

Sculpture: Head densely areolate-rugose. Cephalic vertex weakly rugose to smooth. Epistomal sulcus smooth. Clypeus smooth without punctation. Gena (malar area) distinctly alveolate in lateral view. Antennal scape densely but weakly verrucose. Dorsum and side surface of pronotum weakly costate anteriorly. Mesonotum including mesopleuron, metathotax smooth and shiny. Propodeum rugose in lateral view. Pronotum weakly costate anteriorly. Dorsum of petiolar peduncle densely areolate-rugose. Side surface of petiolar node weakly rugose while dorsum is shiny. Dorsum of postpetiole entirely shiny. Gaster entirely smooth and shiny excluding relatively short basigastral costulae.

Distribution: Republic of Korea (Geoje) (Fig. 12), Japan.

Remarks

This species is very similar to *S. benten* and *S. formosimonticola*, that have been recorded in Japan and Taiwan. According to Bolton (2000), this species can be separated by a character that erect and suberect hairs present on cephalic dorsum in profile view. *S. alecto*: in profile view, standing hairs are present from occipital margin to in front of highest point of the head vertex. *S. benten*, *S. formosimonticola*: in profile view, standing hairs are only present from occipital margin to highest point of the head vertex (Fig. 5).

Strumigenys kumadori Yoshimura & Onoyama, 2007 (Fig. 6)

Strumigenys sp. 1: Sonobe, 1977: 113 Type locality: Japan (Ibaraki)

Strumigenys sp.: Masuko, 1984: 432, Masuko *et al.*, 1985: 11

Strumigenys sp.: Choi, 1995: 190

Strumigenys lewisi: Munakata, 1972: 314; Bolton, 2000 (in part)

Strumigenys sp. 4: Onoyama *et al.*, 1992: 63; JADG, 2003a: 224, 2003b: 196, 2003c: CD-ROM

Diagnosis

This species can be distinguished from other Korean *Strumigenys* species by the combination of following characteristics: Head distinctly longer than wide with deeply concaved occipital margin. Apicoscrobal hair distinctly long, usually flagelliform, rarely filiform. Clypeus fan shaped. Mandibles long, linear and elongated. Pronotal humeral hair flagelliform. Posterior margin of propodeal lamella straight or slightly convex, not distinctly concave.

Material examined

REPUBLIC OF KOREA: 61 workers, Mt. Yongmunsan, Yangpyeong-gun, Gyeonggi-do, 37.508089, 127.530069, alt. 229m, 5. May. 2018. Coll. M.S. Dong, Hand collecting; 7 workers, 1 queen, near Mt. Hallasan, Aewol-eup, Jeju-si, Jeju-do Is., 33.398889, 126.443119, alt. 668m, 11. Aug. 2018. Coll. M.S. Dong, Berlese trap; 2 workers, Gakhwasa (Temple), Chunyang-myeon, Bonghwa-gun, Gyeongsangbuk-do, 36.989044, 128.908881, alt. 663m, 9. Jul. 2019. Coll. M.S. Dong, Berlese trap.

Description

Worker (Fig. 6)

Body: Total body length 2.2–2.5mm, orange to yellow ground color.

Head (Fig. 6A, B): Head distinctly longer than wide. Occipital margin deeply concave. Cephalic posterolateral margin roundly convex. Frons weakly raised in profile view. Eyes small and circular or ellipse form. Antennae 6-segmented, scape cylindrical-shaped. Clypeus small, fan shaped. Anterior clypeal margin convex, posterior clypeal margin pointed. Mandibles long, elongated and linear. Mandibular outer and inner margin evenly curved. Mandibles with a couple of sharp teeth apically.

Mesosoma (Fig. 6B, C): Pronotum and mesonotum evenly convex. Promesonotal suture and metanotal groove smooth, indistinct. Dorsum of propodeum flat. Propodeal declivity straight. Propodeal spines thin, almost invisible due to lamella. Posterior margin of spongiform tissue (propodeal lamella) straight or slightly convex. In dorsal view, anterior and lateral margin of pronotum convex with slightly angulate. Propodeum much narrower than pronotum. Each propodeal spine divergent.

Metasoma (Fig. 6B): Petiolar peduncle thin, elongated. Petiolar node reverse-U shaped, dorsum of node flat. In dorsal view, petiolar peduncle long and thin. Postpetiolar dorsum wider than long. Spongiform tissue attached on petiole and postpetiole lateroventrally. Spongiform tissue on side petiolar node and postpetiole triangular shaped with posterior margin slightly concave. Gaster largely oval shaped.

Pilosity: Head largely covered with erect and appressed simple hairs. Apicoscrobial hair present, distinctly long and flagelliform, but rarely seem filiform rather than flagelliform. Head dorsolateral margin with projected simple hairs. Clypeus densely covered with appressed hairs. Antennal scape and funiculus entirely covered with fine appressed hairs. J-shaped to subdecumbent simple hairs present along edge of anterior margin of antennal scape. Mandibles covered with fine appressed hairs. Dorsum of side of pronotum and mesonotum with fine filiform hairs. Propodeum with a couple of filiform hairs. A pair

of pronotal humeral hair flagelliform and clearly seen in dorsal view. Petiole and postpetiole covered with long fine filiform and flagelliform hairs. Gaster covered with long fine hairs.

Sculpture: Entire head including clypeus and malar area densely reticulate-punctate. Antennal scape densely but weakly verrucose. Dorsum and side of pronotum and mesonotum reticulate-punctate, mesopleuron and metapleuron almost smooth and shiny. Dorsum of propodeum also reticulate-punctate while side smooth. Dorsum of petiolar peduncle and node verrucose and reticulate-punctate, respectively. Dorsum of postpetiole entirely shiny. Gaster entirely smooth and shiny, basigastral costulae distinct.

Distribution Republic of Korea (Boeun, Bonghwa, Cheongsong, Chuncheon, Gunsan, Incheon, Jeju, Seoul, Yangpyeong) (Fig. 12), China, Japan, Taiwan.

Remarks

This species is morphologically very similar to its sibling species, *S. lewisi* Cameron, 1886, making it very hard to distinguish them from each other, especially for the worker caste. Gynes are much easier to distinguish from *S. lewisi* by following combination of the characteristics. ***Strumigenys kumadori*:** Compound eyes distinctly larger than *S. lewisi*. Each ocellus with separate dark patterns. Promesonotal suture distinct and concave. Posterior margin of scutellum perpendicular in lateral view (Fig. 7).

This species is mainly found in leaf-litter of mountainous forests in Korea. They make their colony in the rotten trees, beneath barks, rotten acorns, cracked rocks, and fallen leaves under stones located in shady forests. This species was previously known as *Strumigenys* sp. by Choi (1995) in Korea.

***Strumigenys masukoi* (Ogata & Onoyama, 1998) (Fig. 8) - new record**

Smithistruma masukoi Ogata & Onoyama, 1998: 283. Type locality: Japan (Honshu).

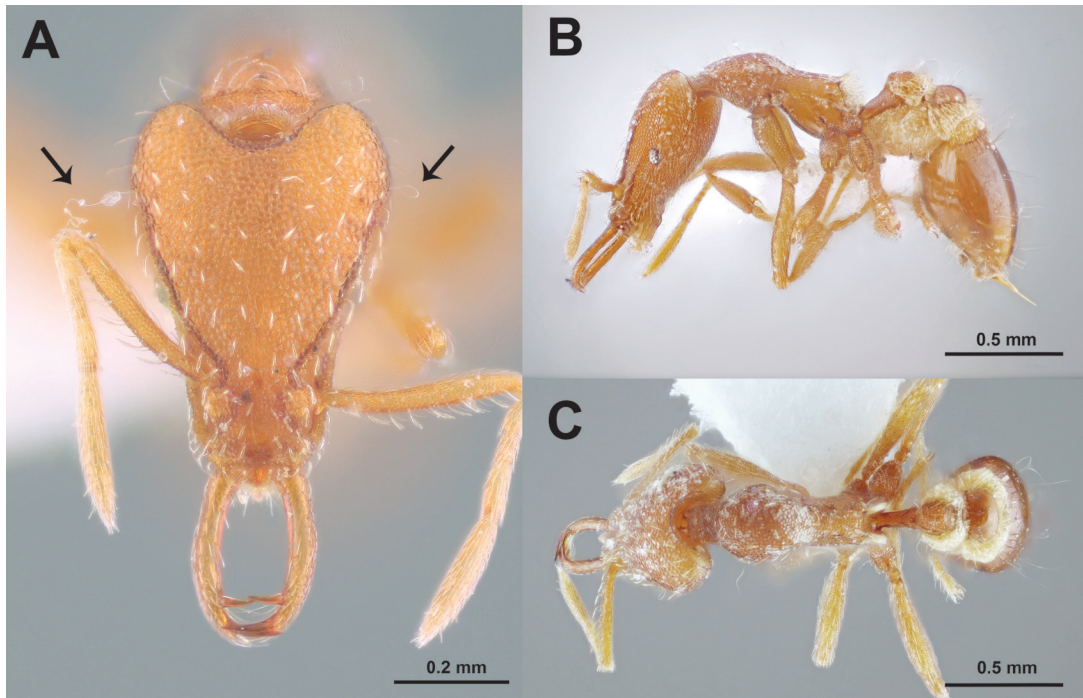


Fig. 6. Worker of *Strumigenys kumadori* Yoshimura & Onoyama, 2007 **A.** Full-face view. **B.** Profile view. **C.** Dorsal view.

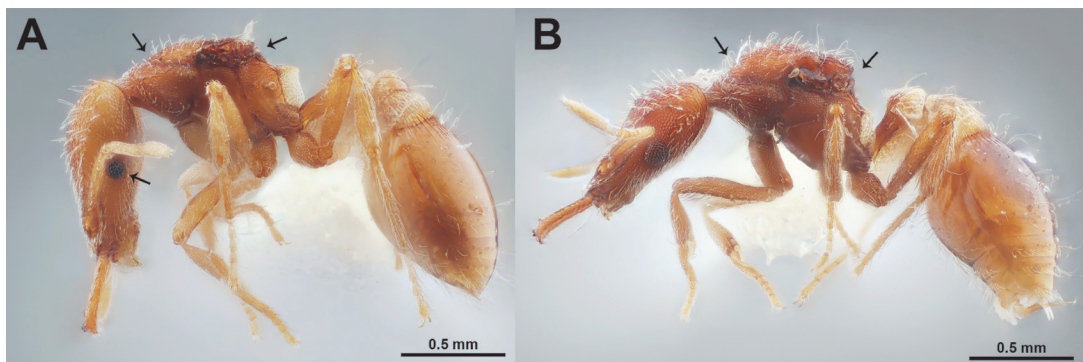


Fig. 7. Profile view of queen of two closely resembling sibling species. **A.** *Strumigenys lewisi*. **B.** *S. kumadori*.

Diagnosis

This species is a member of *Strumigenys baudu-eri*-group, and the only species of this group encountered in the eastern Palaearctic region. This species can be distinguished from other Korean *Strumigenys* spp. by the combination of the following characteristics: Head distinctly long and elongated in full-face view. Apicoscrobial hair

present, long, flagelliform in full-face view. Anterior part of head including mandibles without long erect hairs in profile view. Clypeus distinctly longer than wide. Mandibles short, triangular shaped, always shorter than clypeal length. Pronotal humeral hair present. Body moderately covered with flagelliform hairs.

Material examined

REPUBLIC OF KOREA: 1 worker, Mt. Jirisan, Sandong-myeon, Gurye-gun, Jeollanam-do, 35.307222, 127.510000, alt. 1056m, 26. May. 2018. Coll. M.S. Dong, Sifting.

Descriptions

Worker (Fig. 8)

Body: Total body length 1.9mm, ruby to dark orange ground color.

Head (Fig. 8A, B): Distinctly long and elongated in full-face view. Occipital margin shallowly concave. Frons and clypeus gradually raised in profile view, not distinctly convex. Eyes small and circular. Antennae 6-segmented. Antennal scape slightly flattened cylindrical-shaped. Antennal pedicel (1st segment of antennal funiculus) distinctly border than 2, 3 funicular segments. Clypeus parallelogram-shaped, longer than wide. Anterior clypeal margin narrowly convex, converged at a midpoint. Posterior clypeal margin much narrow and pointed than anterior margin. Mandibles in full-face view short, always shorter than clypeal length. Mandibles slightly elongated triangular shaped, fully closed without diastema. Mandibular external margin long evenly curved. Mandibular tooth small and denticulate.

Mesosoma (Fig. 8B, C): In profile view, dorsum of mesosoma bumpy. Pronotum lower than mesonotum, dorsum of pronotum almost flat, but anteriorly curved. Dorsum of mesonotum evenly convex. Metanotal groove weakly concave. Dorsum of propodeum flat. Propodeal spines short, acute and almost invisible because of spongiform tissue (lamella). Lamella evenly concave. In dorsal view, pronotal humeral angle indistinct, lateral margin of pronotum evenly convex in dorsal view. Propodeum much narrower than pronotum and mesonotum. Each propodeal spine parallel or divergent rather than convergent.

Metasoma (Fig. 8B): Petiolar peduncle short, node convex and round. Dorsum of postpetiole weakly convex. Petiolar node and postpetiole almost invisible due to extensive spongiform

tissue. Spongiform tissue on side petiolar node triangular shaped with posterior margin slightly concave. Medially concaved spongiform tissue attached on bottom of petiole. Postpetiole lateroventrally covered with stretched semicircular spongiform tissue. In dorsal view, dorsum of postpetiole visible while petiolar node concealed. Postpetiolar dorsum wider than long. Gaster oval shaped, basally attached sparse spongiform tissue present.

Pilosity: Head largely covered with dense pelt of short hairs, fine filiform and flagellate hairs in full-face view. Apicoscrobial hair present, distinctly long and flagelliform. A couple of flagelliform and filiform hairs on head vertex in profile view. Clypeus densely covered with spatulate hairs. Antennal scape and funiculus entirely covered with fine appressed hairs. Spatulate hairs present along anterior margin of antennal scape. Mandibles densely covered with extremely short fine hairs. Dorsum of pronotum and mesonotum with dense pelt of short hairs and fine filiform hairs. A couple of distinctly long hairs present. Propodeum almost lacks hairs on lateral surface, only a couple of hairs present on dorsal surface. Pronotal humeral hair clearly absent in dorsal view, but seen in paratype specimen available in AntWeb (CASENT0900152). Petiole and postpetiole covered with long appressed and erect filiform hairs. Gaster covered with long fine hairs.

Sculpture: Head densely areolate. Epistomal sulcus smooth. Clypeus smooth without punctation. Gena (malar area) alveolate in lateral view. Antennal scape densely but weakly verrucose. Mesosoma including mesopleuron, metathorax smooth and shiny. Propodeum smooth as well. Dorsum of petiolar peduncle weakly verrucose. Dorsum of postpetiole entirely shiny. Gaster entirely smooth and shiny, basigastral costulae obscured partially by spongiform tissue.

Distribution: Republic of Korea (new record: Gurye) (Fig.12), Japan.

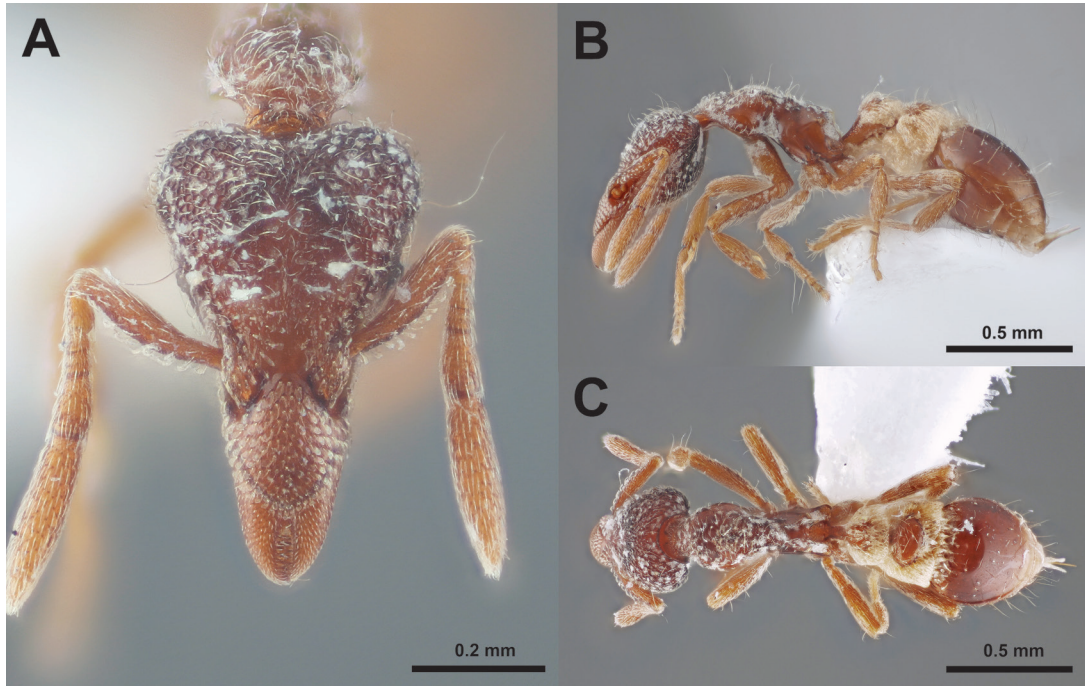


Fig. 8. Worker of *Strumigenys masukoi* (Ogata & Onoyama, 1998) A. Full-face view. B. Profile view. C. Dorsal view.

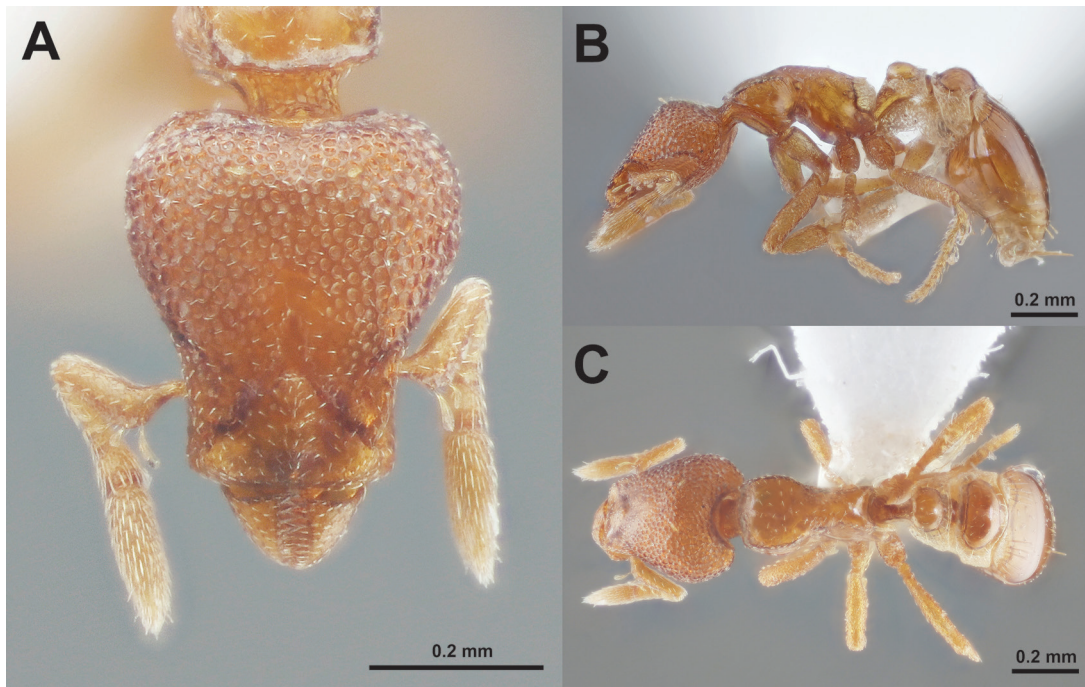


Fig. 9. Worker of *Strumigenys membranifera* Emery, 1869 A. Full-face view. B. Profile view. C. Dorsal view.

Remarks

According to Imai *et al.* (2003), this species is very rarely collected in Japan, found only on the floor of broad-leaved forest. A single worker specimen of this species has been collected from a soil sample in the broad-leaved forest at an elevation above 1000m in Korea.

Strumigenys membranifera Emery, 1869 (Fig. 9) - new record

Strumigenys (Trichoscapa) membranifera Emery, 1869b: 24. Type locality: Italy (Napoli)

Strumigenys foochowensis Wheeler, 1928: 28. Type locality: China

Strumigenys (Trichoscapa) membranifera var. *marioni* Wheeler, 1933: 276. Type locality: USA

Strumigenys (Trichoscapa) membranifera var. *santschii* Forel, 1904: 6. Type locality: Tunisia

Strumigenys (Trichoscapa) membranifera r. *simillima* Emery, 1890: 69. Type locality: Antilles

Strumigenys (Trichoscapa) membranifera var. *williamsi* Wheeler, 1933: 276. Type locality: Hawaii

Strumigenys silvestriana Wheeler, 1928: 27. Type locality: China

Strumigenys vitiensis Mann, 1921: 461. Type locality: Fiji

Diagnosis

This species can be easily distinguished from other Korean *Strumigenys* spp. by the combination of following characteristics: Frons with erect spatulate hair in lateral view. Frontal clypeal margin extended and broad, slightly convex, not concave in full-face view. Anterolateral clypeal margin perpendicular. Mandibles short. triangu-

lar shaped, fully closed without diastema. Legs with spatulate hair apically.

Material examined

REPUBLIC OF KOREA: 2 workers, Taejongdae, Yeongdo-gu, Busan-si, 35.051000, 129.086639, alt. 98m, 26. May. 2018. Coll. M.S. Dong, Sifting.

Descriptions

Worker (Fig. 9)

Body: Total body length 2.2–2.5mm, bright orange ground color.

Head (Fig. 9A, B): Head longer than wide. Occipital margin weakly concave in full-face view, not distinctly angulated. Frons distinctly convex in profile view. Eyes extremely small. Antennae 6-segmented, scape flattened cylindrical-shaped, basally distinctly thin and curved. Clypeus distinctly triangular-shaped, anterior clypeal margin broadly well expanded and straight to weakly convex, both anterolateral margin of clypeus protruded and angulated. Mandibles in full-face view short triangular shaped, fully closed without diastema, not elongated or narrow. Basal margin of mandibles evenly concave. Mandibles with small denticles and without distinctly elongated apical tooth.

Mesosoma (Fig. 9B, C): In profile view, dorsum of mesosoma unevenly convex. Dorsum of pronotum weakly raised or flat. Promesonotal suture gently raised. Dorsum of mesonotum also flat. Metanotal groove indistinct and smooth. In dorsal view, lateral margin of dorsum of pronotum gently curved. Dorsum of propodeum weakly concave to flat. Pronotal humeral angle present and angulate. Propodeal spines almost invisible. Each spine parallel, not convergent in dorsal view. Spongiform tissue (propodeal lamella) post-ventrally developed between propodeal spine and propodeal lobe.

Metasoma (Fig. 9B): In profile view, petiole lateroventrally covered with stretched semicircular spongiform tissue. Petiolar peduncle short. Medially concaved spongiform tissue

attached under petiolar peduncle. Petiolar node reverse U-shaped, evenly convex, highest point of node relatively narrow. Postpetiole gently convex. Stretched semicircular spongiform tissue attached on postpetiole lateroventrally. In dorsal view, both petiolar node and postpetiole wider than long. Gaster largely oval shaped.

Pilosity: Entire head covered with scattered short fine hairs, without any distinctly projected hairs in full-face view. In profile and dorsal views, a pair of erect spatulate hairs present on highest point of head vertex. Antennal scape and funiculus are also covered with fine hairs anteriorly, with no projected hairs in its posterior margin in full-face view. A couple of spatulate hairs present along anterior margin of antennal scape, basal spatulate hair is almost twice as long as other spatulate hairs. Hairs on antennal funiculus are denser than hairs on the antennal scape. Dorsum of mesosoma with fine appressed hairs, lacks erect hairs. Side of mesosoma without any hairs in profile view. Pronotal humeral hair absent in dorsal view. Petiole and postpetiole covered with appressed hairs in profile view. Gaster covered with fine appressed hairs and suberect or erect spatulate hairs.

Sculpture: Head strongly areolate. Epistomal sulcus smooth. Clypeus smooth without punctation. Gena (malar area) alveolate in lateral view. Antennal scape densely but weakly verrucose. Pronotum margin weakly costate. Dorsum of petiolar peduncle rugose. Dorsum of postpetiole entirely shiny. Gaster entirely smooth and shiny excluding long basigastral costulae.

Distribution

Native: Ghana, Sierra Leone, South Africa Introduced: a widespread species in multiple biogeographic realms. For a full global account, please refer to records presented under antmaps.org (Janicki *et al.* 2016, Guénard *et al.* 2017). Here, the Asian distribution is presented for the Oriental (China: Guangdong, Hong Kong, Yunnan; India; Taiwan) and Sino-Japanese realms (Bhutan, China: Fujian, Sichuan; Japan: Honshu, Kyushu, Ryukyu Islands, Shikoku; Nepal). In Korea, we were able to collect this species from the southern port city of Busan. (**Fig. 12**).

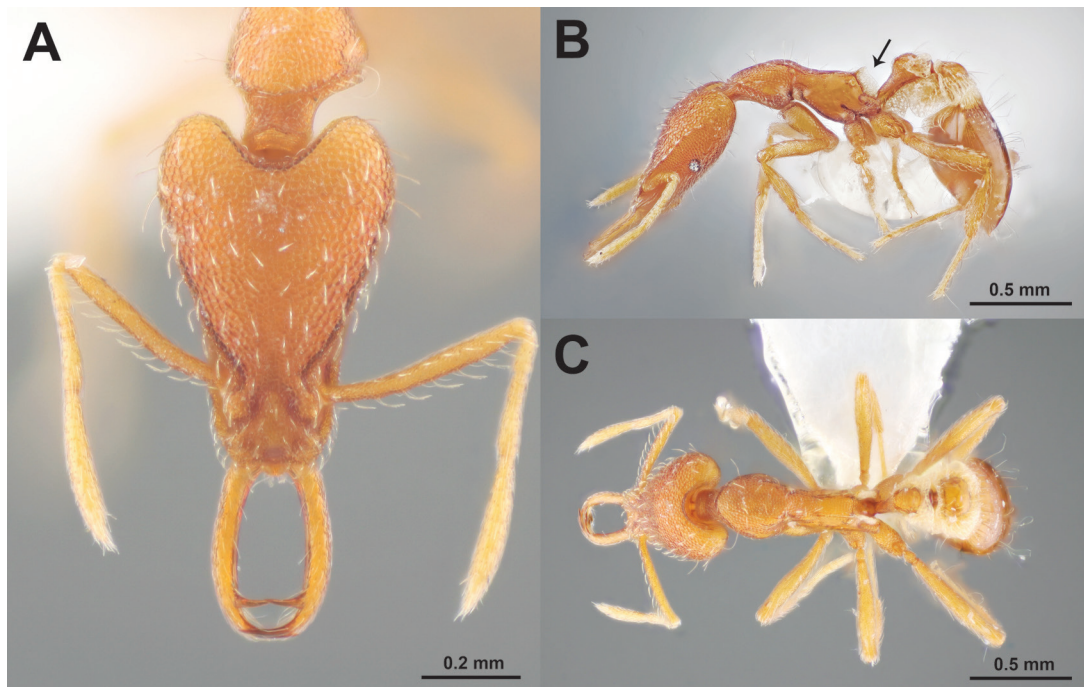


Fig. 10. Worker of *Strumigenys solifontis* Brown, 1949 **A.** Full-face view. **B.** Profile view. **C.** Dorsal view.

Remarks

Strumigenys membranifera is known as pantropical tramp species that has spread from its putative native range, in Africa, via human commerce and is usually found in open areas such as urban gardens and parks but can also be found in woods (Wetterer 2011). Despite the notorious invasion of this species worldwide, little is known about its ecological impacts on the native ant fauna or its relationships with other species (Sharaf *et al.* 2015).

In Korea, we were able to collect this species from leaf litter sifting in the dried open habitat covered with the grass nearby a forest margin.

Strumigenys solifontis Brown, 1949 (Fig. 10)

Strumigenys (*Strumigenys*) *solifontis* Brown, 1949d: 18. Type locality: Japan (Shikoku)

Diagnosis

This species can be distinguished from other Korean *Strumigenys* spp. by the combination of the following characteristics: Apicoscrobal hair present, short, not flagelliform. Mandibles linear, teeth apically. Body slender and thin. Pronotal humeral hair long. Mesosoma with long filiform hairs. Propodeal lamellae slightly concave anteriorly.

Material examined

REPUBLIC OF KOREA: 2 workers, Gakhwasa (Temple), Chunyang-myeon, Bonghwa-gun, Gyeongsangbuk-do, 36.988503, 128.908383, alt. 625m, 9. Jul. 2019. Coll. M.S. Dong, Berlese trap; 14 workers, Mt. Oksuksan, Chunyang-myeon, Bonghwa-gun, Gyeongsangbuk-do, 37.037728, 128.795250, alt. 806m, 10. Jul. 2019. Coll. M.S. Dong, Sifting; 21 workers, Jodong-ri, Dongryang-myeon, Chungju-si, Chungcheongbuk-do, 37.048361, 127.981306, alt. 164m, 7. May. 2018. Coll. J.H. Park, Hand collecting.

Descriptions

Worker (Fig. 10)

Body: Total body length 2.9–3.2mm, orange to yellow ground color.

Head (Fig. 10A, B): Head narrow, distinctly longer than wide. Occipital margin deeply concave. Cephalic posterolateral margin roundly convex. Frons weakly raised in profile view. Eyes small and circular or ellipse form. Antennae 6-segmented, scape cylindrical-shaped. Clypeus small, fan shaped. Anterior clypeal margin convex, posterior clypeal margin pointed. Mandibles long, elongated and linear. Mandibular outer and inner margin evenly curved. Mandibles with a couple of sharp teeth apically.

Mesosoma (Fig. 10B, C): Pronotum and mesonotum evenly convex. Promesonotal suture and metanotal groove smooth, indistinct. Dorsum of propodeum flat. Propodeal declivity straight. Propodeal spine thin, almost invisible due to lamella. Posterior margin of spongiform tissue (propodeal lamella) straight or slightly convex. In dorsal view, anterior and lateral margin of pronotum convex with slightly angulate. Propodeum much narrower than pronotum. Each propodeal spine divergent.

Metasoma (Fig. 10B): Petiolar peduncle thin, elongated. Petiolar node reverse-U shaped, dorsum of node flat. In dorsal view, petiolar peduncle long and thin. Postpetiolar dorsum wider than long. Spongiform tissue attached on petiole and postpetiole lateroventrally. Spongiform tissue on side petiolar node and postpetiole triangular shaped with posterior margin slightly concave. Gaster largely oval shaped.

Pilosity: Head largely covered with erect and appressed simple hairs. Apicoscrobal hair present, relatively short and erected, rarely filiform. Head dorsolateral margin with projected simple hairs. Clypeus densely covered with appressed hairs. Antennal scape and funiculus entirely covered with fine appressed hairs. J-shaped to subdecumbent simple hairs present along edge of anterior margin of antennal scape. Mandibles covered with fine appressed hairs, a couple of projected suberect hairs on inner margin. Dorsum of pronotum and mesonotum with fine filiform and erect hairs. Propodeum with a couple of fi-

liform hairs on dorsoposterior surface. A pair of pronotal humeral hairs filiform or erected, clearly seen in dorsal view. Petiole and postpetiole covered with long fine filiform and flagelliform hairs. Gaster covered with long fine hairs.

Sculpture: Entire head including clypeus and malar area densely reticulate-punctate. Antennal scape densely but weakly verrucose. Dorsum and side of pronotum and mesonotum reticulate-punctate, mesopleuron and metapleuron almost smooth and shiny. Dorsum of propodeum also weakly reticulate-punctate while side smooth. Dorsum of petiolar peduncle and node verrucose and reticulate-punctate, respectively. Dorsum of postpetiole entirely shiny. Gaster entirely smooth and shiny, basigastral costulae distinct.

Distribution Republic of Korea (Bonghwa, Chungju, Daegu, Geoje, Gimhae) (Fig. 12), Japan, Taiwan.

Remarks

The propodeal lamella of all Korean specimens examined is not evenly distinctly concave compared with Japanese (JAID 2006: PCD1050-11, PCD2228-53) and Taiwanese specimens (ANT-

WEB, CASENT0280743), including for the picture of the type specimen available on JAID (Fig. 11).

List of 13 Korean *Strumigenys* species

Strumigenys argiola group

Strumigenys hexamera (Brown, 1958)

Strumigenys baudueri group

Strumigenys masukoi (Ogata & Onoyama, 1998)
- New record

Strumigenys godeffroyi group

Strumigenys choii Lyu, 2007

Strumigenys kumadori Yoshimura & Onoyama, 2007

Strumigenys lewisi Cameron, 1886

Strumigenys solifontis Brown, 1949

Strumigenys leptothrix group

Strumigenys alecto (Bolton, 2000)

Strumigenys calvus sp. nov. - New species

Strumigenys japonica Ito, 1914

Strumigenys membranifera group

Strumigenys membranifera Emery, 1869 - New record

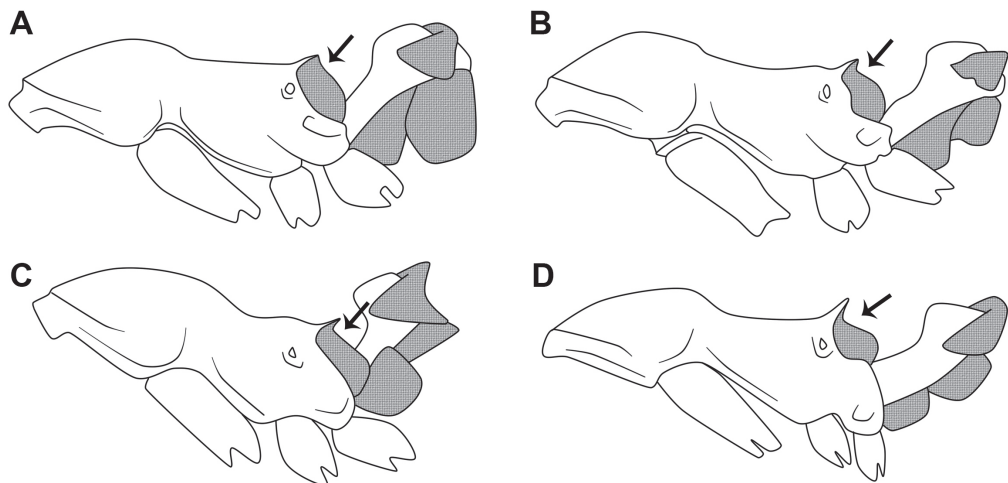


Fig. 11. Variation on propodeal lamellae of *Strumigenys solifontis*. **A.** Korea. **B.** Taiwan (ANTWEB: CASENT0280743). **C.** Japan (JAID: PCD1050-11) **D.** Japan (JAID: HOLOTYPE, PCD2228-53).

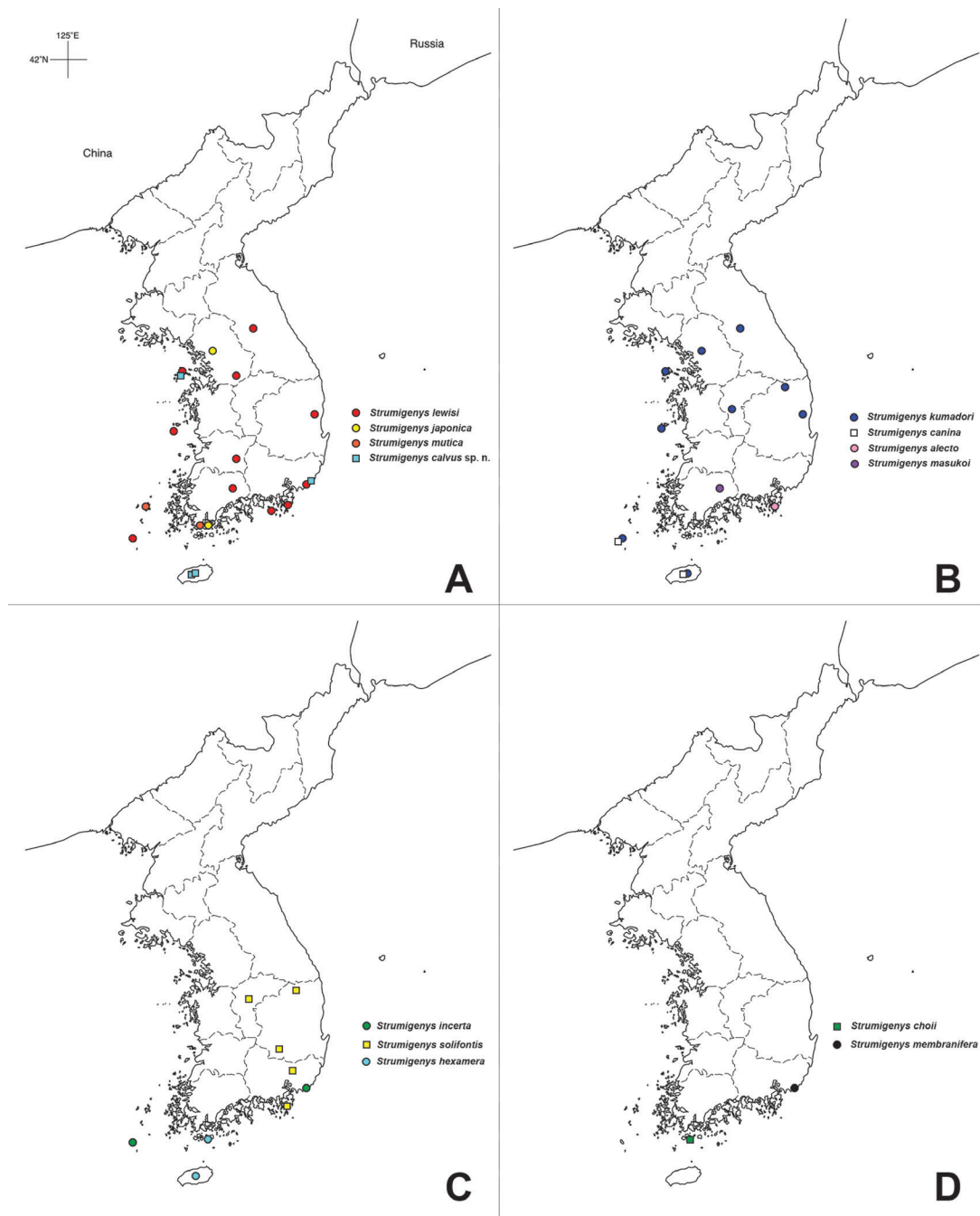


Fig. 12. Distribution maps for *Strumigenys* species in South Korea. **A.** *S. lewisi*, *S. japonica*, *S. mutica*, *S. calvus* sp. n. **B.** *S. kumadori*, *S. canina*, *S. alecto*, *S. masukoi*. **C.** *S. incerta*, *S. solifontis*, *S. hexamera*. **D.** *S. choii*, *S. membranifera*.

***Strumigenys mutica* group**

Strumigenys mutica (Brown, 1949)

***Strumigenys rostrate* group**

Strumigenys incerta (Brown, 1949)

***Strumigenys sauteri* group**

Strumigenys canina (Brown & Boisvert, 1979)

Key to Korean *Strumigenys* based on worker

1) Mandibles short, as long as clypeus length, triangular to subtriangular shaped, not elongated, without apical teeth. Mandibular masticatory margin relatively wide with small teeth. 2

– Mandibles long, more than twice as long as clypeus length, linear, with a couple of apical teeth. Mandibular masticatory margin relatively narrow. 10

2) Head including clypeus, mandibles, antennal scape densely covered with reniform hairs in full-face view. *Strumigenys hexamera*

– Head without reniform hairs in full-face view. 3

3) Diastema present between basal mandibles in full-face view. A couple of erect spatulate hairs on head, mesosoma, petiole, post petiole and gaster in profile view. *Strumigenys mutica*

– Diastema absent between basal mandibles in full-face view. Lacking distinct erect spatulate hairs on body in profile view. 4

4) Anterior clypeal margin broadly and shallowly expanded, straight or concave. 5

– Anterior clypeal margin not broadly expanded. 7

5) Midpoint of anterior clypeal margin slightly convex or straight in full-face view; anterolateral margins of clypeus angulated. *Strumigenys membranifera*

– Midpoint of anterior clypeal margin distinctly concave in full-face view; anterolateral margins of clypeus rounded. 6

6) Entire clypeus and anterior margin of antennal scape covered with numerous appressed and erect spatulate hairs. Body covered with hairs. *Strumigenys incerta*

– Clypeus and antennal scape without appressed and erect spatulate hairs. Body almost entirely bare. *Strumigenys canina*

7) Clypeus distinctly longer than wide. Dorsum of body covered with numerous long flagellate hairs. *Strumigenys masukoi*

– Clypeus length as long as wide, or wider than long. 8

8) Head entirely covered with appressed small spatulate hairs in full-face view. Frons not protruded in lateral view. *Strumigenys japonica*

– Head without appressed spatulate hairs except mandibles in full-face view. Frons distinctly protruded in lateral view. 9

9) Numerous laterally projecting hairs present along the dorsolateral margin of head in full-face view. Dorsum of pronotum and mesonotum covered with numerous long standing hairs. *Strumigenys alecto*

– Lack of laterally projecting hairs along the dorsolateral margin of head in full-face view. Dorsum of pronotum and mesonotum covered with appressed hairs, without distinctly long standing hairs in profile view. *Strumigenys calvus* sp. nov.

10) Entire body except mandibles and lateral thorax covered with numerous spatulate hairs
.....***Strumigenys choii***

– Spatulate hairs not distinctly present on body...
..... 11

11) Body big, slender and elongated in dorsal view (ca. 3.0mm). Mandibles relatively long. Mesosoma in dorsal view relatively narrow. Propodeal lamellae concave anteriorly (**Fig. 10**).
.....***Strumigenys solifontis***

– Body small and stubby (ca. 2.5mm). Mandibles relatively short. Mesosoma in dorsal view relatively wide. Propodeal margin of propodeal lamellae usually straight or slightly convex. 12

12) Apicoscrobial hair relatively short, not flagelliform.....***Strumigenys lewisi***

– Apicoscrobial hair long filiform, usually flagelliform.....***Strumigenys kumadori***

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