

Distribution of *Myrmica* Species (Hymenoptera, Formicidae) in Mongolia

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Abstract Fourteen *Myrmica* species are recorded from Mongolia. Their worker diagnoses and a key to the species are presented. All the localities previously known and confirmed in the present study for these species are listed, and plotted on maps. No species was found from semi-desert and desert areas. Among the species 64% (9 species) belong to the *M. lobicornis* group, agreeing with the general tendency seen for the entire *Myrmica* fauna of the Siberian-Mongolian Center sensu RADCHENKO and ELMES.

Introduction

Central Asian ants have been studied mainly by European entomologists for more than a century. However, the ant fauna of Mongolia was first seriously treated only in mid-1960s by G. M. DLUSSKY using the material collected by Z. KASZAB (PFEIFFER *et al.*, 2007). PFEIFFER *et al.* (2007) gave a comprehensive list of the Mongolian ants, compiling previous records and their own data. In total 68 species belonging to 17 genera were recorded by them.

DLUSSKY and PISARSKI (1962) and PISARSKI (1969a, b) recorded seven species of *Myrmica* from Mongolia, mainly based on the material collected by Z. KASZAB. Since their works several species have been added, and finally PFEIFFER *et al.* (2007) listed 14 species. However, information on their geographical distribution in Mongolia is still scanty. RADCHENKO and ELMES's (2010) revision of the Old World species of this genus presented very useful maps for all the known species, though the range of each species in Mongolia is often ambiguous.

In this paper we present basic data for the geographical ranges of the Mongolian *Myrmica* species based on the previous records and our own data. Although the collection sites are still 'spots' rather than 'areas', maps presented in this paper would be a first step for a more comprehensive understanding of the distribution of the Mongolian ants.

A diagnosis of the worker ant is given for each species together with a key to the species for general entomologists and biodiversity scientists interested in local faunas. Complete keys to the Old World species and drawings of important characters of them are available in RADCHENKO and ELMES (2010).

Treatment by species

The 14 species treated here are arranged in alphabetical order. In the distribution records, the place names are arranged from aimag to more specific sites. Mongolia has 22 aimag or provinces, the names of which are arranged in alphabetical order. Y&A denotes YAMANE and AIBEK.

Myrmica commarginata RUZSKY, 1930 is omitted here because this form might represent a group of abnormal individuals of more than one species (for more information, see RADCHENKO and ELMES, 2010). PFEIFFER *et al.* (2007) recorded this 'species' from Derris (1,154 m alt.), Chonoharaihiin gol, Durgun soum, Hovd aimag.

Head width was measured in full-face view just behind the eyes. Ten workers randomly chosen were used for the measurement except otherwise stated.

Myrmica angulinodis RUZSKY, 1905

Worker diagnosis. Body brown to dark reddish brown, with head and gaster often darker; legs yellowish brown. Medium-sized species with head width 0.81–1.00 mm (mean 0.93). Dorsum of head medially with longitudinal carinae, laterally and posteriorly reticulate; sides of head reticulate. Frontal carina merging with a short carina extending posteriad. Anterior margin of clypeus almost straight, with a weak median emargination. Antennal scape curved rather strongly (less than right angle) near base; its basal shaft with weak longitudinal carina; carina bordering the shaft and apical main portion absent. Dorsum and side of mesosoma with coarse longitudinal rugae. Metanotal groove present but shallow. Propodeal spines rather strongly upward directed, seen from above curved inwardly. Petiole in profile with a rather sharp anterodorsal edge; its dorsal face and posterior slope continuous. Dorsa of petiole and postpetiole coarsely sculptured.

Habitat preference. Mainly inhabits birch (*Betula*) and larch (*Larix*) forests and nearby steppes, nesting in decayed wood and soil.

Distribution records. ARHANGAI aimag. Tsetserleg (Y&A). BULGAN aimag. Khanjargalant, 1,350 m (PISARSKI and KRZYSTOFIAK, 1981); Khutag-Undur, Namnangiin nuruu, 1,150 m (PISARSKI and KRZYSTOFIAK, 1981). DORNOD aimag. Numrug (Y&A). KHENTII aimag. Near Bayan-adarga, 1,190 m (Y&A); Bereevin hiid (Y&A); near Dadal, 1,050 m (Y&A). OVORHANGAI aimag. Near Harhorin, 1,700 m (Y&A). SELENGE aimag. Khonin Nuga, 930 m (Y&A); Namdavaa, 1,000 m (Y&A); Unegt (Y&A). TUV aimag. Jargalant (Y&A); Ulaanbaatar, Bogd uul, Khurhree, 1,550 m (Y&A); Ulaanbaatar, Bogd uul, Nuht, 1,100, 1,500 & 1,650 m (PISARSKI, 1969a, b; PISARSKI and KRZYSTOFIAK, 1981; Y&A); Ulaanbaatar, Bogt uul, Shajinhurh (Y&A); Ulaanbaatar, Bogd, Turgen (Y&A); Ulaanbaatar, Bogd, Turhurh, 1,598 m (Y&A); Ulaanbaatar, Bogd uul, Zaisan, 1,400 m (PISARSKI, 1969b); around Ulaanbaatar city (PISARSKI, 1969b); Ulaanbaatar, Bogd uul (DLUSSKY and Pisarski 1970).

Remarks. This species belongs to the *kasczenkoi*-complex of the *lobicornis* group. It is similar to *M. forcipata* in size and structure, but the carina at the basal bend of the scape is much more developed in the latter.

Myrmica arnoldii DLUSSKY, 1963

Worker diagnosis. Entire body yellowish brown, with head and gaster often slightly darker. Smallest species in Mongolia with the head width 0.79–0.87 mm (mean 0.83).

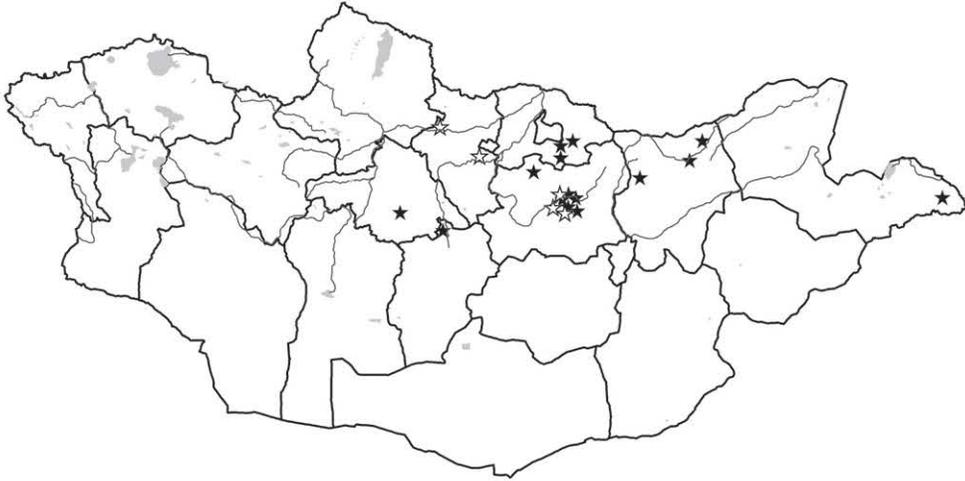


Fig. 1. Localities for *Myrmica angulinodis* (☆ previous records, ★ present study). Gray areas: lakes; gray lines: rivers.

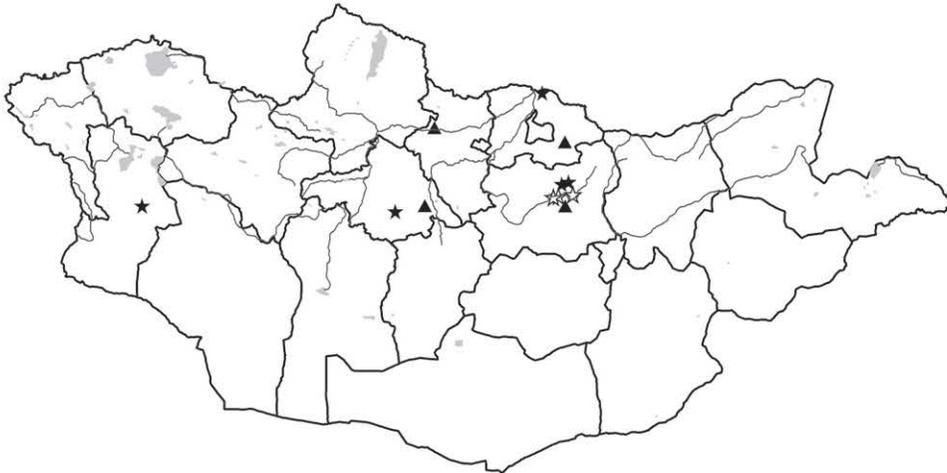


Fig. 2. Localities for *Myrmica arnoldii* (▲) and *M. divergens* (☆ previous records, ★ present study).

Dorsum of head with regular longitudinal rugae, but posteriorly weakly reticulate; side of head irregularly reticulate. Frontal carina curved outwardly to merge with a carina surrounding antennal socket. Anterior margin of clypeus almost straight, virtually without median emargination; clypeus with carinae that are often ill developed, with interspaces smooth and shiny. Antennal scape gently curved near base; the bend without carina separating the shaft from main portion of scape; basal shaft without longitudinal carina. Dorsum of mesosoma coarsely and irregularly reticulate; side of mesosoma irregularly rugose but rugae often indistinct. Metanotal groove deep; mesonotum distinctly higher

than propodeum. Petiolar node in profile nearly triangular with rounded summit; dorsal plate very short, continuous to posterior slope. Propodeal spines thin with sharp apex, seen from above diverging, sometimes very weakly curved inwardly. Dorsa of petiole and postpetiole weakly sculptured.

Habitat preference. Most of the nests were found in birch/larch forests (often forest gaps) from rotting twigs, rotting wood and soil, and from under logs.

Distribution records. ARHANGAI aimag. Ugii nuur (DLUSSKY and PISARSKI, 1970). BULGAN aimag. Khutag-Undur, Namnangiin nuruu, 1,150 m (Pisarski and Krzystofiak 1981). SELENGE aimag. Khonin Nuga, 930 m (Y&A); between Khonin Nuga & Ulaanbaatar (Y&A). TUV aimag. Ulaanbaatar (PISARSKI, 1969b).

Remarks. This is the sole member of the *M. arnoldii* group.

Myrmica divergens KARAVAEV, 1931

Worker diagnosis. Bicolorous, with head and gaster dark brown to blackish brown, and mesosoma, antennae and legs brown to reddish brown. Relatively large species with head width 0.94–1.10 mm (mean 1.02). Dorsum of head closely and regularly rugose medially, but weakly reticulate posteriorly and laterally; side and venter of head reticulate. Frontal carina merging a carina extending toward occipital margin. Anterior margin of clypeus straight, with a median emargination that is weak or rather distinct; clypeus with strong longitudinal carinae. Scape strongly but roundly bending near base; weak carina present along basal shaft; no carina separating the shaft and apical main portion. Side of mesosoma densely rugose; mesosoma dorsally with sinuated longitudinal rugae, with pronotum anteriorly reticulate. Metanotal groove distinct, in profile often U-shaped. Propodeal spines directed posteriad, in profile broadened at base, seen from above parallel. Petiolar node in profile with roundly angled anterodorsal corner; dorsal face and posterior slope continuous; dorsum of petiole minutely punctate; dorsum of postpetiole with longitudinal carinae in addition to minute punctuation.

Habitat preference. Among the four colonies collected, three were found in meadows or at riverside from under stones. The remaining one was dug from under a thick tree root near ground surface in a *Betula* forest (isolated forest in a desert area).

Distribution records. ARHANGAI aimag. Tsagaan Davaa (Y&A). HOVD aimag. 47°02'565N 92°58'242E (Y&A). SELENGE aimag. Khentii Mts., Galsan bulag (Y&A). TUV aimag. Terelj, 1,250 m (Y&A); Ulaanbaatar, Bogd uul (DLUSSKY and PISARSKI, 1970); Ulaanbaatar, Bogd uul, Zaisan, 1,400 m (PISARSKI, 1969b); Ulaanbaatar, Tsognii ovoo, 1,700–1,900 m (PISARSKI and KRZYSTOFIAK, 1981); Ulaanbaatar, Gorhit (PISARSKI, 1969b). TUV aimag. Tuul Basin (Y&A).

Remarks. This species belongs to the *bergi*-complex of the *scabrinodis* group.

Myrmica eidmanni MENOZZI, 1930

Worker diagnosis. Mesosoma and waist orange brown, with darker dorsum; legs and antenna deep yellow to yellowish brown; head and gaster reddish brown to dark reddish brown. Relatively large species with head width 0.94–1.08 mm (mean 1.10). Dorsum of head rather finely rugose in median portion, posteriorly and laterally reticulate; side and venter reticulate. Anterior margin of clypeus straight or weakly convex, with a median emargination. Frontal carina merging with a carina(e) extending posteriad. Antennal scape strongly bent (right-angled) near base; a carina present that separates basal shaft and

apical main part, continuing as a carina along whole length of basal shaft. Side of mesosoma moderately rugose (pronotal side anteriorly reticulate); dorsum of mesosoma coarsely and irregularly reticulate. Metanotal groove shallow but recognizable. Propodeal spines relatively long, only slightly shorter than apical segment of antenna, seen from above weakly diverging. Petiolar node in profile round at apex; dorsa of petiole and postpetiole minutely and densely punctate, provided with a few indistinct carinae.

Habitat preference. We collected two nests in Khonin Nuga. One was found from surface soil on roadside, and the other from under a stone in the grassland.

Distribution records. SELENGE aimag. Galsan bulag (Y&A); near Eruu River, Khonin Nuga (PFIFFER *et al.*, 2007); Khonin Nuga, 930 m (Y&A).

Remarks. This species belongs to the *lobicornis*-complex of the *lobicornis* group. The species is similar to *M. divergens* in body sculpture, but easily distinguished from the latter by the carinate bend of the antennal base.

Myrmica forcipata KARAVAIEV, 1931

Worker diagnosis. Mesosoma and waist yellowish brown to pale reddish brown; legs and antenna deep yellow to yellowish brown; head and gaster dark brown to dark reddish brown. Relatively small species with head width 0.71–0.92 mm (mean 0.84); size variation considerable. Dorsum of head extensively rugose; reticulation restricted to narrow area near occipital margin and to lateral area; side and venter of head irregularly rugose to reticulate. Anterior margin of clypeus straight, shallowly and widely emarginated in middle; striation on disc not strong. Frontal carina merging with a ruga(e) that extends posteriad. Antennal scape strongly curved (right-angled) near base; carina separating basal shaft and apical main part distinct; the shaft with developed dorsal carina along its whole length. Side of mesosoma coarsely rugose; dorsum of mesosoma with coarse sinuate rugae, with a few cross meshes. Metanotal groove present but shallow. Propodeal spines thick, strongly upward directed, seen from above strongly curved inwardly. Petiole in profile with angled anterodorsal corner; dorsa of petiole and postpetiole minutely and densely punctate, with a few longitudinal carinae.

Habitat preference. Nests were found in varying habitats, e.g., *Betula* bush, roadside in grassland, riverside meadow, from decayed wood or soil.

Distribution records. BULGAN aimag. Khishig-Undur, 1,390 m (PISARSKI and KRZYSTOFIAK, 1981); Khutag-Undur, Namnangiin nuruu, 1,150 m (PISARSKI and KRZYSTOFIAK, 1981); Khanjargalant, 1,350 m (PISARSKI and KRZYSTOFIAK, 1981). KHENTII aimag. Near Batnorov, NE of Ondorkhaan (Y&A); 65 km E of Ondorkhaan (Y&A). KHUVSGUL aimag. Tosontsengel, 1,450 m (PISARSKI and KRZYSTOFIAK, 1981). SELENGE aimag. Khonin Nuga, 930 m (Y&A). TUV aimag. Batsumber (PISARSKI, 1969b); Bayantsogt, 1,600 m (PISARSKI 1969a); Lun, 1,200 m (PISARSKI and KRZYSTOFIAK, 1981); Ulaanbaatar, Bogd uul, Khurhree, 1,550 m (Y&A); Ulaanbaatar, Bogd uul, Nuht, 1,500–1,800 m (PISARSKI, 1969a); same loc., 1,880–2,000 m (PISARSKI, 1969a); Ulaanbaatar, Bogd uul, Zaisan (PISARSKI, 1969b); Ulaanbaatar, Bogd (Y&A); Ulaanbaatar, Tsognii ovoo, 1,500–1,700 m (PISARSKI and KRZYSTOFIAK, 1981).

Remarks. This species belongs to the *lobicornis*-complex of the *lobicornis* group. It is very similar to *M. angulinodis* in body size, body sculpture and angled petiolar node, but is distinguished from the latter by the developed carinae at the apex and upper margin of the shaft of the antennal scape. *M. angulinodis* inhabits predominantly in forests, while *M. forcipata* prefers more opened areas.

Myrmica kamtschatica KUPIANSKAYA, 1986

Worker diagnosis. Material of this species from Mongolia is not available. The following description is based on three paratype specimens from Kamchatka kindly donated by Dr. Kupianskaya to the SKY Collection. Body brown to light reddish brown, with head and gaster slightly darker and mandibles, antennae and legs paler. Medium-sized species with head width 0.94–0.98 mm (mean 0.96) (3 workers from Russia). Dorsum of head extensively reticulate; only its central portion longitudinally rugose. Clypeus with longitudinal rugae; its anterior margin weakly emarginated medially; mandible strongly striate. Antennal scape rather strongly bent near base; the bend less than 90°, without a developed carina separating shaft and remaining distal part; the shaft with a carina along its upper margin. Dorsum of mesosoma coarsely and irregularly rugoso-reticulate; lateral face of pronotum coarsely rugose; mesopleuron, metapleuron and lateral face of propodeum with weaker rugae; metanotal groove shallow but distinct; propodeal spines seen from above weakly diverging, not distinctly curved inwardly. Petiole short with its dorsal face not clearly separated from posterior slope; postpetiole larger than petiole, globular, shorter than high; in profile its dorsal outline roundly convex, without flat apical portion; lateral faces of petiole and postpetiole rather coarsely and irregularly sculptured; mediodorsal portion of postpetiole finely punctate.

Habitat preference. No information is available in Mongolia. This species has a relatively strong resistance against cold climates and can live even in tundra habitats with permafrost (BERMAN *et al.*, 2010).

Distribution records. SELENGE aimag. Near Sharlan River, Khonin Nuga, 970 m (PFEIFFER *et al.*, 2007).

Remarks. This species, belonging to the *kasczenkoi* complex of the *lobicornis* group, is similar to *M. angulinodis*, but separable from the latter by the more rounded antero-dorsal corner of petiole and diverging propodeal spines.

Myrmica kasczenkoi RUZSKY, 1905

Worker diagnosis. Mesosoma, legs and antennae brown to reddish brown; head sometimes with same colour near posterior margin. Medium-sized species with head width 0.90–0.96 mm (mean 0.94). Dorsum of head coarsely rugose; rugae regular and parallel; posterior and lateral portions reticulate. Anterior margin of clypeus straight with a weak median emargination; rugae on clypeus coarse and regular. Frontal carina merging with a ruga extending posteriad. Antennal scape rather strongly but smoothly curved near base, with a faint carina along the upper rim of shaft, but without carina between shaft and apical main part of scape. Side of mesosoma with coarse regular rugae; on the dorsum of mesosoma coarse rugae often sinuated. Metanotal groove very weak or absent. Propodeal spines at most as long as, often shorter than, apical antennal segment, slightly down-curved, and seen from above straight and diverging. Petiolar node with anterior slope concave; in profile dorsal and posterior faces forming a single arch; anterodorsal corner of petiole round, but sometimes weakly angled; subpetiolar process lobe-like; tergal portion of petiole and postpetiole rugose in addition to minute punctation.

Habitat preference. This species inhabits disturbed steppe and open bare ground, and nests in soil.

Distribution records. ARHANGAI aimag. Ikhtamir, 2,150 m (PISARSKI, 1969a). BAYANKHONGOR aimag. Egiin davaa, 2,300 m (PISARSKI, 1969a). BAYAN-OLGII aimag. Near Tsengel, 1,900 m (Y&A). BULGAN aimag. Khanjargalant, 1,350 m (PISARSKI and KRZYSTOFIAK 1981). DUNDGOVI aimag. Delgerkhangai, Choot bulag, 1,480 m (PISARSKI and KRZYSTOFIAK, 1981); GOVI-ALTAI aimag. Sharga, Khuvs gul tunamal nuur (PISARSKI and KRZYSTOFIAK, 1981). KHENTII aimag. Murun, 1,200 m (PISARSKI, 1969a). KHUVSGUL aimag. Burenkhaan, 1,650 m (PISARSKI and KRZYSTOFIAK, 1981); Murun, 1,740–1,900 m (PISARSKI and KRZYSTOFIAK, 1981); Tosontsengel, 1,480 m (PISARSKI and KRZYSTOFIAK 1981). TUV aimag. Bayandelger, 1,400 m (PISARSKI, 1969a); Bayantsogt, 1,600 m (PISARSKI, 1969a); Hustai, Khushuut (Y&A); Lun, 1,180 m (PISARSKI, 1969a); Terelj, 1,250 m (Y&A); Ulaanbaatar, Kherlen buudal (PISARSKI, 1969b); Ulaanbaatar, Bogd uul, Khurhree, 1,550 m (Y&A); Ulaanbaatar, Bogd uul, Nuht, 1,800 m (Pisarski, 1969a); Ulaanbaatar, Bogd, Shajinhurh (Y&A); Ulaanbaatar, Bogd, Turgen (Y&A); Ulaanbaatar, Bogd, Turhurh, 1,598 m (Y&A); Ulaanbaatar, Songino (PISARSKI, 1969b); Ulaanbaatar, Tuul hundii (DLUSSKY and PISARSKI, 1970); Ulaanbaatar, Zosiin davaa, 1,650 m (PISARSKI and KRZYSTOFIAK, 1981). UVS aimag. Uureg nuur, 1,500 m (PISARSKI and KRZYSTOFIAK, 1981). ZAVHAN aimag. Telmen nuur, 1,827 m (Y&A).

Remarks. This species belongs to the *kasczenkoi*-complex of the *lobicornis* group.

Myrmica koreana ELMES, RADCHENKO et KIM, 2001

Worker diagnosis. Mesosoma, waist, mandibles, antennae and legs yellowish brown to brown; head and gaster reddish brown to dark reddish brown. Medium-sized species with head width 0.90–0.96 mm (mean 0.93) (3 specimens measured). On the dorsum of head rugae confined to a small area behind frontal triangle; other areas extensively reticulate. Anterior margin of clypeus not convex, with a wide and shallow median emargination; striae on clypeal disc fine and widely spaced. Frontal carina merging with rugae extending posteriad; frontal lobe exceptionally large; its broadest portion slightly less than twice as broad as narrowest portion. Antennal scape strongly curved (angle > 90°) near base, with a large round lobe at bend and a wide fringe of lamella along basal shaft. Side of mesosoma coarsely rugose; rugosity on dorsum of mesosoma similarly coarse but less regular. Propodeal spines seen in profile long and sharp, seen from above almost parallel. Petiolar node long, seen from above much longer than broad; anterior face of petiole comprising narrow pedicel-like anterior part and steep posterior part; with petiole in profile anterodorsal corner more or less angled; dorsal face short, followed by gently sloping posterior face; subpetiolar process very small forming a small anterior angle; dorsa of petiole and postpetiole rather coarsely sculptured.

Habitat preference. We collected only foragers in a well-preserved steppe. RADCHENKO and ELMES (2011) mentioned that this species inhabits mainly in steppes and steppe-like habitats, both on planes and mountains up to 1,700 m alt. Nests are constructed in soil.

Distribution records. DORNOD aimag. Menengiyn tal, 627 m (Y&A). TUV aimag. Zorgol (PFEIFFER *et al.*, 2007). DORNOGOVI aimag. Delgerekh (PFEIFFER *et al.*, 2007).

Remarks. This species belongs to the *schrencki* group. It is similar to *M. kasczenkoi* in the sculpture of the mesosoma, but is easily separable from all the other Mongolian congeners by the very large frontal lobe, long petiole and vestigial subpetiolar process.

Myrmica lobicornis NYLANDER, 1846

Worker diagnosis. We do not have any specimen of this species (see remarks).

Habitat preference. In Mongolia nothing is known of its biology.

Distribution records. DORNOD aimag. Choibalsan, Tamsagbulag, 600 m (PISARSKI and KRZYSTOFIAK, 1981). DUNDGOVI aimag. Delgerkhangai uul, 1,650–1,700 m (PISARSKI and KRZYSTOFIAK, 1981). KHENTII aimag. Undurkhaan, 1,000 m. SUKHBAATAR aimag. Baruun-Urt, 1,050 m (PISARSKI and KRZYSTOFIAK, 1981).

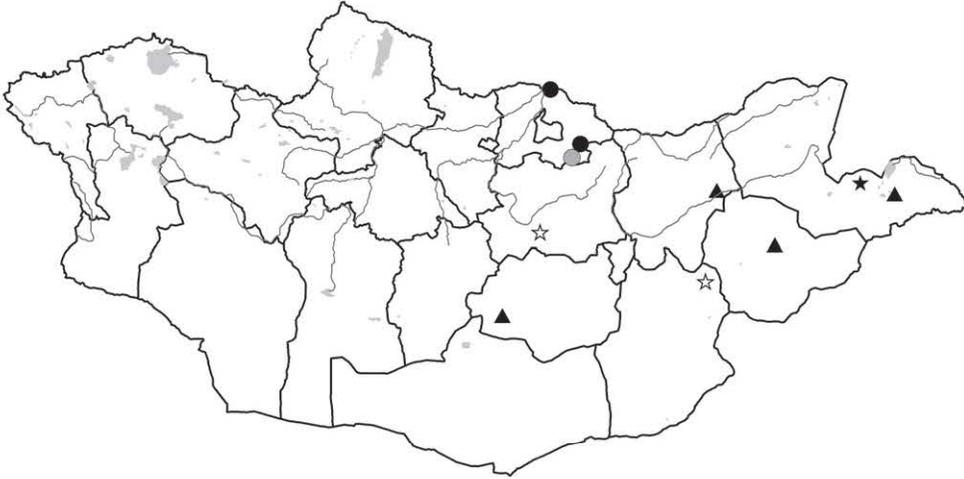


Fig. 3. Localities for *Myrmica eidmanni* (● previous records, ● present study), *M. koreana* (☆ previous records, ★ present study) and *M. lobicornis* (▲).

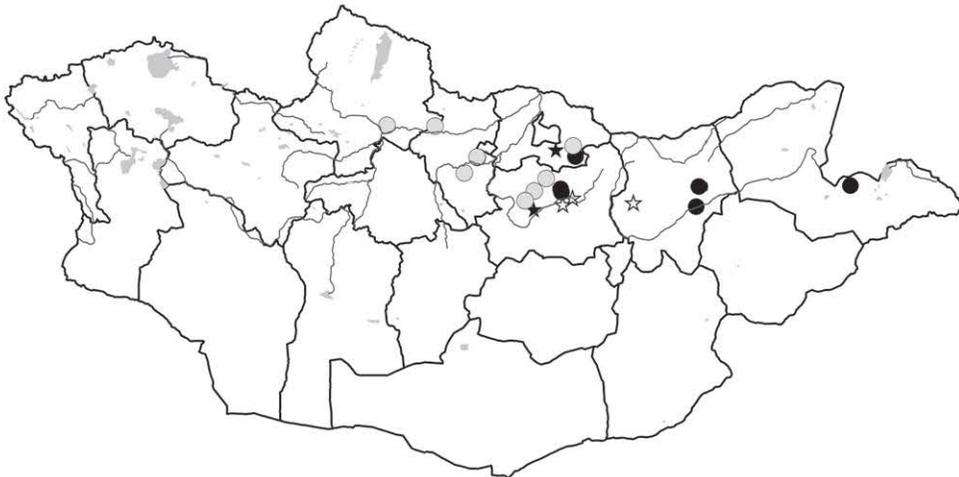


Fig. 4. Localities for *Myrmica forcipata* (● previous records, ● present study) and *M. sulcinodis* (☆ previous records, ★ present study).

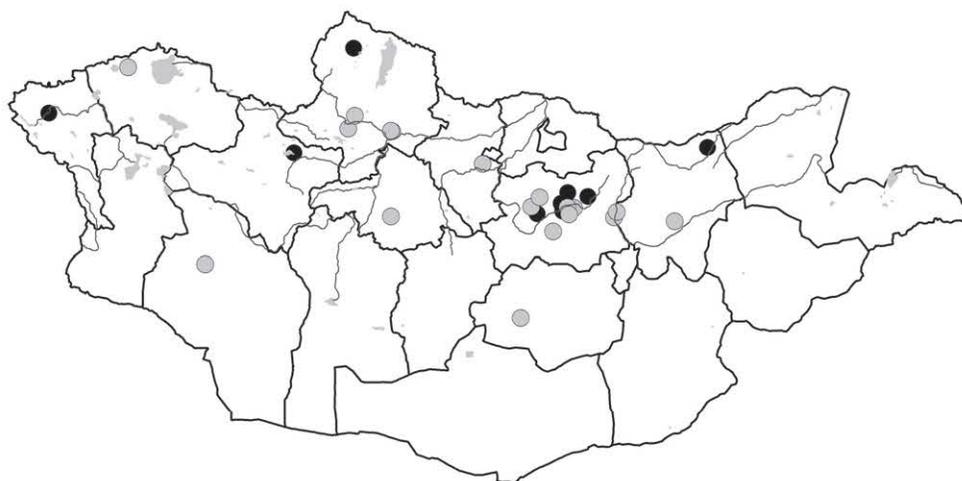


Fig. 5. Localities for *Myrmica kasczenkoi*. ● previous records, ● present study.

Remarks. This species belongs to the *lobicornis*-complex of the *lobicornis* group. This species is said to show an extreme variation in morphology (RADCHENKO and ELMES, 2010), but can be distinguished from the other Mongolian congeners by the following set of characteristics: Antennal scape strongly bent near base; lobe encircling the bend generally very large; basal shaft of scape without well-developed fringe of lamella; with petiole in profile anterodorsal corner of petiolar node acute or right angled.

Myrmica pisarskii RADCHENKO, 1994

Worker diagnosis. Mesosoma, waist, legs, mandibles and antennae yellowish brown to pale reddish brown; head and gaster dark reddish brown. Relatively small species with head width 0.79–0.90 mm (mean 0.83). Small area behind frontal triangle longitudinally rugose; other parts of dorsum of head reticulate. Anterior margin of clypeus not convex, with a broad and shallow median emargination; rugae on clypeal disc coarse. Frontal carina merging with a carina(e) that extends posteriad. Side of mesosoma with relatively regular and coarse rugosity; rugae on dorsum of mesosoma sinuated. Metanotal groove inconspicuous or absent. Propodeal spines thin and sharp, seen from above weakly diverging and slightly curved inwardly. Petiole in profile with anterior slope nearly straight; pedicel and node not differentiated; anterodorsal corner bluntly angled; subpetiolar process a small process projecting anteroventrad; petiole and postpetiole (particularly their sides) rather coarsely rugose.

Habitat preference. This species is mainly collected in disturbed steppes, and nests in soil.

Distribution records. ARHANGAI aimag. Tsenkher, Urdtamir gol, 1,620 m (PISARSKI, 1969a). BULGAN aimag. Bayan-Nuur, 1,000 m; Khutag-Undur, Namnangiin nuruu, 1,150 m (PISARSKI and KRZYSTOFIAK, 1981); near Rashaant, 1,420 m (Y&A). DUNDGOVI aimag. Delgertsogt, 1,480 m (PISARSKI and KRZYSTOFIAK, 1981). KHENTII aimag. Dadal, 900 m (Y&A); Delgerkhaan, 1,250 m (PISARSKI, 1969a); Jargaltkhaan, Chandagan tal, 1,300 m (PISARSKI, 1969a); Murun, 1,200 m (PISARSKI, 1969a); Tsenkhermandal, 1,400 m (PISARSKI, 1969a). KHUVSGUL aimag. Burenkhaan,

1,650 m (PISARSKI and KRZYSTOFIAK, 1981); Hanh, Tarag (Y&A); Tosontsengel, 1,480 m (PISARSKI and KRZYSTOFIAK, 1981). SUKHBAATAR aimag. Baruun-Urt, 1,050 m (PISARSKI, 1969a); Khongor, Ongon els, 900 m (PISARSKI, 1969a); Tumentsogt, 1,000 m (Pisarski 1969a). TUV aimag. Bayanbaraat, 1,380 m (PISARSKI and KRZYSTOFIAK, 1981); Bayandelger, Kherlen buudal, 1,400 m (PISARSKI, 1969a); Bayantsogt, 1,600 m (PISARSKI 1969a); Ulaanbaatar, Bogd, Khurhree, 1,550 m (Y&A); Ulaanbaatar, Bogd, Shajinhurh (Y&A); Ulaanbaatar, Bogd, Turhurh, 1,598 m (Y&A); Ulaanbaatar, Bogd uul, Zaisan, 1,400 m (Pisarski 1969a); Ulaanbaatar, Bogd, Zosiin Davaa, 1,650 m (PISARSKI and KRZYSTOFIAK, 1981); Ulaanbaatar, City area (Y&A). ZAVHAN aimag. Tosontsengel to Hyargas nuur (Y&A).

Remarks. This species belongs to the *lobicornis*-complex of the *lobicornis* group.

Myrmica rubra (LINNAEUS, 1758)

Worker diagnosis based on specimens from Finland. Body deep yellow through yellowish brown to brown; dorsum of head and gaster often darker; legs and antennae more yellowish. Medium-sized species with head width 0.87–0.98 mm (mean 0.94) (5 Finish specimens measured). Dorsum of head weakly rugose; side of head (and often posterior portion of head) somewhat reticulate. Anterior margin of clypeus nearly straight to weakly convex, without median emargination; disc of clypeus smooth and shiny, with weak carinae that terminate as small denticles on anterior margin of clypeus. Frontal triangle smooth and shiny. Frontal carina generally curved outwardly to merge with a carina(e) that surrounds antennal socket. Antennal scape gently curved without distinct angle near base; vertical carina on basal shaft, if any, vestigial. Side of mesosoma rugose; dorsum of mesosoma with rugose and irregular reticulation. Metanotal groove distinct. Propodeal spines variable in length, often longer than apical segment of antenna. With petiole in profile node with round apex; anterior face concave; tergal portion of petiole and postpetiole entirely finely and superficially sculptured, with a few weak, longitudinal carinae.

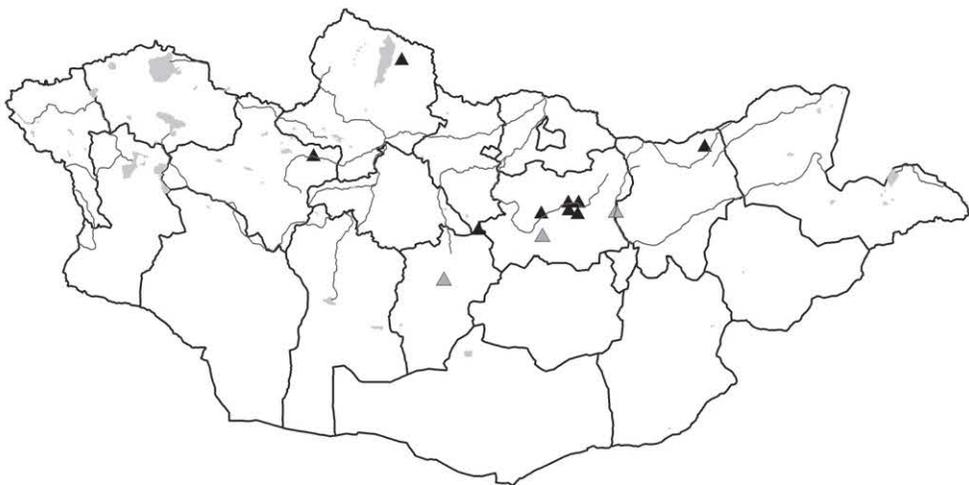


Fig. 6. Localities for *Myrmica pisarskii* (▲ previous records, ▲ present study).

Habitat preference. No information is available of the biology of this species in Mongolia. In Europe this species inhabits a variety of habitat types from grassland to forest, generally preferring wet soil. It nests in soil, under or in decayed wood.

Distribution records. Not available, but see RADCHENKO and ELMES (2010, Map 94).

Remarks. This species belongs to the *rubra* group.

Myrmica ruginodis NYLANDER, 1846

Worker diagnosis. Specimens from Mongolia are not available. The following description is based on Korean and Japanese specimens. Body yellowish brown to brown; dorsa of head, mesosoma and waist, and gaster often darker; legs and antennae more yellowish. Relatively large species with head width 0.98–1.04 mm (mean 1.01) (5 South Korean specimens measured). Dorsum of head rugose, but reticulate posteriorly and laterally to variable extent; side and venter of head often with fine sculpture only. Anterior margin of clypeus distinctly produced medially where several small denticles are present; disc of clypeus smooth and shiny, with more than 10 longitudinal carinae.

Habitat preference. Inhabits forests and forest edges, but without information in Mongolia.

Distribution records. Not available, but see RADCHENKO and ELMES (2010, Map 95).

Remarks. This species belongs to the *rubra* group.

Myrmica sulcinodis NYLANDER, 1846

Worker diagnosis. Conspicuously bicolorous; mesosoma reddish brown; waist slightly darker; legs extensively and antennae except for apical segments dark brown; head and gaster blackish brown. Largest species in Mongolia with head width 1.08–1.17 mm (mean 1.13). Dorsum of head very coarsely sculptured; area between frontal carinae up to the half length of head longitudinally rugose; other parts of head reticulate. Anterior margin of clypeus weakly convex, without median emargination; disc of clypeus with coarse rugae. Frontal triangle also sculptured. Frontal carina merging with a carina that extends posteriad, but often also connected with carinae surrounding antennal socket. Antennal scape rather strongly bent (angle > 90°) near base; carina separating basal shaft and apical main part absent; carina along basal shaft weak. Entire mesosoma with very coarse rugae; posterior face of propodeum extensively sculptured. Propodeal spines stout and long, much longer than apical segment of antenna, rather strongly upward directed, and seen from above distinctly curved inwardly. With petiole in profile anterior slope concave, and anterodorsal corner distinctly angled; subpetiolar process triangular; tergal parts of petiole with several strong longitudinal carinae, interspaces being very deep; postpetiole also coarsely rugose with deep interspaces.

Habitat preference. The colonies were collected in forested or wet areas near the river.

Distribution records. KHENTII aimag. Tsenkhermandal, 1,400 m (PISARSKI, 1969a). SELENGE aimag. Namdavaa, 1,000 m (Y&A). TUV aimag. Hustai, Ehen-Us (Y&A); Ulaanbaatar (PISARSKI, 1969b); Ulaanbaatar, Bogd uul, Nuht, 1,500–1,800 m (PISARSKI, 1969a).

Remarks. This species belongs to the *sulcinodis*-complex of the *lobicornis* group. This is a very distinctive species with very coarse rugae over surface of mesosoma and waist.

***Myrmica transsibirica* RADCHENK, 1994**
(= *Myrmica taediosa* BOLTON)

Worker diagnosis. Material from Mongolia is not available. The following description is based on specimens from southern Primorye, Russia. Body light brown to brown; gaster and head darker; mandibles, antennae and legs paler, but legs only slightly lighter than mesosoma. Relatively small to medium-sized species with head width 0.85–0.96 mm (mean 0.92) (5 specimens from Russian Primorye and South Korea). Head extensively reticulate; median portion of dorsum of head with rather regular longitudinal rugae; clypeus sparsely rugose, with anterior margin very weakly emarginated medially; lateral margin of clypeus raised as a wall surrounding antennal socket. Antennal scape strongly bent near base; the bend less than 90°; carina separating basal shaft and remaining distal part absent; carina along upper margin of the shaft developed. Entire mesosoma more or less regularly and longitudinally rugose; on promesonotum rugae waved; metanotal groove shallow but distinct; propodeal spines sharp at apex, weakly diverging posteriad. Petiole in profile round dorsally, but median ‘flat’ section separable from posterior slope; postpetiole much larger than petiole; sculpture on petiole and postpetiole weak.

Habitat preference. No information is available in Mongolia.

Distribution records. Not available, but see RADCHENKO and ELMES (2010, Map 125).

Remarks. This species belongs to the *excelsa*-complex of the *lobicornis* group, and has been referred to as *M. taediosa* Bolton. *M. transsibirica* is very similar to *M. excelsa* KUPIANSKAYA with a more easterly distribution. However, it is easily separated from the latter by the entirely smooth gastral tergite 1, which is superficially coriaceous over the surface in the latter (YAMANE, 2008).

Key to the *Myrmica* species from Mongolia

1. Lateral portion of clypeus raised as a wall so that antennal socket is surrounded by a continuous ridge. *M. transsibirica* (= *M. taediosa*)
- Lateral portion of clypeus low so that the bottom of antennal socket is at the same level as clypeus. 2
2. Antennal scape strongly curved near its base with a distinct angle bearing a developed carina or lobe, which separates basal shaft and main part of scape. Anterior clypeal margin convex and medially more or less notched. 3
- Antennal scape weakly to rather strongly curved near base, without a developed carina/lobe separating its basal shaft from main part of scape (vertical carina can be seen on basal shaft). Anterior margin usually without median notch, but sometimes notched. 7
3. Propodeal spines seen from above distinctly curved inwardly. *M. forcipata*
- Propodeal spines seen from above almost straight. 4
4. Metanotal groove usually distinct, sometimes deep. 5
- Metanotal groove if any very weak; mesosoma in profile with an almost straight dorsal outline..... 6

5. Carina at bend of antennal scape low, not forming a lobe. With petiole in profile, anterodorsal corner round. Mesosomal dorsum predominantly with rather regular longitudinal carinae. *M. eidmanni*
- Carina at bend of antennal scape developed, lobe-like. With petiole in profile, anterodorsal corner acute or right-angled. Pronotum entirely reticulate. *M. lobicornis*
6. Frontal lobe strongly expanded laterally with distinctly suberect lateral part. Anterior face of petiole distinctly concave. Spaces between rugae on mesosoma almost smooth and shining. Propodeal spine more strongly upward-directed. *M. koreana*
- Frontal lobe weakly expanded laterally. Anterior face of petiole in profile only weakly concave. Spaces between rugae on mesosoma subopaque. Propodeal spines tend to be more posteriorly directed, sometimes down-curved. *M. pisarskii*
7. Propodeal spines seen from above inwardly curved. With petiole in profile anterodorsal corner more or less angulated. 8
- Propodeal spines seen from above almost straight. Petiole in profile with rounded apex; anterior face meets dorsal face without a distinct angle. 9
8. Petiole and postpetiole coarsely rugose; dorsum of petiole with 3 strong longitudinal rugae; spaces among these rugae very deep. Propodeal spine dorsally with several standing hairs. *M. sulcinodis*
- Petiole and postpetiole much weakly sculptured; dorsum of petiole without very strong longitudinal rugae. Propodeal spine dorsally with at most 1 standing hair, usually without hairs. *M. angulinodis*
9. Anterior margin of clypeus nearly straight or weakly emarginate medially, without distinct denticles medially. Frontal carina posteriorly not curved outward, merging with longitudinal rugae running toward posterior margin of head (except in *M. arnoldii*). 10
- Anterior margin of clypeus often produced medially, rarely straight, usually with several denticles medially. Frontal carina posteriorly curved outward so as to merge with rugae surrounding antennal socket. 13
10. Body light brown to yellowish brown, with head and gaster slightly darker. Antennal scape only weakly and smoothly curved near base; its basal shaft without a distinct longitudinal carina. Subpetiolar process large and wide, lobe-like. *M. arnoldi*
- Body bicolorous with mesosoma and waist reddish, and head and gaster dark brown; or body more uniformly brown to dark brown without yellow tint. Basal curvature of antennal scape various, often strongly angled; basal shaft of scape with a distinct longitudinal carina. Subpetiolar process small and narrow. 11
11. Mesosoma seen in profile with a very shallow metanotal groove; the groove often essentially absent. Side of mesosoma with strong and sparse rugae that are rather regular throughout. *M. kasczenkoi*
- Mesosoma seen in profile with a distinct metanotal groove. Side of mesosoma with dense weak striation that is often irregular. 12
12. Antennal scape gently curved near base, without carina at bend. With petiole in profile node round dorsally. *M. divergens*
- Antennal scape strongly curved with distinct bend (almost right-angled); bend with a weak carina bordering basal shaft and main part of scape. With petiole in profile anterodorsal corner of node angled. *M. kamtschatica*

13. With petiolar node in profile dorsal outline rounded; dorsa of petiolar and post-petiolar nodes smooth or only weakly striate. *M. rubra*
 – With petiolar node in profile dorsal outline nearly flat; dorsa of petiolar and post-petiolar nodes with strong longitudinal rugae. *M. ruginodis*

Discussion

Mongolia is part of the Siberian-Mongolian Center in terms of the *Myrmica* species diversity (RADCHENKO and ELMES, 2010). This center in turn constitutes the East Palearctic together with the Central Asian Mountains (Himalayas), Tibetan Plateau, and Far East (Far East Russia, northeast China, Korean Peninsula and Japan). The Siberian-Mongolian Center has a unique *Myrmica* fauna characterized by the dominance of the *M. lobicornis* group (60% of the 19 recorded species) and 10 endemic species and one endemic species group (the *arnoldii* group). Among the 14 species recorded from Mongolia (*M. commarginata* excluded), 9 (64%) belong to the *lobicornis* group.

One of the remarkable features in the distribution of the Mongolian ants is the almost complete lack of *Myrmica* species in the desert area. They are in most cases found in forests and steppes, i.e., the forest belt, forest steppe and forest-meadow belt, and dry steppe belt according to the system proposed by GUNIN *et al.* (2010). PFEIFFER *et al.* (2003) beautifully show the sudden disappearance of *Myrmica* in the desert along a north-south transect from Ulaanbaatar to Gobi desert. An exception is a colony of *M. divergens* found by us in an isolated birch (*Betula*) forest in a very dry area in Hovd aimag. RADCHENKO and ELMES (2010) also pointed out that a few *Myrmica* species can be found in wet patches in desert areas in Central Asia. The northerly and easterly biased distribution of *Myrmica* species in Mongolia is explained by their preference for moist habitats.

Another aspect of their distribution concerns the distribution of permafrost, which is concentrated in Altai (western part) and north-central mountain regions (National Map, 1990, Ulaanbaatar-Moscow). Two species, *M. kasczenkoi* and *M. pisarskii*, range from discontinuous to continuous permafrost regions. Both species are most frequently found in steppes and meadows (often also in downtown), not from forests. *M. kamtschatica* should be more resistant to cold winter temperatures as indicated by BERMAN *et al.* (2010) for the population of Upper Kolyma, Russia, though we did not collect this species in Mongolia. In contrast to these species, *M. angulinodis* and *M. forcipata*, prefer regions of seasonal freezing, and are only occasionally found in discontinuous permafrost regions. *M. angulinodis* prefers sparse forests of larch and birch, usually nesting in decayed wood, while *M. forcipata* mainly inhabits grassland, meadow and bush (RADCHENKO and ELMES, 2010). Other species are situated more or less between these two extremes, but obviously more often encountered in discontinuous permafrost regions than in other conditions.

We did not make surveys in high mountain regions. The altitudinal range for the records of each species is: 1,000–1,700 m (*angulinodis*), 930 m (*arnoldii*), 1,200–1,250 (*divergens*), 1,550 m (*forcipata*), 900–2,207 m (*kasczenkoi*), 627 m (*koreana*), 1,420–1,823 (*pisarskii*), and 1,000 m (*sulcinodis*). *M. kasczenkoi* and *M. pisarskii* have wider ranges in altitude, showing an adaptation to colder climates. This is consistent with their spatial distribution including permafrost areas.

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