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The Ants (Hymenoptera: Formicidae) of South Korea: An Updated Checklist with Biological Notes

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ABSTRACT. Republic of Korea (South Korea) lies between the Eurasian continent and the Japanese archipelago and spans temperate to subtropical climates. The geographic position of South Korea provides a biogeographic bridge that promotes high ant diversity. Recent taxonomic revisions are, however, generally lacking, and North Korean records are often merged uncritically with those of South Korea, underscoring the need for a comprehensive update. In this study, we provide an updated checklist of the ants of South Korea based on extensive field collections, critical examination of museum specimens, and a comprehensive review of published records. We recognize 147 valid species belonging to 44 genera in South Korea, with 22 species reported here for the first time. The updated list also recognizes six endemic species and thirteen non-native species, five of which are newly confirmed in South Korea (*Monomorium carbonarium* (Smith, 1858), *Nylanderia* sp. cf. *jaegerskioeldi* (Mayr, 1904), *Pheidole parva* Mayr, 1865, *Technomyrmex vitiensis* Mann, 1921, and *Tetramorium lanuginosum* Mayr, 1870). Based on the literature and museum investigations, we also remove 31 species previously reported from South Korea. In addition, we present morphological descriptions and ecological information for the newly reported species and *Camponotus dorex* Fisher, 2025, a South Korean endemic with previously limited information. The checklist also identifies five dubious species and provides revised taxonomic treatments of problematic taxa, notably designating *Aphaenogaster schmidti* Karavaiev, 1912 as a *nomen* *dubium*. We further discuss distribution patterns, highlight ecological features such as endemism and potential future discoveries, and assess the current status and risks of introduced ants. This work offers the most comprehensive and up-to-date framework for understanding the diversity, distribution, and conservation priorities of South Korean ants.

Keywords Biodiversity, Checklist, Conservation, Formicidae, Invasive Species, South Korea

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INTRODUCTION

The Korean peninsula is located in the northeastern Palearctic realm (124-132°E) stretching from north to south from 33° to 44°N, and exhibits a diverse array of geographical features. The eastern coast of the peninsula is mainly lined with mountain ranges (Baekdu-daegan) covering 70% of the total land mass (Kwon 2003). These mountains gradually descend to the west and the south eventually forming complex shorelines and thousands of islands where tidal flats and marshes are formed. About 83 km off the southern coast lies Jeju Island shaped by volcanic activity. Mt. Hallasan, the highest peak (1,947 m) for both the island and the nation, provides a gradient of different habitats from cold subalpine environments near the summit to the warm southern climates in the lower areas contributing to Jeju's rich biodiversity. South Korea's climate shows stark seasonal shifts in temperature and humidity. Summers are hot and humid under the East Asian monsoon, averaging 710.9 mm of rainfall (June–September), 25.6°C (max 41.0°C), and 70–80% humidity. Winters are cold and dry due to Siberian air masses, averaging -0.25°C (min -32.6°C) and 30–50% humidity (Korea Meteorological Administration, 2024).

The geographical and climatic diversity creates a wide range of ecological niches along the peninsula, supporting a rich biodiversity, with the presence of 61,230 species documented (National List of Species of Korea 2024). Historical factors have also contributed to this high biodiversity, as Korean peninsula has served as a land bridge between the Japanese archipelago and the Eurasian continent. During periods of lower sea levels caused by glacial oscillations, both landmasses were often connected through the Tsushima Strait and the Yellow Sea (Shikama 1962; Yoshikawa et al. 2007; Taruno 2010). Consequently, the current distribution of fauna in South Korea reflects the historical influence of such dispersal events.

Numerous faunistic efforts were conducted in attempts to catalogue the biodiversity of Korea, of which ants were no exception. Ants (family Formicidae) are one of the most successful insects alive and are ubiquitous on every continent, only absent in Antarctica (Hölldobler and Wilson 1990). With nearly 16,000 species and subspecies described, Formicidae is the 13th most diverse insect family (Fernández et al. 2021) and the combined weight of all ants is thought to outweigh both wild mammals and birds combined (Schultheiss et al. 2022). Assessing ant diversity is important because ants serve as a model organism for understanding global biogeographic, ecological, and evolutionary patterns (Economo et al. 2018; Wang et al. 2024), and their ease of collection using standardized methods provides ecological information that can help identify conservation priorities and predict biodiversity hotspots (Underwood and Fisher 2006; Kass et al. 2022).

It is also important to recognize the potential challenges associated with certain ant species as they can easily spread through anthropogenic means (Wong et al. 2023). Some ants can become invasive, causing disruptions in native ecosystems leading to serious environmental and economic consequences (Siddiqui et al. 2021). Ants spreading through human activities began centuries ago, which often resulted in serious damage to native ecosystem and local environments (Gotzek et al. 2015). In South Korea, recent invasions of ant species with histories of negative ecological and economic impacts have been reported, such as *Linepithema humile* (Park SH et al. 2021; Park J et al. 2021a; Lee et al. 2023; Park et al. 2023). Moreover, several putative non-native ant species (e.g., *Pheidole indica*) are thought to have entered South Korea before they were even recognized as alien species, and have since established themselves in various ecosystems, making it difficult to assess their impacts and trace their history (Dong 2017). Thus, it is important to comprehend and monitor ant species composition regularly not only for conservation biology but also for deep ecological studies and quarantine purposes (Wong et al. 2023). Efforts such as antmaps.org (Guénard et al. 2017) have been established to maintain global-scale comprehensive databases and facilitate knowledge sharing in this field. These initiatives aid in our understanding of ants and their broader ecological implications, enabling us to make informed decisions for conservation and ecological research; however, they should serve as a starting point to refine current knowledge.

Checklists incorporating both field and museum surveys serve as a crucial first step, but several difficulties have existed in the survey of South Korea ants. While North and South Korea are geographically connected and have no biogeographical factor separating the two nations, research on ants in the two countries has been compartmentalized due to researchers holding different species concepts. North Korea's myrmecofauna was mainly studied by European myrmecologists (Collingwood 1976; Radchenko 2005). On the other hand, myrmecological research in South Korea has primarily revolved around faunistic studies conducted by Korean myrmecologists (e.g., Choi et al. 1993; Kim 1996; Lyu 2006), as well as contributions from Japanese and European myrmecologists (e.g., Karavaiev 1912; Rigato 1994; Terayama et al. 1992; Wheeler 1928). Although our understandings of biogeography, evolution, and species delimitations have improved a lot in the past decades, such new findings were often omitted in South Korean ant studies as most studies were conducted endogenously resulting in errors such as recognizing East Palearctic species as their strictly western counterparts. Straightening out such errors is a complicated process due to the frequent loss of voucher and type specimens, as well as difficulties in accessing collections stored overseas. Therefore, records of ants from South and North Korea have often been unintentionally combined, or studies have been carried out by researchers with completely different interpretations of certain species, resulting in many species with unclear records in the literature and without careful re-examination. As a result, even though records for some ant species already exist for South Korea, a comprehensive taxonomic review is still required.

In this study, we present an updated checklist of South Korean ants based on the most recent taxonomic data. This revision integrates extensive field collections by the first authors (2016–2024), critical examinations of museum voucher specimens, and a comprehensive review of published records. We here recognize 44 genera and 147 species, including 22 newly reported species in the country, while removing 31 previously reported records based on literature and voucher specimen examinations. This checklist defines five dubious species whose presence in South Korea is doubtful but cannot be formally excluded due to limited evidence at this point. In addition to providing up-to-date taxonomic treatments of several species, we also discuss the challenges in identifications of several particularly taxonomically complicated groups. We also delve into a comprehensive overview of South Korean ants, addressing their distribution patterns, levels of endemism, characteristics of exotic species, and the imperative for conservation at both habitats and species levels.

MATERIAL AND METHODS

Subdivision of bioregions in South Korea

Located on the transitional zone from temperate to subtropical climates, South Korea exhibits a diverse environment despite its relatively small landmass (~100,000 km^2). Along the temperature gradient and associated geographic features from the alpine north to the southern shorelines, both the dominant flora and the ant species inhabiting them show distinct variation. We broadly divided the country into four bioregions that correspond to the gradual distributional changes in ant species. It should be noted that these distinctions are not sharply defined, and many species coexist in the intermediate zones. We here use it to highlight the habitat preferences of each species than to precisely divide the ranges. Distribution allocation of each ant species was based on the authors' collections and numerous literatures (e.g., antmaps.org; AntWeb.org; Choi et al. 1993; Dong 2017; Terayama et al. 1992).

Some alien ant species occur almost exclusively in heated indoor environments. Since these indoor environments provide thermally stable conditions comparable to those in lower-latitude regions, we believe it is better to consider such environments as a separate section in addition to the four natural habitat zones described above. Therefore, we designated indoor environments as a separate subdivision (I in Table 1). The significance of these environments is further discussed in the "Discussion" section.

Zone 1: This section corresponds to the higher alpine regions mostly centered from the eastern to the Southern mountainous ranges (Baekdudaegan to Mt. Jirisan). Diversity overall declines as the altitude gets higher but some species such as *Formica candida* Smith, 1878, *Formica* sp. 1 and *Myrmica* spp. are only found in these areas. The exact turning point between zone 1 and zone 2 can be obscure but is generally between 500~1000 m above sea level depending on the latitude and aspect. It should be noted that this boundary also seems to be shifting upwards due to climate change in recent years.

Zone 2: This zone covers the majority of the country, covering the lowlands (mostly urban or farmland) and small hills. These areas are mostly covered with deciduous forests consisting of trees such as oaks (*Quercus* spp.), maples (*Acer* spp.), while conifers (*Pinus* spp. and *Abies* spp.) grow on more barren, drier locations. Dominant ant species found in these regions are generalist in terms of environments.

Zone 3: This zone corresponds to the southern coastline areas where evergreen forests can be found. The ria coastlines of southern and western South Korea have formed thousands of small islands and peninsulas in which the maritime climate provides warm winters allowing cold intolerant species (e.g., *Ochetellus glaber* (Mayr, 1862), *Monomorium intrudens* Smith, 1874) to thrive. This coastal factor seems to outweigh the latitudinal factors as this zone stretches up north along the coast.

Zone 4: We have decided to assign the large volcanic island of Jeju a separate section due to its unique environments and the ants found therein. The island's environments mostly overlap with zone 3 but gradual alterations in fauna are found along the steep slopes of the central volcano, Mt. Hallasan, with only the most alpine species found near the tip almost reaching 2,000 m above sea levels overlapping with species from zone 1. Species found in zone 3 and 4 are more often also found in the Japanese archipelago, likely due to the past land bridges resulting from sea level fluctuations in the Late Pleistocene (Taruno 2010).

Materials examined

The following is a list of institutions and universities where voucher specimens were examined.

1. Animal and Plant Quarantine Agency, Gimcheon, Republic of Korea
2. Chungnam National University, Daejeon, Republic of Korea

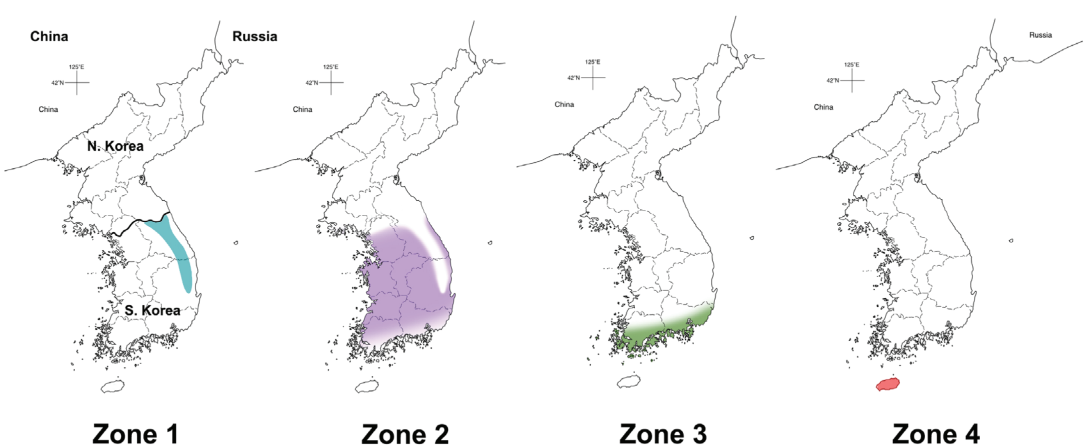

Fig. 1. Newly proposed subdivision of bioregions of South Korea in terms of ant distribution.

3. Kangwon National University, Chuncheon, Republic of Korea
4. Korea National Arboretum, Pocheon, Republic of Korea
5. Korea National Park Service, Wonju, Republic of Korea
6. NIBR (National Institute of Biological Resources), Incheon, Republic of Korea
7. Prof. Dr. Seiki Yamane's collection, Kagoshima, Japan (SKYC)
8. Seoul National University, Seoul, Republic of Korea
9. Yeungnam University, Gyeongsan, Republic of Korea

Images

The images used in this study were taken with a Leica DFC 425 camera mounted on a microscope and a Sony ILCE-6600 digital camera. Images captured with the Leica DFC 425 camera were processed using Leica Application Suite software, while those taken with the Sony ILCE-6600 were focus-stacked using Zerene Stacker. The final stacked images were adjusted for brightness and sharpness in Adobe Photoshop 2024.

Remarks on the checklist

The checklist (Table 1) was compiled from previously published checklists (Paik 1984; Terayama et al. 1992; Choi et al. 1993; Choi 1997; Dong 2017) and the first author's field collections, with the most recent references in which each species is mentioned being cited. For species that were confirmed to occur in South Korea after the publication of these previous checklists, the most recently published sources were cited.

Some invasive species have been recorded exclusively during quarantine in ports (e.g., *Anoplolepis gracilipes*, *Paratrechina longicornis*; Lyu et al. 2000). Such species are not included in this checklist as our study focuses on native and introduced species that are established in South Korea, not on temporary introductions representing non-established populations.

Our use of the term "Newly reported species" covered three situations: (1) species recorded for the first time in South Korea (e.g., *Monomorium carbonarium*, *Tetramorium nipponense*); (2) species previously reported in the country but for which all earlier records are now recognized as belonging to a different species which has not been recorded in Korea (e.g., *Lasius longipalpus*, *Lasius* sp. 1, *Formica* sp. 1, *Formica* sp. 2); and (3) cases where a portion of the populations previously included under an existing species is now recognized as a separate species (e.g., *Camponotus yamaokai*).

We excluded species if (1) any previous publication had questioned their occurrence and we also failed to find reliable evidence, including voucher material from earlier studies, or (2) their known global distribution makes their presence in South Korea highly unlikely, for example in species restricted to the Western Palearctic. If no such doubts were raised in the literature but the reported range still appears doubtful, and a natural presence cannot be completely ruled out, we listed the species as "Dubious species" instead of removing it (Table 3).

For certain species the authors could not directly confirm their occurrence in South Korea, however those do not fall under the "Dubious species" criteria. In these cases, even if we were unable to directly examine the specimens, we could not find convincing reasons to consider previous records to be erroneous and therefore we did not exclude the species from our list. Such species are marked "Needs verification".

RESULTS

Species newly reported from South Korea (22 species): *Brachyponera nakasujii* Yashiro, Matsuura, Guénard, Terayama & Dunn, 2010, *Camponotus bishamon* Terayama, 1999, *Camponotus yamaokai* Terayama & Satoh, 1990, *Dolichoderus* sp. 1, *Formica* sp. 1, *Formica* sp. 2, *Hypoponera nubatama* Terayama & Hashimoto, 1996, *Lasius koreanus* Seifert, 1992, *Lasius longipalpus* Seifert, 2020, *Lasius vostochni* Seifert, 2020, *Lasius* sp. 1, *Monomorium carbonarium* (Smith, 1858), *Nylanderia* sp. cf. *jaegerskioeldi* (Mayr, 1904), *Pheidole parva* Mayr, 1865, *Stigmatomma caliginosum* (Onoyama, 1999), *Strumigenys hirashimai* (Ogata, 1990), *Strumigenys rostrataeformis* (Brown, 1949), *Tapinoma sahohime* Terayama, 2013, *Technomyrmex vitiensis* Mann, 1921, *Temnothorax* sp. 1, *Tetramorium lanuginosum* Mayr, 1870, *Tetramorium nipponense* Wheeler, 1928

Table 1. An updated checklist of ants of South Korea with their distribution patterns. A (Alien species), D (Dubious species), E (Endemic species), I (Indoor environment), N (Newly reported species), V (Needs verification).

	Taxon	**Distribution**					**Remarks**	**References**
		1	**2**	**3**	**4**	**I**		
	Amblyoponinae Forel, 1893							
1	*Stigmatomma caliginosum* Onoyama, 1999			●			N	
2	*Stigmatomma silvestrii* Wheeler, 1928		●	●	●			Dong 2017
	Dolichoderinae Forel, 1878							
3	*Dolichoderus sibiricus* Emery, 1889	●	●	●	●			Dong 2017
4	*Dolichoderus* sp. 1		●				N	
5	*Linepithema humile* Mayr, 1868			●			A	Lee et al. 2020
6	*Ochetellus glaber* Mayr, 1862			●	●			Dong 2017
7	*Tapinoma melanocephalum* Fabricius, 1793			●		●	A	Dong 2017
8	*Tapinoma sahohime* Terayama, 2013			●	●		N	
9	*Technomyrmex vitiensis* Mann, 1921					●	N, A	
10	*Technomyrmex gibbosus* Wheeler, 1906		●	●	●			Dong 2017
	Dorylinae Leach, 1815							
11	*Syscia humicola* Ogata, 1983		●	●	●			Dong 2017
	Formicinae Latreille, 1809							
12	*Acropyga sauteri* Forel, 1912			●				Kwon et al. 2017
13	*Camponotus amamianus* Terayama, 1991				●		D	Lyu and Um 2007
14	*Camponotus atrox* Emery, 1925	●	●		●			Dong 2017
15	*Camponotus bishamon* Terayama, 1999			●	●		N	
16	*Camponotus dorex* Fisher, 2025		●	●	●		E	Dong 2017
17	*Camponotus fuscus* Kim & Kim, 1994		●				D, E	Kim and Kim 1994
18	*Camponotus itoi* Forel, 1912		●	●	●			Dong 2017
19	*Camponotus japonicus* Mayr, 1866	●	●	●	●			Dong 2017
20	*Camponotus jejuensis* Kim & Kim, 1986			●	●		D, E	Kim and Kim 1986
21	*Camponotus kiusiuensis* Santschi, 1937		●	●	●			Dong 2017
22	*Camponotus nawai* Ito, 1914			●	●			Dong 2017
23	*Camponotus nipponensis* Santschi, 1937		●		●			Dong 2017
24	*Camponotus quadrinotatus* Forel, 1886	●	●	●	●			Dong 2017
25	*Camponotus vitiosus* Smith, 1874		●	●	●			Dong 2017
26	*Camponotus yamaokai* Terayama & Satoh, 1990			●	●		N	
27	*Camponotus yessensis* Yasumatsu & Brown, 1951		●					Hong 2023
28	*Colobopsis nipponica* Wheeler, 1928			●	●			Dong 2017
29	*Formica candida* Smith, 1878	●			●			Dong 2017
30	*Formica hayashi* Terayama & Hashimoto, 1996	●	●		●			Dong 2017

	Taxon	Distribution					Remarks	References
31	*Formica japonica* Motschoulsky, 1866	●	●	●	●			Dong 2017
32	*Formica sanguinea* Latreille, 1798	●	●					Dong 2017
33	*Formica truncorum* Fabricius, 1804	●	●	●				Dong 2017
34	*Formica* sp. 1	●					N	
35	*Formica* sp. 2				●		N	
36	*Lasius capitatus* (Kuznetsov-Ugamsky, 1927)	●	●					Choi 1997
37	*Lasius flavus* Fabricius, 1782	●	●	●	●			Dong 2017
38	*Lasius fuji* Radchenko, 2005	●	●	●	●			Dong 2017
39	*Lasius hayashi* Yamauchi & Hayashida, 1970	●	●	●	●			Dong 2017
40	*Lasius japonicus* Santschi, 1941	●	●	●	●			Dong 2017
41	*Lasius koreanus* Seifert, 1992		●	●			N	
42	*Lasius longipalpus* Seifert, 2020	●	●		●		N	
43	*Lasius meridionalis* Bondroit, 1920		●		●			Choi 1997
44	*Lasius nipponensis* Forel, 1912	●	●	●				Choi 1997
45	*Lasius orientalis* Karavaiev, 1912	●	●					Choi 1997
46	*Lasius productus* Wilson, 1955	●	●					Cho et al. 2020
47	*Lasius sonobei* Yamauchi, 1979		●	●				Choi 1997
48	*Lasius spathepus* Wheeler, 1910	●	●	●	●			Dong 2017
49	*Lasius talpa* Wilson, 1955		●	●	●			Dong 2017
50	*Lasius umbratus* Nylander, 1846		●	●				Dong 2017
51	*Lasius vostochni* Seifert, 2020	●	●				N	
52	*Lasius* sp. 1		●	●			N	
53	*Nylanderia* sp. cf. *jaegerskioeldi* (Mayr, 1904)					●	N, A	
54	*Nylanderia flavipes* Smith, 1874	●	●	●	●			Dong 2017
55	*Nylanderia yaeyamensis* Terayama, 1999				●		D	Lyu and Um 2007
56	*Paraparatrechina sakurae* Ito, 1914		●	●	●			Dong 2017
57	*Plagiolepis flavescens* Collingwood, 1976		●	●	●			Dong 2017
58	*Plagiolepis manczshurica* Ruzsky, 1905		●	●	●			Dong 2017
59	*Polyergus samurai* Yano, 1911		●					Dong 2017
60	*Polyrhachis lamellidens* Smith, 1874		●	●	●			Dong 2017
61	*Uwari keihitoi* Forel, 1913			●	●			Choi 1997
	Myrmicinae Lepeletier de Saint-Fargeau, 1835							
62	*Aphaenogaster famelica* Smith 1874			●				Dong 2017
63	*Aphaenogaster japonica* Forel 1911	●	●	●	●			Dong 2017
64	*Aphaenogaster lepida* Wheeler 1930		●	●	●			Shin et al. 2020c
65	*Aphaenogaster tipuna* Forel 1913			●			D	Dong 2017

	Taxon	Distribution					Remarks	References
66	*Cardiocondyla kagutsuchi* Terayama, 1999			●			A	Seifert 2003
67	*Crematogaster matsumurai* Forel, 1901		●	●	●			Dong 2017
68	*Crematogaster osakensis* Forel, 1900		●	●	●			Dong 2017
69	*Crematogaster teranishii* Santschi, 1930		●	●	●			Dong 2017
70	*Crematogaster vagula* Wheeler, 1928		●	●	●			Dong 2017
71	*Dacatria templaris* Rigato, 1994		●	●				Choi 1997
72	*Leptothorax acervorum* Fabricius, 1793	●			●			Choi 1997
73	*Messor aciculatus* Smith, 1874		●	●	●			Dong 2017
74	*Monomorium carbonarium* (Smith, 1858)			●			N, A	
75	*Monomorium chinense* Santschi, 1925		●	●	●			Dong 2017
76	*Monomorium intrudens* Smith, 1874			●	●			Dong 2017
77	*Monomorium pharaonis* Linnaeus, 1758					●	A	Dong 2017
78	*Monomorium triviale* Wheeler, 1906			●	●			Dong 2017
79	*Myrmecina flava* Terayama, 1985	●	●					Dong 2017
80	*Myrmecina nipponica* Wheeler, 1906	●	●	●	●			Dong 2017
81	*Myrmica ademonia* Bolton, 1995	●						Shin et al. 2020d
82	*Myrmica angulinodis* Ruzsky, 1905	●						Authors' confirmation
83	*Myrmica excelsa* Kupyanskaya, 1990	●	●					Cho et al. 2020
84	*Myrmica jessensis* Forel, 1901	●			●			Dong 2017
85	*Myrmica koreana* Elmes, Radchenko & Kim, 2001	●						Lyu 2006
86	*Myrmica kotokui* Forel, 1911	●	●		●			Dong 2017
87	*Myrmica kurokii* Forel, 1907	●	●		●			Lyu 2006
88	*Myrmica luteola* Kupyanskaya, 1990	●			●			Shin et al. 2020d
89	*Myrmica ruginodis* Nylander, 1846	●	●		●			Lyu 2006
90	*Myrmica sulcinodis* Nylander, 1846	●			●		V	Kim et al. 1993; Lyu 2006
91	*Myrmica transsibirica* Radchenko, 1994	●	●		●			Lyu 2006
92	*Pheidole fervida* Smith, 1874	●	●	●	●			Dong 2017
93	*Pheidole indica* Mayr, 1879			●	●		A	Dong 2017
94	*Pheidole nodus* Smith, 1874			●	●			Dong 2017
95	*Pheidole parva* Mayr, 1865					●	N, A	
96	*Pheidole pieli* Santschi, 1925		●	●			V	Choi 1997
97	*Pristomyrmex punctatus* Smith, 1860		●	●	●			Dong 2017
98	*Solenopsis japonica* Wheeler, 1928	●	●	●	●			Dong 2017
99	*Stenamma koreanense* Lyu, Dubois & Cho, 2002	●					E	Lyu & Cho 2004
100	*Stenamma owstoni* Wheeler, 1906	●	●	●				Lyu & Cho 2004
101	*Stenamma ussuriense* Arnol'di, 1975	●						Lyu & Cho 2004

	Taxon	Distribution					Remarks	References
102	*Strongylognathus koreanus* Pisarski, 1966			●	●			Choi 1997
103	*Strumigenys alecto* Bolton, 2000			●				Dong & Kim 2020
104	*Strumigenys calvus* Dong & Kim, 2020		●	●	●		E	Dong & Kim 2020
105	*Strumigenys canina* Brown & Boisvert, 1979			●	●			Dong & Kim 2020
106	*Strumigenys choii* Lyu, 2007			●			E	Lyu 2007
107	*Strumigenys hexamera* Brown, 1958			●	●			Dong & Kim 2020
108	*Strumigenys hirashimai* Ogata, 1990				●		N	
109	*Strumigenys incerta* Brown, 1949			●	●			Dong & Kim 2020
110	*Strumigenys japonica* Ito, 1914		●		●			Dong 2017
111	*Strumigenys kumadori* Yoshimura & Onoyama, 2007		●	●				Dong 2017
112	*Strumigenys lewisi* Cameron, 1886		●	●	●			Dong 2017
113	*Strumigenys masukoi* Ogata & Onoyama, 1998			●				Dong & Kim 2020
114	*Strumigenys membranifera* Emery, 1869			●	●		A	Dong & Kim 2020
115	*Strumigenys mutica* Brown, 1949			●	●			Dong 2017
116	*Strumigenys rostrataeformis* (Brown, 1949)		●	●			N	
117	*Strumigenys solifontis* Brown, 1949		●					Dong & Kim 2020
118	*Temnothorax congruus* Smith, 1874		●	●	●			Dong 2017
119	*Temnothorax koreanus* Teranishi, 1940		●					Choi 1997
120	*Temnothorax michali* Radchenko, 2004	●	●	●	●			Shin et al. 2019
121	*Temnothorax nassonovi* Ruzsky, 1895			●	●			Choi 1997
122	*Temnothorax pisarskii* Radchenko, 2004		●					Shin et al. 2019
123	*Temnothorax spinosior* Forel, 1901	●	●	●	●			Dong 2017
124	*Temnothorax wui* Wheeler, 1929	●	●					Shin et al. 2019
125	*Temnothorax xanthos* Radchenko, 2004		●	●	●			Shin et al. 2019
126	*Temnothorax* sp. 1		●				N	
127	*Tetramorium bicarinatum* Nylander, 1846			●	●	●	A	Terayama et al. 1992
128	*Tetramorium nipponense* Wheeler, 1928				●		N	
129	*Tetramorium lanuginosum* Mayr, 1870					●	N, A	
130	*Tetramorium tsushimae* Emery, 1925	●	●	●	●			Dong 2017
131	*Vollenhovia emeryi* Wheeler, 1906	●	●	●	●			Dong 2017
132	*Vollenhovia nipponica* Kinomura & Yamauchi, 1992		●	●				Shin et al. 2020a
	Ponerinae Lepeletier de Saint-Fargeau, 1835							
133	*Brachyponera chinensis* Emery, 1895		●	●	●			Dong 2017
134	*Brachyponera nakasujii* Yashiro, Matsuura, Guénard, Terayama & Dunn, 2010			●	●		N	
135	*Cryptopone sauteri* Forel, 1913	●	●	●	●			Dong 2017

	Taxon	Distribution					Remarks	References
136	*Ectomomyrmex javanus* Mayr, 1867	●	●	●	●			Dong 2017
137	*Euponera pilosior* Wheeler, 1928		●	●	●			Dong 2017
138	*Hypoponera nippona* Santschi, 1937		●	●	●			Choi 1997
139	*Hypoponera nubatama* Terayama & Hashimoto, 1996			●	●		N	
140	*Hypoponera ragusai* Emery, 1894		●		●		A, V	Choi 1997
141	*Hypoponera sauteri* Forel, 1912		●	●	●			Dong 2017
142	*Ponera japonica* Wheeler, 1906	●	●	●	●			Dong 2017
143	*Ponera scabra* Wheeler, 1928		●	●	●			Dong 2017
144	*Ponera takaminei* Terayama, 1996				●		V	Lyu and Um 2007
	Proceratiinae Emery, 1895							
145	*Discothyrea sauteri* Forel, 1912			●	●			Shin et al. 2020b
146	*Proceratium itoi* Forel, 1918		●	●	●			Dong 2017
147	*Proceratium watasei* (Wheeler, 1906)				●		V	Kim et al. 1993

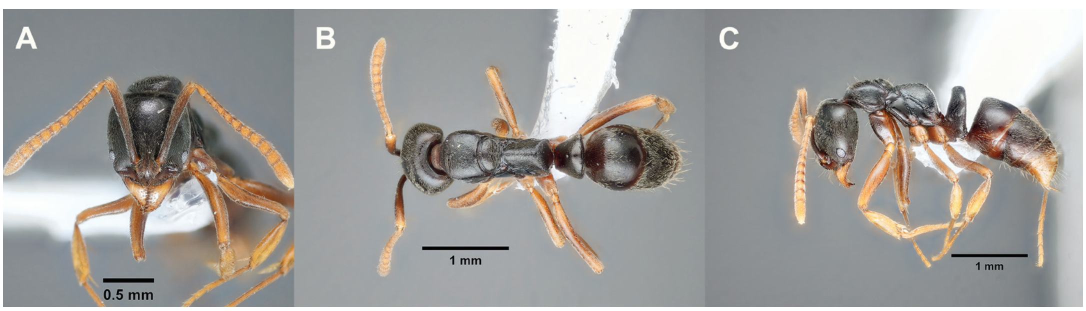

Fig. 2. Habitus of worker of *Brachyponera nakasujii* Yashiro, Matsuura, Guénard, Terayama & Dunn, 2010. A: Full-face view; B: Dorsal view; C: Lateral view.

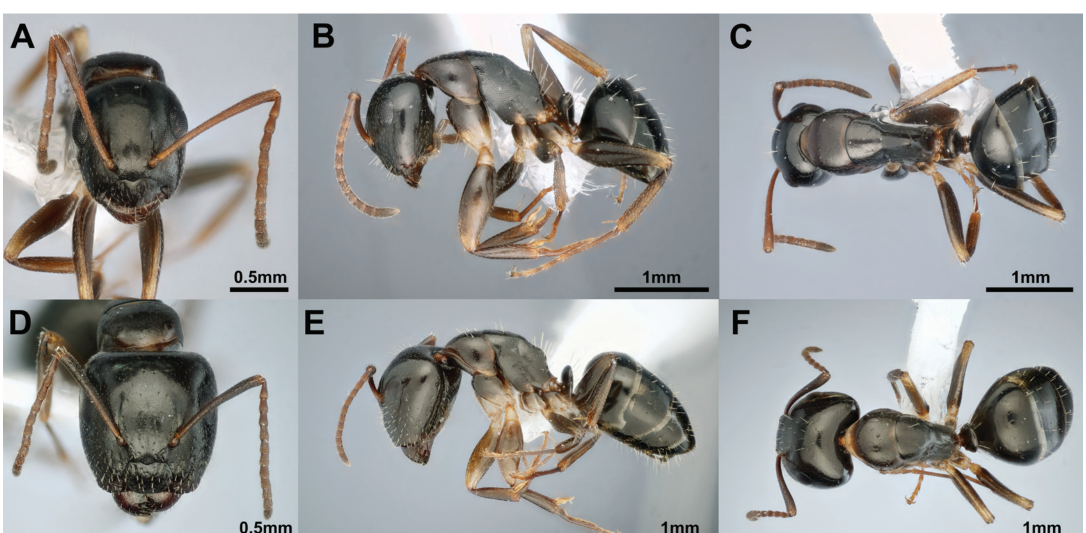

Fig. 3. Habitus of worker of *Camponotus bishamon* Terayama, 1999. A-C: Minor worker; A: Full-face view; B: Lateral view; C: Dorsal view. D-F: Major worker; D: Full-face view; E: Lateral view; F: Dorsal view.

Brachyponera nakasujii **Yashiro, Matsuura, Guénard, Terayama & Dunn, 2010 (Fig. 2)**

Material examined: [South Korea] 20 workers 3 queens, Donnaeko Valley, Seogwipo-si, Jeju Island, 33.3007, 126.5807, alt. 258 m, 20 May 2023, Coll. J. Park, Litter sifting.

Morphology: *Brachyponera nakasujii* can be separated from *B. chinensis* in workers having broader petioles, by the smaller mean body size of *B. nakasujii*, and males having darker body coloration and well-developed mandibles compared to *B. chinensis*.

Ecology: *Brachyponera nakasujii* nests were found to be restricted to damp, well covered forests, while *B. chinensis* were much more dry-tolerant and found from deep forests to busy streets of major cities.

Remarks: In 2010, *B. nakasujii* was described from Japan as a cryptic species from its sympatric congener *B. chinensis* (Yashiro et al. 2010). We have also found it to be the case in South Korea, with *B. nakasujii* mixed in with *B. chinensis* samples.

Camponotus bishamon **Terayama, 1999 (Fig. 3)**

Material examined: [South Korea] 3 workers, Mt. Nojasan, Geoje–do Is., Gyeongsangnam–do, 34.7844, 128.6295, alt. 158 m, 26. May. 2018. Coll. M. Dong, Berlese trap. 10 workers, Jin-ri, Heuksan-myeon, Sinan-gun, Jeollanam-do, 34.6872, 125.4270, alt. 15 m, 27. Dec. 2018, Coll. J. Park, Hand collecting. 20 workers, 1 queen, Jisimdo, Irun-myeon, Geoje-si, Gyeongsangnam-do, 34.8174, 128.7481, alt. 32 m, 9. Feb. 2019., Coll. J. Park, Hand collecting. 20 workers, Jejigi Oreum, Seogwipo-si, Jeju Island, 33.2412, 126.6098, alt. 195 m, 21. Feb. 2019., Coll. J. Park, Hand collecting. 20 workers, Gageodo, Heuksan-myeon, Sinan-gun, Jeollanam-do, 34.0509,125.1304, alt. 2 m, 7. Apr. 2019., Coll. J. Park, Hand collecting. 20 workers, Jisimdo, Irun-myeon, Geoje-si, Gyeongsangnam-do, 34.8174, 128.7481, alt. 32 m, 25. May. 2020., Coll. J. Park, Hand collecting. 20 workers, Yeoseodo, Cheongsan-myeon, Wando-gun, Jeollanam-do, 33.9862, 126.9197, alt. 83 m, 1. Jul. 2020., Coll. J. Park, Hand collecting. 10 workers, Eocheongdo, Okdo-myeon, Gunsan-si, Jeollabuk-do, 36.1156, 125.9807, alt. 49 m, 3. May. 2022., Coll. J. Park, Hand collecting. **[Japan]** 15 workers, Hirae, Ishigaki, Okinawa 907-0003, 24.4173, 124.1901, alt. 159 m, 11. Aug. 2025., Coll. J. Park, Hand collecting.

Morphology: This species closely resembles the more widespread *C. vitiosus*, but differs in having a higher petiole and straighter propodeal dorsum in both minor and major workers. It should be noted, however, that in specimens of *C. bishamon* collected in South Korea, the dorsal propodeal outline is more concave compared to the original description of *C. bishamon* where it is stated the almost straight dorsal outline can be used to distinguish *C. bishamon* from *C. vitiosus*. We have compared *C. bishamon* specimens collected from Ishigaki Island, Japan (where some paratypes were collected), and found that the degree of propodeal dorsum depression varies considerably between samples, often showing more concavity than in the original description. Thus, we concluded that the petiolar node which is higher, thinner, and asymmetrical in *C. bishamon* when seen laterally, is a more reliable character in distinguishing *C. bishamon* from *C. vitiosus*. Workers and gynes occasionally possess white spots on their first two gastral segments, but are very small and slight, much less pronounced compared to species such as *C. yamaokai*, *C. nawai*, or *C. quadrinotatus*.

Ecology: They inhabit the coastal forests in the south (Zone 3) and can be locally common, often outnumbering the more widespread *C. vitiosus*.

Camponotus yamaokai **Terayama & Satoh, 1990 (Fig. 4)**

Material examined: [South Korea] 2 workers, Mt. Nojasan, Geoje–do Is., Gyeongsangnam–do, 34.7844, 128.6295, alt. 158 m, 26. May. 2018. Coll. M. Dong, Berlese trap. 20 workers, 4 queens, Yeongcheon-Ag, Seogwipo-si, Jeju Island, 33.2942, 126.6009, alt. 146 m, 23. Jan. 2018., Coll. J. Park, Hand collecting. 10 workers, Mt. Sangwang-san, Wando-gun, Jeollanam-do, 34.3602, 126.7118, alt. 260m, 18. May. 2018., Coll. J. Park, Hand collecting. 10 workers, Yeongcheon-Ag, Seogwipo-si, Jeju Island, 33.2942, 126.6009, alt. 146 m, 21. Feb. 2019., Coll. J. Park, Hand collecting. 10 workers, Mt. Gogeun-san, Seogwipo-si, Jeju Island, 33.2641, 126.5134, alt. 284 m, 7. Aug. 2020., Coll. J. Park, Hand collecting. 10 workers, Mt. Gogeun-san, Seogwipo-si, Jejudo Island, 33.2641, 126.5134, alt. 284 m, 29. Mar. 2021., Coll. J. Park, Hand collecting. 3 workers, Yeongcheon-ag, Seogwipo-si, Jeju Island, 33.2942, 126.6009, alt. 146 m, 6. Jun. 2022., Coll. J. Park, Hand collecting. 2 workers, Mt. Jirisan, Gurye-gun, Jeollanam-do, 35.2669, 127.5041, alt. 262 m, 15. Aug. 2023., Coll. J. Park, Hand collecting.

Morphology: This species is smaller, has a thinner petiole, and have protruding compound eyes in minor workers compared to the closely resembling *C. nawai*.

Ecology: This species inhabits the evergreen forests of the southern edges of the peninsula and is apparently more abundant than the previously recorded *C. nawai*, which the latter being restricted to forests directly meeting the coastlines.

Remarks: Similar to how the two species were confused in Japan, the species remained unnoticed in South Korea as it was misidentified for *C. nawai*. Therefore, previous records of *C. nawai* in South Korea should be interpreted as the combined records of *C. yamaokai* and *C. nawai*,

***Dolichoderus* sp. 1 (Fig. 5)**

Material examined: [South Korea] 30 workers, Jeonbuk National University, Jeonju-si, Jeollabuk-do, 35.8487, 127.1345, alt. 53 m, 5. May. 2018., Coll. J. Park, Hand collecting. 30 workers, Jeonbuk National University, Jeonju-si, Jeollabuk-do, 35.8487, 127.1345, alt. 53 m, 30. Apr. 2020., Coll. J. Park, Hand collecting. 20 workers, Cheonan High School, Dongnam-gu, Cheonan-si, Chungcheongnam-do, 36.8088, 127.1343, alt. 25 m, 4. Jun. 2020., Coll. J. Park, Hand collecting. 5 workers, Wansan-gu, Jeonju-si, Jeollabuk-do, 35.8108, 127.1626, alt. 48 m, 12. Sep. 2020., Coll. J. Park, Hand collecting. **[Hong Kong SAR]** 10 workers, Yuen Chau Tsai Park, Tai Po Road (Yuen Chau Tsai), Tai Po, 22.4478, 114.1774, alt. 3 m, 29. May. 2023., Coll. J. Park, Hand collecting.

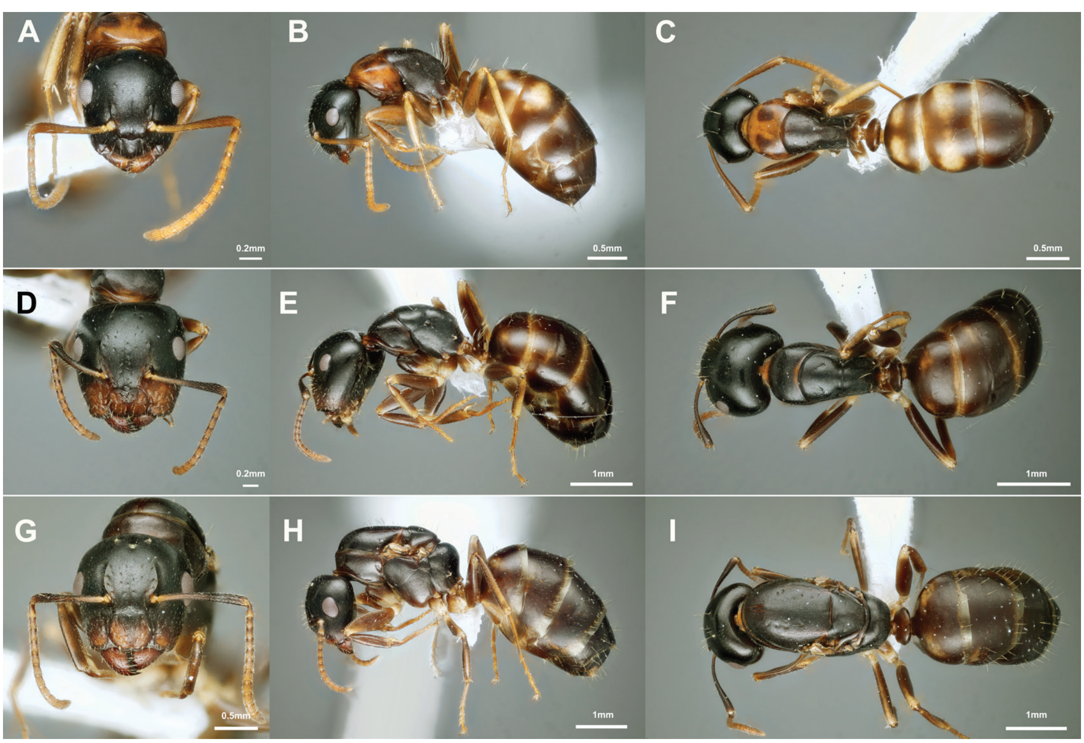

Fig. 4. Habitus of *Camponotus yamaokai* Terayama & Satoh, 1990. A-C: Minor worker; A: Full-face view; B: Lateral view; C: Dorsal view. D-F: Major worker; D: Full-face view; E: Lateral view; F: Dorsal view. G-I: Queen; G: Full-face view; H: Lateral view; I: Dorsal view.

Fig. 5. Habitus of worker of *Dolichoderus* sp. 1. A: Full-face view; B: Lateral view; C: Dorsal view.

Morphology: Similar to *Dolichoderus sibiricus* but can be identified by the combination of red head, funicular segments 3-7 being shorter than broad. The shape of the propodeum is much more variable compared to *D. sibiricus*.

Ecology: In South Korea, these ants are only found in some parts in the western lowlands, between Cheonan and Jeonju, likely reflecting its continental origins, where it would have been connected in the glacial periods when sea levels were low (unpublished data). Places where they co-occur with *D. sibiricus*, the latter is found near more natural conditions while this species lives in more disturbed areas.

Remarks: This species is common and widespread in southern China, and it likely corresponds to *Dolichoderus sinensis* Wheeler, 1921, currently regarded as a junior synonym of *D. sibiricus*. Morphological and molecular data show the two are indeed distinct species, having diverged even before *D. sibiricus* and *D. quadripunctatus* of western Palearctic diverged (Park et al. 2020; unpublished data).

***Formica* sp. 1 (Previously recorded as *F. lemani*; Fig. 6)**

Material examined: [South Korea] 27 workers, Hoenggye-ri, Daegwalnyeong-myeon, Pyeongchang-gun, Gangwon-do, 37.7636, 128.6695, alt. 844 m, 16. Aug. 2020., Coll. M. Dong, Hand collecting. 2 workers, Mt. Deogyusan, Seolcheon-myeon, Muju-gun, Jeollabuk-do, 35.8650, 127.7436, alt. 1115 m, 13. Aug. 2019., Coll. M. Dong, Hand collecting. 20 workers, Sangwonsa temple, Mt. Odaesan, Jinbu-myeon, Pyeongchang-gun, Gangwon-do, 37.7864, 128.5644, alt. 850 m, 9. Jul. 2023., Coll. J. Park, Hand collecting. 15 workers, Mt. Jiri-san, Jeollanamdo, 35.3014,127.5002, alt. 950 m, 15. Aug. 2023., Coll. J. Park, Hand collecting. 15 workers, Mt. Seorak-san, Inje, Gangwon-do, 38.1047, 128.4124, alt. 1270 m, 26. Aug. 2023., Coll. J. Park, Hand collecting. **[Japan]** 2 colonies, 10 workers each, Mt. Fuji Subaru line Gogome station, Minamitsuru District, Yamanashi, 35.3959, 138.7334, alt. 2300 m, 1. Aug. 2023., Coll. J. Park, Hand collecting.

Morphology: Compared to other South Korean *Formica fusca* group species, workers of *Formica* sp.1 can be identified by a combination of features. From *F. hayashi*, *Formica* sp.1 can be distinguished in having over 10 standing setae in the first two gastral tergites while in *F. hayashi*, the first tergite usually lacks standing setae on the first tergite and has two or fewer on the second. *Formica* sp.1 can be separated from *F. japonica* by the relative sparse gastral pubescence, especially on the third tergite where the distance between the hairs is about four times the thickness, in contrast to it only being about twice in *F. japonica*. Queens of *Formica* sp.1 are well polished and lacks the obvious dense pubescence which makes it easy to be separated from both *F. japonica* and *F. hayashi*. *Formica candida* can be easily distinguished from the above mentioned three species as both workers and queens of *F. candida* are glossy and well-polished. *Formica* sp. 1 and *Formica* sp. 2 are most closely related to each other within the five *F. fusca* group species in South Korea. Morphological differences between the two are discussed under *Formica* sp. 2.

Ecology: *Formica* sp. 1 is a common montane species in high altitudes 800 m above sea level. They are found in well-lit areas naturally or artificially cleared of trees. Nests are polygynous, mostly made under rocks. Workers were mostly seen collecting honey dew from aphids and carrying back dead insects. Nuptial flights take place from late July to August.

Remarks: This species corresponds to *F. lemani* records from Korea and Japan (see "Taxonomic remarks"). The exact extent of the species' range within the eastern palearctic remains unknown.

***Formica* sp. 2 (Previously recorded as *F. fusca*; Fig. 7)**

Material examined: [South Korea] 30 workers, 1 queen, Yeongsil trail, Dosun-dong, Seogwipo-si, Jeju Island, 33.3573, 126.5089, alt. 1266 m, 16. Jul. 2018., Coll. J. Park, Hand collecting. 30 workers, 1 male, 1 queen, Witse Oreum, Gwangryeong-ri, Aewol-eup, Jeju-si, Jeju Island, 33.3619, 126.5177, alt. 1081 m, 6. Aug. 2020., Coll. J. Park, Hand collecting. 20 workers, Mt. Hallasan peak, Sanghyo-dong, Seogwipo-si, Jeju Island, 33.3623, 126.5363, alt. 1928 m, 3. Jun. 2023., Coll. J. Park, Hand collecting.

Morphology: *Formica* sp. 2 is most related to *Formica* sp. 1 and the characters used for differentiating *Formica* sp. 1 from the other three *F. fusca* group species can also be used for *Formica* sp. 2. The two can be separated in *Formica* sp. 2 having a narrower head, larger angle of the mesonotal and propodeal dorsal outlines seen from the lateral view and having a stronger velvety luster made by the dense appressed pubescence, compared to *Formica* sp. 1. To our knowledge, the two species are geographically well separated thus the collected location itself is enough for separating the two species.

Ecology: This species is found in Mt. Hallasan of Jeju Island above 1400 m altitude where dense forests are naturally replaced with smaller shrubs. Here *Formica* sp. 2 is extremely common outnumbering any other ant species. Other biological features seem to be identical to sp. 1, likely due to sharing near identical niches.

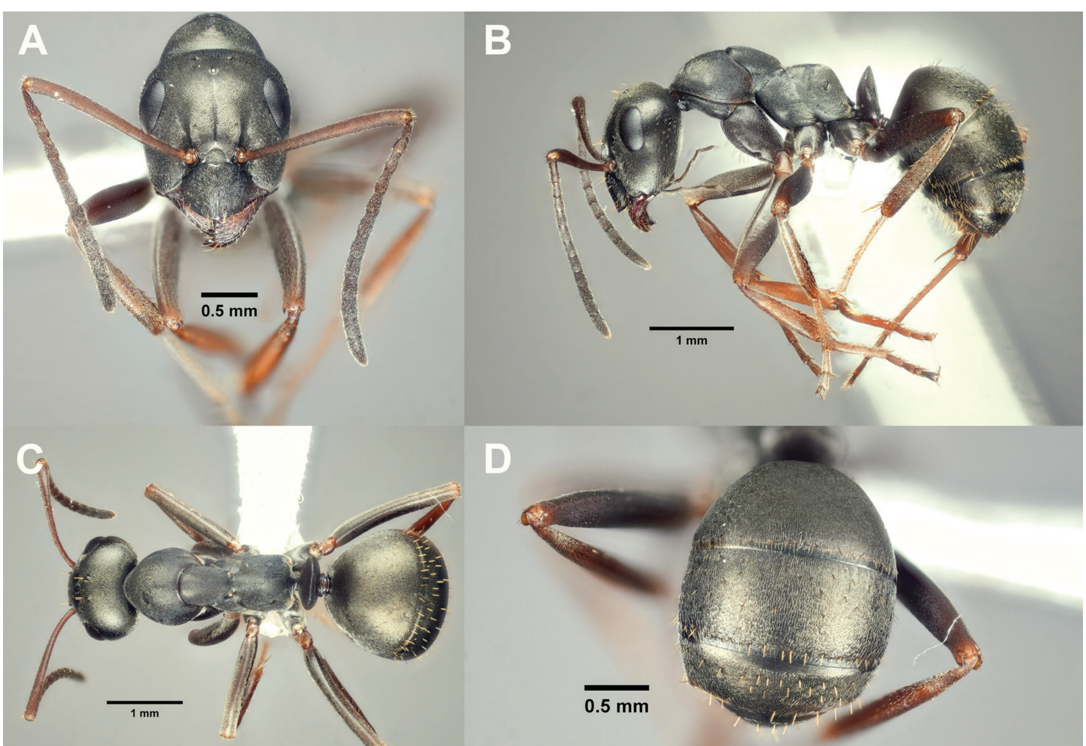

Fig. 6. Habitus of worker of *Formica* sp. 1. A: Full-face view; B: Lateral view; C: Dorsal view; D: Gaster.

Remarks: This species corresponds to all records of *F. fusca* in Mt. Hallasan (see " Taxonomic remarks "). To our knowledge, this species is only present in Jeju Island and is completely absent from other mountains of the nation. This species is likely a novel species endemic to the island or a remote population of a boreal species from higher latitudes, isolated from the last glacial maximum.

***Hypoponera nubatama* Terayama & Hashimoto, 1996**

Material examined: [South Korea] 1 queen, Yeongcheon-Ag, Seogwipo-si, Jeju Island, 33.2942, 126.6009, alt. 146 m, 6. Jun. 2022., Coll. J. Park, Litter sifting. 12 workers, Seoho-dong, Seogwipo-si, Jeju Island, 33.2980, 126.5188, alt. 546 m, 08. Jul. 2020., Coll. M. Dong, Hand collecting.

Morphology: *Hypoponera nubatama* is a small black species that can easily be identified as it is the only black *Hypoponera* of the nation.

Ecology: *Hypoponera nubatama* is found in leaf litter of low broad leaf evergreen forest of Jeju Island and southern coast of the peninsula. Although not a direct indicator of a nuptial flight, a wandering female alate was collected in early June. Yamauchi and collaborators (2001) reported alates were found mainly from late August to mid-October and wingless reproductives of both sexes were found in July to mid-August, thus, our findings could indicate a regional variety in seasonal cycles, but additional surveys are required for verification.

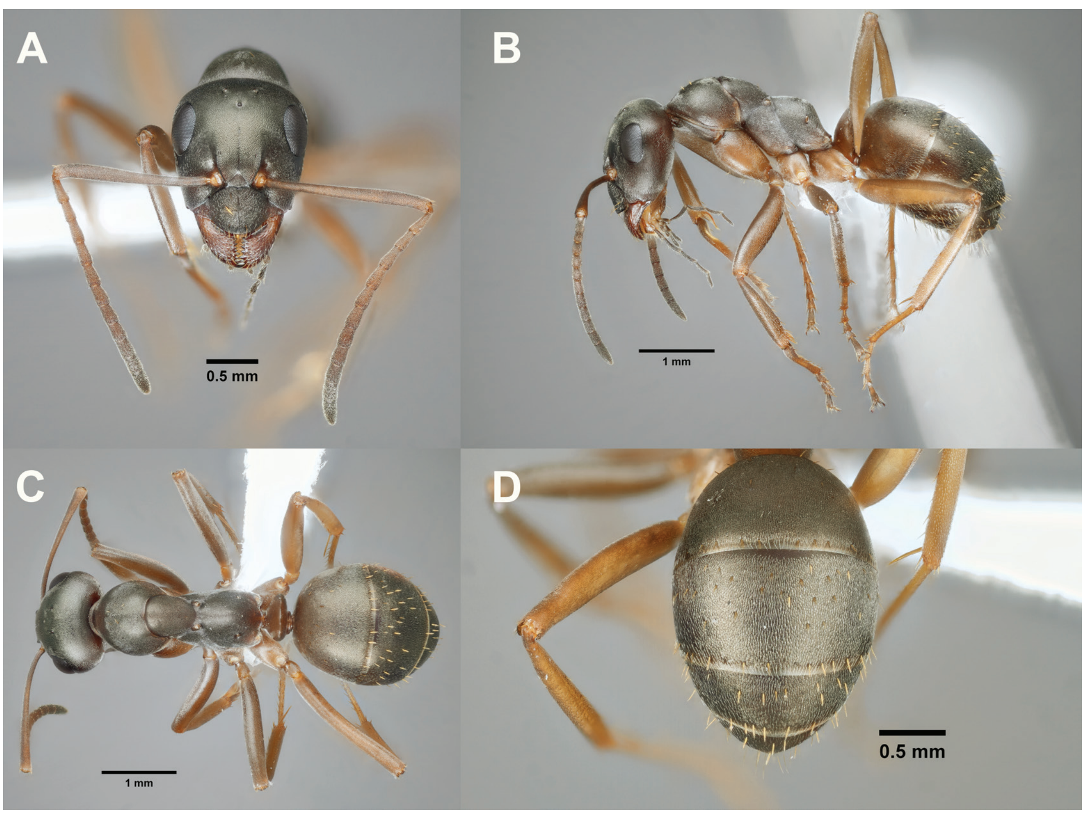

Fig. 7. Habitus of worker of *Formica* sp. 2. A: Full-face view; B: Lateral view; C: Dorsal view; D: Dorsal view of gaster.

Lasius koreanus **Seifert, 1992 (Fig. 8A-C)**

Material examined: [South Korea] 1 worker, Lake Songjiho, Donghae-daero, Jugwang-myeon, Goseong-gun, Gangwon-do, 38.3319, 128.5134, alt. 10 m, 25. Jun. 2023., Coll. J. Park, Hand collecting. 20 workers, Mt. Godaesan, Daegwang-ri, Sinseo-myeon, Yeoncheon-gun, Gyeonggi-do, 38.2061, 127.1453, alt. 95 m, 25. Jun. 2023., Coll. J. Park, Hand collecting. 30 workers, Korea University, Seongbuk-gu, Seoul, 37.5839, 127.0272, alt. 57 m, 21. Jul. 2023., Coll. J. Park, Hand collecting.

Morphology: This species can most easily be confused with *L. longipalpus* which presents similarities in its small size, elongate head shape, and large eyes but can be separated from *L. koreanus* which has a much brighter red body color, shorter scapes, and a higher abundance of setae on the scapes and genal areas.

Ecology: To our knowledge, this species is widespread in South Korea but more commonly found in the northern parts of the country. They live in a wide range of habitats from urban parks to deep forests, but even in deep forests nests are mainly in areas where direct sunlight reaches. Colonies are mostly found in low densities compared to other species of the *L. niger* group in the region.

Remarks: This species was originally described in North Korea in 1992, where it is believed to be very widespread and common according to Radchenko 2005. Although the latter study regards all North Korean *L. niger* group species with low setae number on scapes and tibiae as *L. koreanus*, it is likely other hairless species such as *L. longipalpus* would have been involved in the material of this paper. Outside the Korean Peninsula *L. koreanus* is only recorded in the Kuril Islands.

Lasius longipalpus **Seifert, 2020 (Previously recorded as *L. alienus*; Fig. 8D-F)**

Material examined: [South Korea] 15 workers, Mt. Baegunsan, Ongnyong-myeon, Gwangyang-si, Jeollanam-do, 35.0705, 127.5973, alt. 170 m, 17. Jul. 2017., Coll. J. Park, Hand collecting. 20 workers, Mt. Gwangdeoksan, Sanae-myeon, Hwacheon-gun, Gangwon-do, 38.1070, 127.4416, alt. 201 m, 1. Aug. 2017., Coll. J. Park, Hand collecting. 2 workers, Mt. Nojasan, Geoje–do Is., Gyeongsangnam–do, 34.7844, 128.6295, alt. 158m, 26. May. 2018. Coll. M.S. Dong, Berlese trap. 20 workers, Hangyeryeong, Seorak-ro, Seo-myeon, Yangyang-gun, Gangwon-do, 38.0977, 128.4064, alt. 794 m, 8. Aug. 2018., Coll. J. Park, Hand collecting. 20 workers, Mt. Jijangsan, Jung-ri, Gwanin-myeon, Pocheon-si, Gyeonggi-do, 38.1053, 127.1944, alt. 240 m, 24. Apr. 2022., Coll. J. Park, Hand collecting. 20 workers, Mt. Geumhaksan, Ipyeong-ri, Dongsong-eup, Cheorwon-gun, Gangwon-do, 38.1984, 127.2068, alt. 212 m, 20. May. 2022., Coll. J. Park, Hand collecting. 3 workers, Seongpanak Trail head, Jocheon-eup, Jeju-si, Jeju Island, 33.3847, 126.6190, alt. 603 m, 3. Jun. 2022., Coll. J. Park, Hand collecting. 5 workers, Gwaneumsa Trail, Odeung-dong, Jeju-si, Jeju Island, 33.3934, 126.5393, alt. 383 m, 3. Jun. 2022., Coll. J. Park, Hand collecting. 20 workers, 1100 Highland, Saekdal-dong, Seogwipo-si, Jeju Island, 33.3575, 126.4625, alt. 1100 m, 4. Jun. 2022., Coll. J. Park, Hand collecting. 20 workers, Mt. Godaesan, Daegwang-ri, Sinseo-myeon, Yeoncheon-gun, Gyeonggi-do, 38.2061, 127.1453, alt. 95 m, 25. Jun. 2023., Coll. J. Park, Hand collecting. 15 workers, Ulleungdo island, Gyeongsangbuk-do, 37.4910, 130.8776, alt. 7 m, 30. Sep. 2023., Coll. J. Park, Hand collecting.

Morphology: This species resembles *L. japonicus* the most on the field due to their dark colors but can easily be separated under a microscope by its absence of standing setae on its scapes.

Ecology: These ants seem to have a higher tolerance to shaded areas of deep forests compared to *L. japonicus* and a turnover between the two species can often be found in the forest edges, similar to that of *Formica japonica* and *F. hayashi* or *Camponotus japonicus* and *C. atrox*.

Remarks: Wide ranging species recorded in the western mountain ranges of China, the Russian Far East, and in the mountains of Japan. In South Korea, this species is very common in the mountainous regions and its vicinities especially in the northeast. Interestingly, we have found *L. longipalpus* inhabiting low elevation open habitats in Ulleung Island, where we also found *L. japonicus* to be completely absent.

Lasius vostochni **Seifert, 2020 (Fig. 8G-I)**

Material examined: [South Korea] 5 workers, Mt. Homyeong-san, Gapyeong-gun, Gyeonggi-do, 37.7407, 127.4712, alt. 280 m, 13. Aug. 2023., Coll. J. Park, Hand collecting. 30 workers, Mt. Jiri-san, Jeollanamdo, 35.3014,127.5002, alt. 950 m, 15. Aug. 2023., Coll. J. Park, Hand collecting.

Morphology: Workers of this species can be confused with *L. japonicus* but is smaller and has the lower number of setae on its scapes but has abundant setae in the areas beneath the propodeal spiracles. They are also very similar to *L. koreanus* but it lacks the red color.

Ecology: *Lasius vostochni* were only collected in high mountains and nearby areas in South Korea where workers were found trailing across well-lit hiking trails.

Remarks: This species was described in eastern Russia, where it was found in lower altitudes.

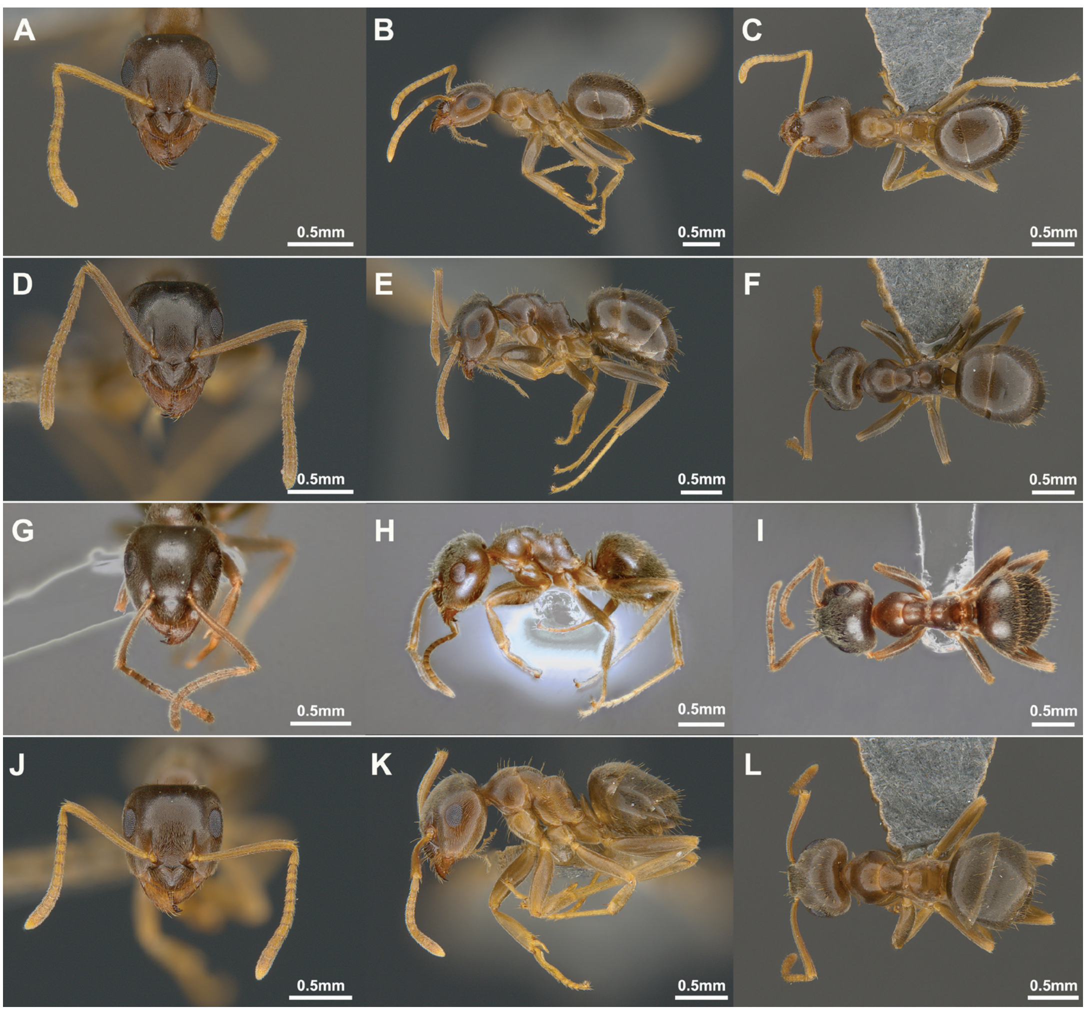

Fig. 8. Habitus of worker of *Lasius niger* group newly recorted from South Korea. A-C: *Lasius koreanus* Seifert, 1992. A: Full-face view; B: Lateral view; C: Dorsal view. D-F: *Lasius longipalpus* Seifert, 2020. D: Full-face view; E: Lateral view; F: Dorsal view. G-I: *Lasius vostochni* Seifert, 2020. G: Full-face view; H: Lateral view; I: Dorsal view. J-L: *Lasius* sp. 1. J: Full-face view; K: Lateral view; L: Dorsal view.

***Lasius* sp. 1 (Previously recorded as *L. brunneus*; Fig. 8J-L)**

Material examined: [South Korea] 20 workers, 20 males, 10 queens, Seochojungang-ro, Seocho-gu, Seoul, 37.5002, 127.0121, alt. 44 m, 23. Jun. 2018., Coll. J. Park, Hand collecting. 5 queens, 67 Ilchul-ro, Yangyang-eup, Yangyang-gun, Gangwon-do, 38.1149, 128.6340, alt. 19 m, 7. Aug. 2018., Coll. J. Park, Hand collecting. 30 workers, Osan air base, Sinjang-dong, Pyeongtaek-si, Gyeonggi-do, 37.0780, 127.0331, alt. 24 m, 21. Sep. 2021., Coll. J. Park, Hand collecting. 30 workers, Imjingak, Majeong-ri, Munsan-eup, Paju-si, Gyeonggi-do, 37.8953, 126.7438, alt. 14 m, 27. Apr. 2022., Coll. J. Park, Hand collecting. 20 workers, 5 queens, Seoul National University, Gwanak-gu, Seoul, 37.4534, 126.9530, alt. 100 m, 12. Jun. 2022., Coll. J. Park, Hand collecting. 7 workers, Korea University, Seongbuk-gu, Seoul, 37.5839, 127.0272, alt. 57 m, 9. Jun. 2023., Coll. J. Park, Hand collecting. 25 workers, Jamwon-ro, Seocho-gu, Seoul, 37.5128, 127.0114, alt. 31 m, 24. Jun. 2023., Coll. J. Park, Hand collecting.

Morphology: The combination of small size, red body color, extremely reduced number of setae (especially on the scapes and genal area), dense appressed pubescence and wide head capsule with small eyes in larger workers are enough to distinguish the species from all other sympatric *L. niger* group species.

Ecology: The most xerophilic species among the *Lasius niger* group species found in South Korea. Urban areas are mostly dominated by this species or *L. japonicus*. In natural conditions they are mostly found in open areas such as riverbeds or shores although it should be noted that nests are preferably made under single groves of trees found in such areas.

Remarks: This species corresponds to the previous records of *L. brunneus* made in South Korea.

***Monomorium carbonarium* (Smith, 1858) (Fig. 9)**

Material examined: [South Korea] 10 workers, 3 queens, Songjeonggangbyeon-ro, Haeundae-gu, Busan, South Korea, 35.1806, 129.2049, 24. Jun. 2018., Coll. J. Park, Hand collecting. 10 workers, 5 queens, Songjeonggangbyeon-ro, Haeundae-gu, Busan, South Korea, 35.1806, 129.2049, 24. Jun. 2018., Coll. J. Park, Hand collecting, 9. Jul. 2018., Coll. J. Park, Hand collecting. 10 workers, 5 queens, Songjeonggangbyeon-ro, Haeundae-gu, Busan, South Korea, 35.1889, 129.2063, 3. Aug. 2024., Coll. J. Park, Hand collecting.

Morphology: *Monomorium carbonarium* stands out from all *Monomorium* species recorded in South Korea by the larger size and the metallic dark body color with a blue tint. It can be confused with *M. chinensis* which is also concolorous black, however the two can easily be separated under a microscope as *M. carbonarium* has a long petiolar peduncle.

Ecology: Colonies of *M. carbonarium* were found in disturbed areas in vicinity of a small hill near a popular beach area of Busan, coexisting with many native species. Nests were most often found in decaying damp wood but were also found nesting in dead bamboo or under large rocks. Foraging worker ants were commonly seen with native species including *Lasius* spp. or *Tetramorium tsushimae*, however, we did not see any case of native species getting overwhelmed.

This species is highly polygynous and both fully winged and ergatoid queens can be found, consistent with the introduced populations in Western Europe (González 2021). In wild colonies, newly emerged reproductive castes were seen in July and mating within nests was observed when the colonies were brought into captivity. This intranidal mating behavior might contribute to the restricted distribution of this species in South Korea, as we have not seen any expansion of their range within the years examined (from 2018 to 2024).

Remarks: This species belongs to the *Monomorium carbonarium* species group (former *Monomorium minimum* group), which was nearly impossible to identify until recently. Based on morphometric data provided by the recent taxonomic revision of the group (Seifert 2025), the South Korean population is identified as *Monomorium carbonarium*. This species is native to the Nearctic region and is now well established in many parts of the western Palearctic (Abdul-Rassoul et al. 2013; Borowiec 2014; Mohamed et al. 2001; Schifani 2019). Due to the species' wide distribution, we cannot determine its point of origin.

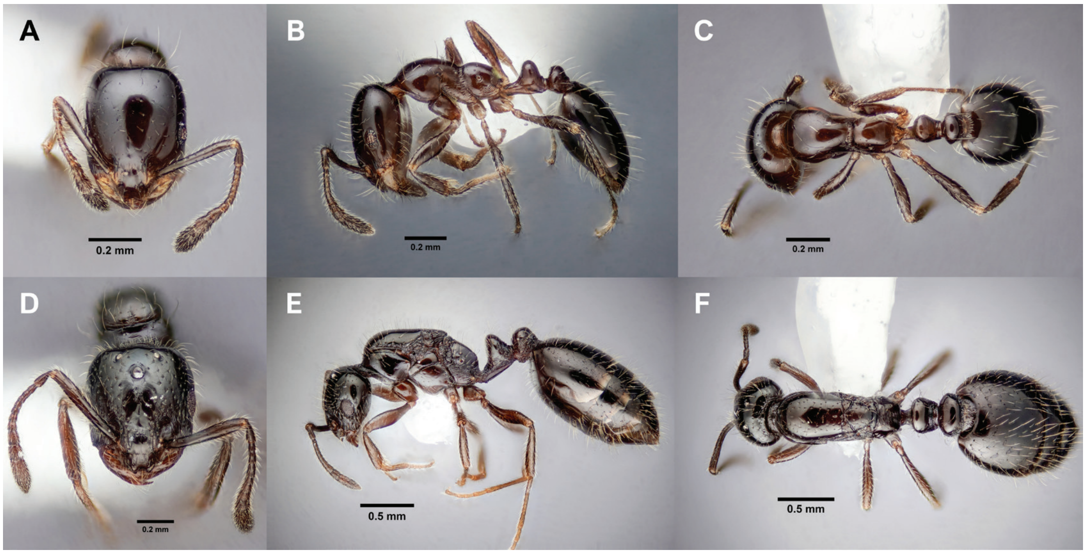

Fig. 9. Habitus of worker of *Monomorium carbonarium* (Smith, 1858). A-C: Worker; A: Full-face view; B: Lateral view; C: Dorsal view. D-F: Queen; D: Full-face view; E: Lateral view; F: Dorsal view.

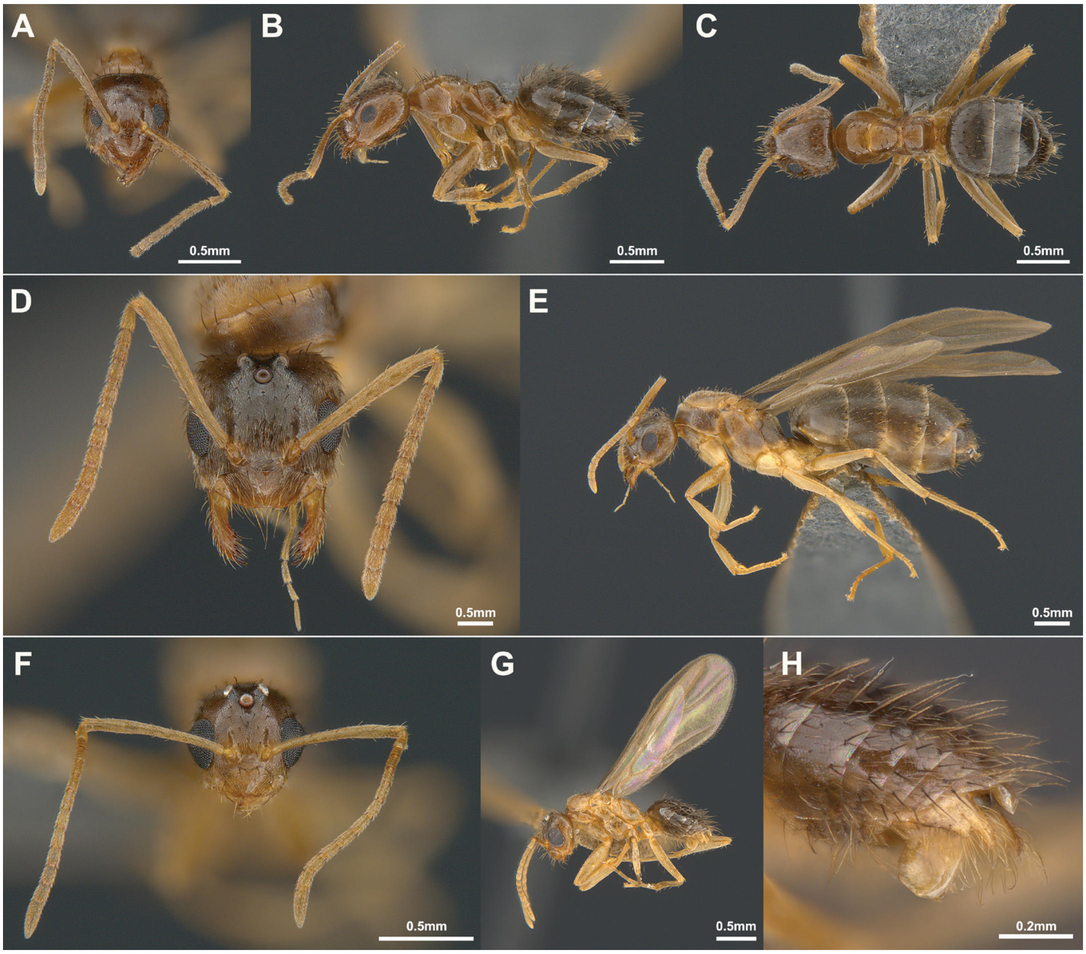

Fig. 10. Habitus of *Nylanderia* sp. cf. *jaegerskioeldi* (Mayr, 1904). A-C: Worker; D-E: Gyne; F-H: Male; H: Male genitalia.

***Nylanderia* sp. cf. *jaegerskioeldi* (Mayr, 1904) (Fig. 10)**

Material examined: [South Korea] 20 workers, 2 males, 1 queen, Buramsan Butterfly garden (Greenhouse), 51-27 Hangeulbiseok-ro 12-gil, Nowon-gu, Seoul, 37.6560, 127.0807, alt. 51 m, 15. Jul. 2020., Coll. J. Park, Hand collecting.

Morphology: Workers of this species are much larger than the native congeners and differ in having dense pubescence covering the whole-body surface, mesosomal setae numerous pronotum always with more than two pairs. Among the 20 species of invasive *Nylanderia* listed in Williams and Lucky 2020, *N. jaegerskioeldi* shows the closest resemblance especially with the males, which are known to be the only morphologically reliable keys separating *N. jaegerskioeldi* from *N. natalensis* (LaPolla et al. 2011).

Ecology: This species was found in a heated indoor butterfly garden where two other new alien species were found. Workers were seen tending mealybugs and gathering nectar as well as dead insects. Nests were made under ornamental rocks and between floor tiles, in which alates of both sexes were found. Many workers were also seen foraging outdoors

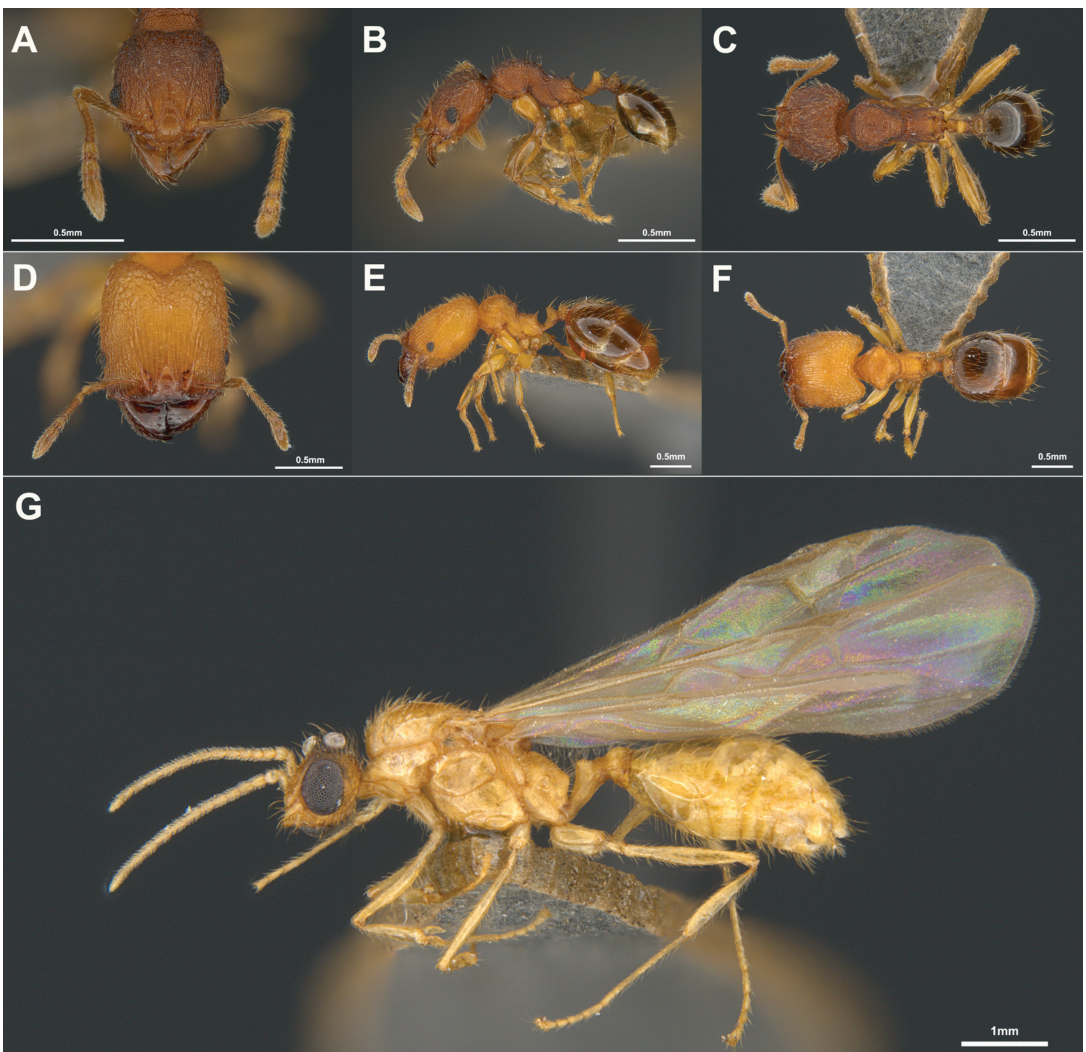

Fig. 11. Habitus of *Pheidole parva* Mayr, 1865. A-C: Minor worker; A: Full-face view; B: Lateral view; C: Dorsal view. D-F: Major worker; D: Full-face view; E: Lateral view; F: Dorsal view. G: Lateral view of the male.

through the windows, but we did not find any nests made outside. Two native ant species similar in size with the *Nylanderia* were abundant in the foraging grounds, *T. tsushimae* and *Pristomyrmex punctatus*. Aggressive interactions with the native ants were often seen near food sources, however, we did not observe any instances where the invasive *Nylanderia* completely overran native species.

***Pheidole parva* Mayr 1865 (Fig. 11)**

Material examined: [South Korea] 20 workers, 5 males, 1 queen, Buramsan Butterfly garden (Greenhouse), 51-27 Hangeulbiseok-ro 12-gil, Nowon-gu, Seoul, 37.6560, 127.0807, alt. 51 m, 15. Jul. 2020., Coll. J. Park, Hand collecting.

Morphology: By the small size, shorter appendages, *Pheidole parva* differs from all other *Pheidole* species recorded in South Korea except *P. pieli. P. parva* differs from *P. pieli* in being darker in color, having coarser sculptures, and majors having a strongly impressed vertex.

Ecology: This species was found in a heated indoor butterfly garden where two other new alien species were found. Workers foraged on the floor and were most often seen gathered around dead butterflies. They were aggressive against other ants found in the greenhouse driving out other ants from the dead insects. Nests were found under series of ornamental rocks when flipped where brood and many alates could be seen. No ants were seen foraging outside the building.

Fig. 12. Habitus of a worker of *Stigmatomma caliginosum* (Onoyama, 1999). A: Full-face view; B: Lateral view; C: Dorsal view.

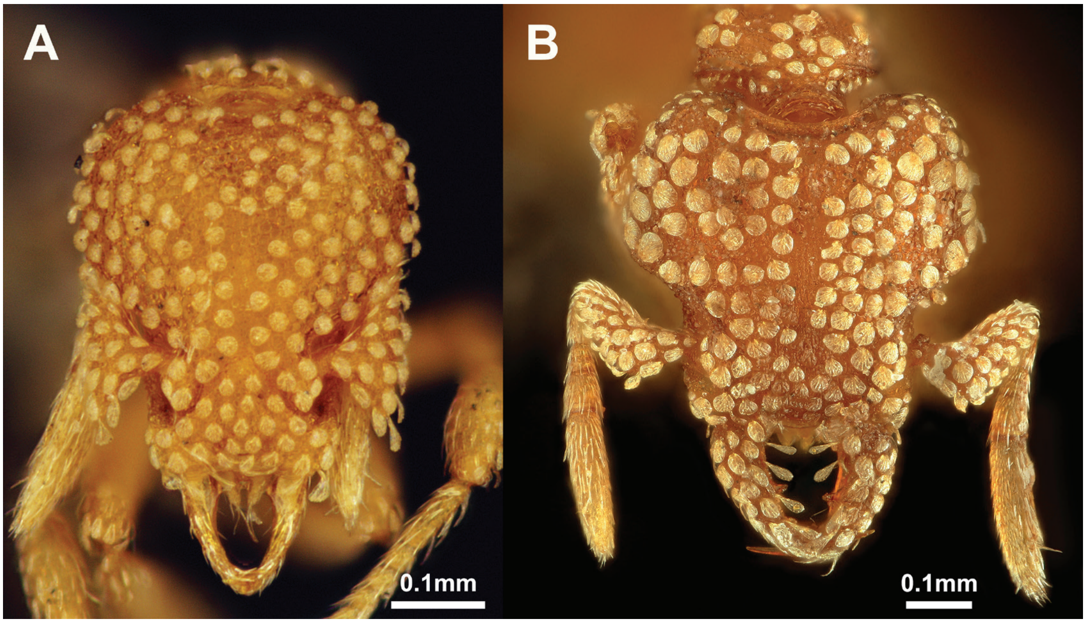

Fig. 13. Full-face view of workers. A: *Strumigenys hirashimai* (Ogata, 1990); B: *Strumigenys hexamera* (Brown, 1958).

Stigmatomma caliginosum **(Onoyama, 1999) (Fig. 12)**

Material examined: [South Korea] 2 workers, 686 Wongye-ri, Naeseo-eup, Masanhoewon-gu, Changwon-si, Gyeongsangnam-do, 35.2274, 128.5112, alt. 17 m, 24. Apr. 2021., Coll. S. H. Jung, Litter sifting.

Morphology: Workers are about 2 mm in length and are yellowish-brown. The anterior margin of the clypeus features five denticles. Each mandible contains seven denticles arranged in a single row (Onoyama 1999). Its conspicuously small body size, bright color, and 11-segmented antennae distinguish it from *Stigmatomma silvestrii*, which has 12-segmented antennae.

Ecology: This species was discovered under a stone in a broadleaf forest in southern South Korea. Based on its records and its distribution in Japan (Honshu and Kyushu), it appears to have a patchy distribution and is likely rare in South Korea as well.

Strumigenys hirashimai **(Ogata, 1990) (Fig. 13)**

Material examined: [South Korea] 1 worker, Yeongcheon-ag, Seogwipo-si, Jeju Island, 33.2942, 126.6009, alt. 146 m, 18. Jul. 2018., Coll. J. Park, Litter sifting.

Morphology: This species closely resembles the sympatric *S. hexamera*; however, *S. hirashimai* has narrower body ratios and lacks teeth on the mandibles compared to the latter.

Ecology: A worker of *Strumigenys hirashimai* was found while sifting leaf litter in an evergreen forest on Jeju Island.

Remarks: This species appears to be extremely rare in South Korea and was not found in subsequent years at the same location.

Strumigenys rostrataeformis **(Brown, 1949) (Fig. 14)**

Material examined: [South Korea] 10 workers, Korea National Arboretum (Outdoors), Soheul-eup, Pocheon-si, Gyeonggi-do, 37.7520, 127.1666, alt. 98 m, 6. Aug. 2023., Coll. J. Park, Hand collecting.

Morphology: This species can be confused with the previously recorded *S. incerta*; however, it differs in that *S. rostrataeformis* bears a straight clypeal margin and a pair of short stout lateral hair on its pronotum in contrast to *S. incerta,* which has an emarginate clypeus and a pair of long curly hairs on the pronotum.

Ecology: A series of foraging workers was collected from a damp stump in the National Arboretum, where they were actively hunting Symphypleona and Entomobryomorpha springtails. Workers foraging on open surfaces were also seen in Busan, suggesting this species is on the more epigaeic scale for *Strumigenys,* compared to other species that are often only found dwelling in leaf litter.

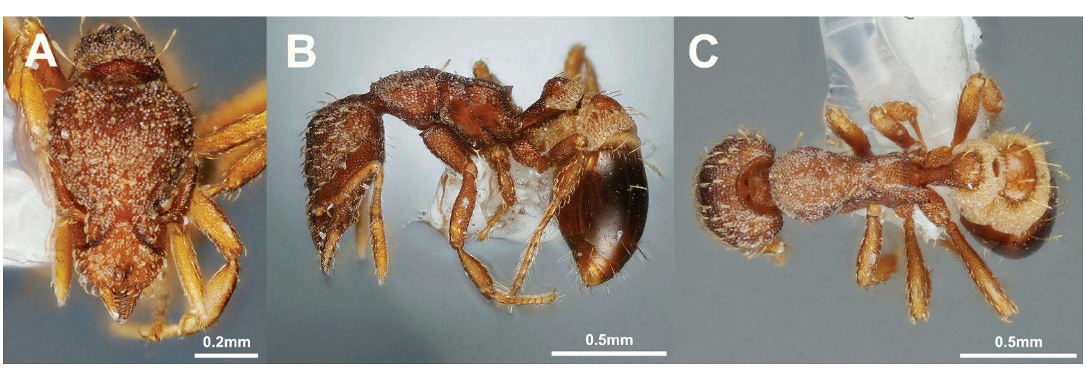

Fig. 14. Habitus of worker of *Strumigenys rostrataeformis* (Brown, 1949). A: Full-face view; B: Lateral view; C: Dorsal view.

Tapinoma sahohime **Terayama, 2013 (Fig. 15)**

Material examined: [South Korea] 20 workers, 3 queens, Jisimdo, Irun-myeon, Geoje-si, Gyeongsangnam-do, 34.8174, 128.7481, alt. 32 m, 9. Feb. 2019., Coll. J. Park, Hand collecting. 30 workers, 10 males, 10 queens, Jisimdo, Irun-myeon, Geoje-si, Gyeongsangnam-do, 34.8174, 128.7481, alt. 32 m, 17. Jul. 2019., Coll. J. Park, Hand collecting. 20 workers, 5 queens, Jisimdo, Irun-myeon, Geoje-si, Gyeongsangnam-do, 34.8174, 128.7481, alt. 32 m, 25. May. 2020., Coll. J. Park, Hand collecting. 20 workers, 3 queens, Yeoseodo, Cheongsan-myeon, Wando-gun, Jeollanam-do, 33.9862, 126.9197, alt. 83 m, 1. Jul. 2020., Coll. J. Park, Hand collecting. 20 workers, 1 queen, Andeok valley, Gamsan-ri, Andeok-myeon, Seogwipo-si, Jeju Island, 33.2572, 126.3532, alt. 62 m, 29. Mar. 2022., Coll. J. Park, Hand collecting. 22 workers, Jeonmang-ro, Yeongdo-gu, Busan, 35.0562, 129.0833, alt. 67 m, 16. Sep. 2017., Coll. M. Dong, Hand collecting.

Morphology: The only yellow *Tapinoma* species of South Korea, this species is unmistakable. Small eyes that are always shorter than the distance between the eyes and anterior clypeal margin could also be used to reliably separate *T. sahohime* from *T. melanocephalum.*

Ecology: This species can be found in dead branches of evergreen trees in the southern coastal forests. They are more often found nesting in close vicinities of other arboreal ants (e.g., *Camponotus* spp., *Colobopsis nipponica*, *Crematogaster teranishii*) and workers of *T. sahohime* were sometimes seen investigating other ants' nest entrances, but no other significant interaction was seen between the two ant species. Colonies are polygynous and polydomous with multiple nests in multiple branches of a single tree. Alates emerge in July and gynes can either have fully sized wings or be brachypterous in a single nest series, which the latter we can speculate to mate near or inside the colony, and bud out, forming the polydomous colony structure.

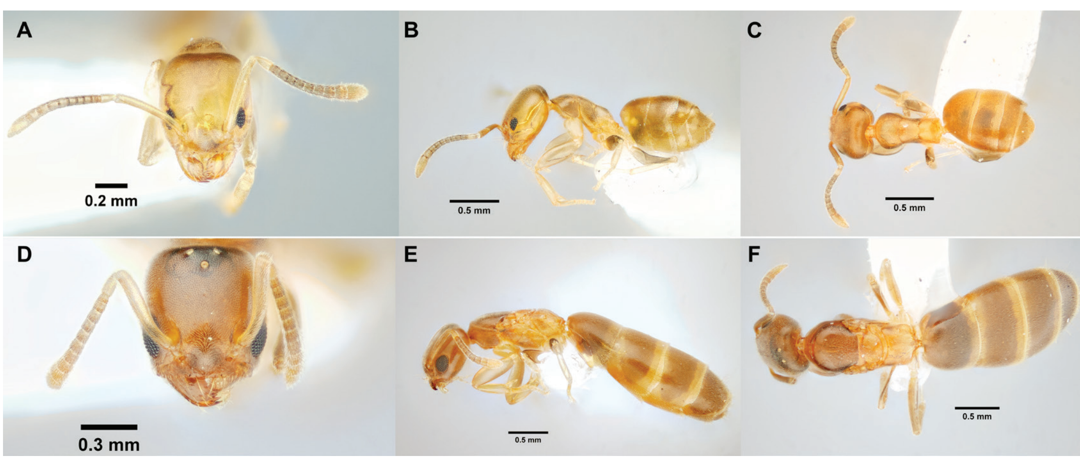

Fig. 15. Habitus of *Tapinoma sahohime* Terayama, 2013. A-C: Worker; A: Full-face view; B: Lateral view; C: Dorsal view. D-F: Queen; D: Full-face view; E: Lateral view; F: Dorsal view.

Fig. 16. Habitus of worker of *Technomyrmex vitiensis* Mann, 1921. A: Full-face view; B: Lateral view; C: Dorsal view.

Remarks: *Tapinoma sahohime* and other yellow *Tapinoma* found in East Asia were originally identified as *T. indicum* but were later proved to be a misidentification. The South Korean population seems to be indistinguishable from the Japanese specimens, which were named in 2013 as *T. sahohime* (Terayama 2013).

Technomyrmex vitiensis **Mann, 1921 (Fig. 16)**

Material examined: [South Korea] 30 workers, Korea National Arboretum Tropical plant garden (Greenhouse), Soheul-eup, Pocheon-si, Gyeonggi-do, 37.7540, 127.1631, alt. 92 m, 6. Aug. 2023., Coll. J. Park, Hand collecting.

Morphology: As a member of the *Technomyrmex albipes* group, *Technomyrmex vitiensis* is easily identified from the native congener *T. gibbosus* by the black color and the presence of many dorsal setae on the gaster, which in *T. gibbosus* only a ring of setae is present on the 4th gastral tergite. For details on distinguishing *T. vitiensis* from closely related tramp species, see Bolton 2007.

Ecology: *Technomyrmex vitiensis* infested the heated greenhouse where it was found in, outnumbering all native and alien ant species cohabiting in the greenhouse. Workers were seen making massive trails between the multiple nests made in cavities of plants and ornaments, but none were seen trailing outside the greenhouse. Many workers were also seen herding mealybugs which were always exposed without a carton tent as sometimes seen in wild colonies in the tropics. A single wandering winged male was found in February.

Remarks: This species is often found associated with greenhouses around the world which was also the case in South Korea (Blatrix et al. 2018; Bolton 2007; Freyhof and Janke 2024; Pospischil 2011; Väänänen et al. 2018). While there are literature records of *T. albipes* group species in South Korea, we find such records doubtful and *T. vitiensis* in South Korea likely is a newly introduced species. See section 7 of "Taxonomic remarks".

Temnothorax **sp. 1 (Fig. 17)**

Material examined: [South Korea] 1 queen, Mt. Gaeun-san, Seongbuk-gu, Seoul, 37.5959, 127.0274, alt. 116 m, 17. Nov. 2017., Coll. J. Park, Hand collecting. 1 worker, 2 queens, Mt. Gaeun-san, Seongbuk-gu, Seoul, 37.5959, 127.0274, alt. 116 m, 18. Feb. 2018., Coll. J. Park, Hand collecting. 1 worker, Korea University, Seongbuk-gu, Seoul, 37.5917, 127.0268, alt. 65 m, 25. May. 2022., Coll. J. Park, Hand collecting.

Morphology: The yellow-black body color and large protruding eyes are enough to separate this species from other *Temnothorax* species recorded in South Korea. Two distinct morphs are observed: a slightly larger queen-like ergatoid individuals with ocelli present, and smaller worker-like individuals without such features.

Ecology: Social parasite of the congeneric species *T. pisarskii*. Colonies consist of small numbers of host workers (8~26) and even smaller numbers of the parasite (up to 4, but mostly 1). Parasitized colonies are always found in crumbling surface of a large granite outcrop and have only been discovered in two mountain sites in eastern Seoul, a much narrower nesting niche compared to the host ant colonies which can be found in a wider range of nesting sites including larger granite cavities or under rocks. It should be noted that satellite colonies of the host species were often found in cavities similar to places where parasitized colonies were found, suggesting that *Temnothorax* sp. 1 could be parasites exclusive to satellite colonies.

Remarks: We believe this species is a rare case of host queen-intolerant inquiline, as per our observations, parasites were always present with the hosts (i.e., not temporary parasitic) and brood raiding activities were never observed (i.e., not dulotic). Observations of wild and captive colonies show that neither morph forages outside, and neither attended to brood care in our limited observations in captivity. Whether the latter caste represents a true worker class remains unclear. Extensive studies are needed to confirm their biology, both in captivity and in their natural habitats.

This species is superficially similar to the Japanese *T. kinomurai*, another host queen-intolerant inquiline. However, *T. kinomurai* uses a different host species (*T. makora*) and have different caste systems consisting of ergatoids and winged queens, both of which castes parasitize other host queen right colonies. We regard the South Korean population a distinct species from the Japanese *T. kinomurai* considering their difference in biology, although confirmation is needed. Research on the phylogenetic relations between the two species and their host species would be fruitful, revealing the evolutionary backgrounds and host shifting histories.

***Tetramorium lanuginosum* Mayr, 1870 (Fig. 18)**

Material examined: [South Korea] 2 workers, Buramsan Butterfly Garden (Greenhouse), 51-27 Hangeulbiseok-ro 12-gil, Nowon-gu, Seoul, 37.6560, 127.0807, alt. 51 m, 15. Jul. 2020., Coll. J. Park, Hand collecting.

Morphology: No other ant species recorded in South Korea has the densely carpeting bifid hairs of *T. lanuginosum* thus the species is unmistakable.

Ecology: Only two workers of this species were collected, but it is likely for the colony to be well established; yet only a small number of workers were found due to relatively small colony size and less active nature of the species compared to other tramp species found together in the greenhouse. One worker was seen carrying a dead *Pheidole pieli* specimen however, the latter was extremely damaged, likely already stepped on and killed before *T. lanuginosum* found it, reflecting a scavenging rather than a predation event.

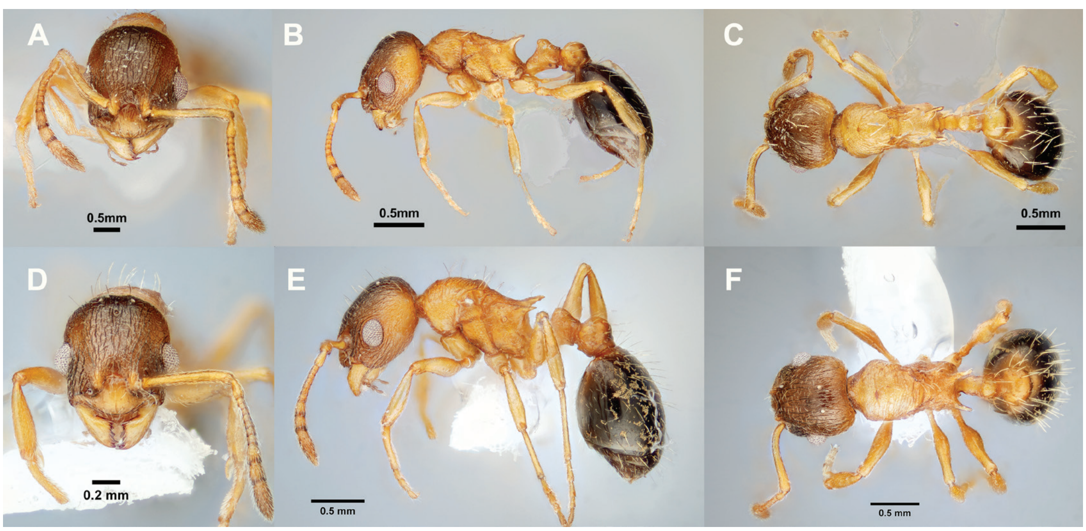

Fig. 17. Habitus of *Temnothorax* sp. 1. A-C: Worker; A: Full-face view; B: Lateral view; C: Dorsal view. D-F: Ergatoid queen; D: Full-face view; E: Lateral view; F: Dorsal view

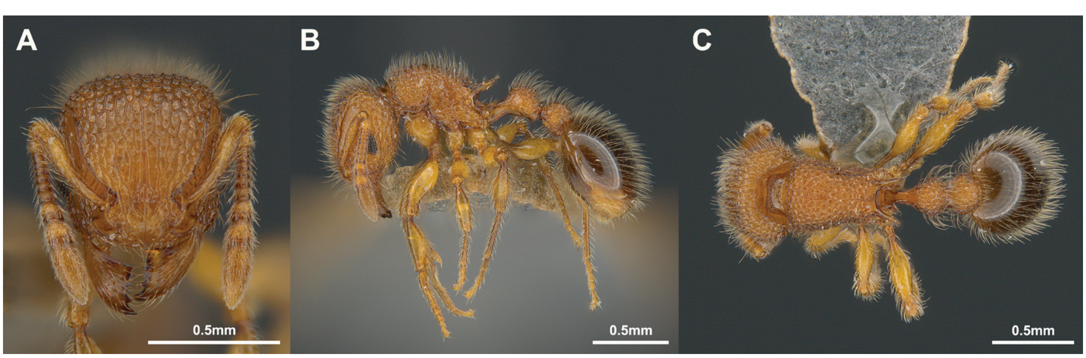

Fig. 18. Habitus of worker of *Tetramorium lanuginosum* Mayr, 1870. A: Full-face view; B: Lateral view; C: Dorsal view.

Tetramorium nipponense **Wheeler, 1928 (Fig. 19)**

Material examined: [South Korea] 20 workers, 10 males, 10 queens, Mt. Gogeun-san, Seogwipo-si, Jeju Island, 33.2641, 126.5134, alt. 284 m, 20. Aug. 2020., Coll. J. Park, Hand collecting. 10 workers, 3 queens, Mt. Gogeun-san, Seogwipo-si, Jeju Island, 33.2641, 126.5133, alt. 284 m, 29. Mar. 2021., Coll. J. Park, Hand collecting. 20 workers, 5 queens, Mt. Gogeun-san, Seogwipo-si, Jeju Island, 33.2641, 126.5134, alt. 284 m, 5. Jun. 2022., Coll. J. Park, Hand collecting.

Morphology: *Tetramorium nipponense* is similar to the introduced *T. bicarinatum*, but it can be distinguished by its longer, upward-oriented propodeal spines, lighter color, lack of a dark band on the gaster, and having longer body hair.

Ecology: This species was found in a mixed forest of cedar and broad-leaved trees in Jeju Island. Nests were found in damp fallen wood and under rocks, containing multiple queens (~10) and a few hundred workers (about 200). The two *Tetramorium* species also differ in habitat preferences (*T. nipponense* in damp forests, while *T. bicarinatum* in coastal or disturbed areas). Workers forage on tree trunks and the forest floor gathering smaller arthropods, including isopods and insect debris. Alates emerged in August, and mating likely takes place shortly afterward. The two species differ in colony structure, with *T. nipponense* colonies collected only 5 meters apart showing aggression to each other, while in contrast colonies of *T. bicarinatum* collected in South Korea are thought to be unicolonial.

Exotic species (13 species): *Cardiocondyla kagutsuchi* Terayama, 1999, *Linepithema humile* (Mayr, 1868), *Monomorium carbonarium* (Smith, 1858), *Monomorium pharaonis* (Linnaeus, 1758), *Nylanderia* sp. cf. *jaegerskioeldi* (Mayr, 1904), *Pheidole indica* Mayr, 1879, *Pheidole parva* Mayr, 1865, *Strumigenys membranifera* Emery, 1869, *Tapinoma melanocephalum* (Fabricius, 1793), *Technomyrmex vitiensis* Mann, 1921, *Tetramorium bicarinatum* (Nylander, 1846), *Tetramorium lanuginosum* Mayr, 1870, *Hypoponera ragusai* (Emery, 1894)

Endemic species (6 species): *Camponotus dorex* Fisher, 2025, *Camponotus fuscus* Kim & Kim, 1994, *Camponotus jejuensis* Kim & Kim, 1986, *Stenamma koreanense* Lyu, DuBois & Cho, 2002, *Strumigenys calvus* Dong & Kim, 2020, *Strumigenys choii* Lyu, 2007

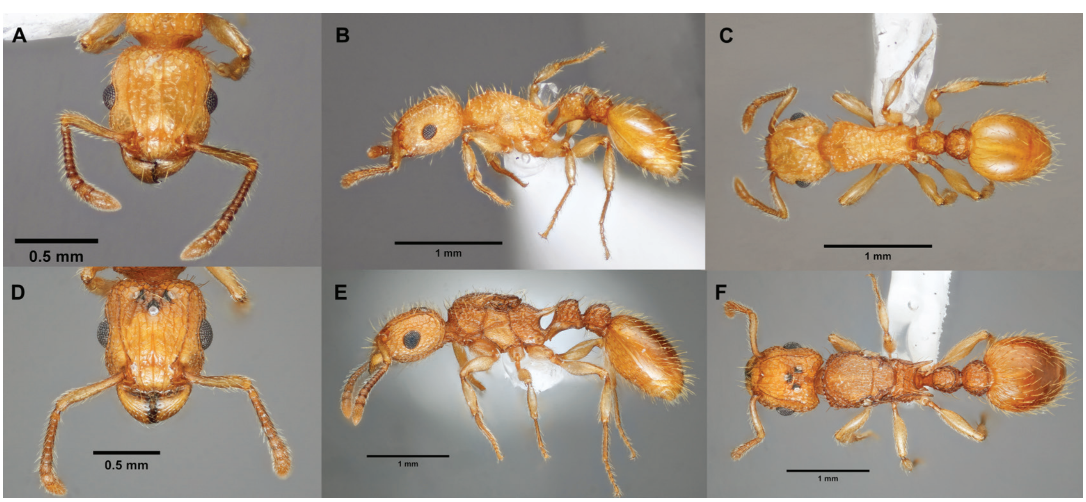

Fig. 19. Habitus of *Tetramorium nipponense* Wheeler, 1928. A-C: Worker; A: Full-face view; B: Lateral view; C: Dorsal view. D-F: Queen; D: Full-face view; E: Lateral view; F: Dorsal view.

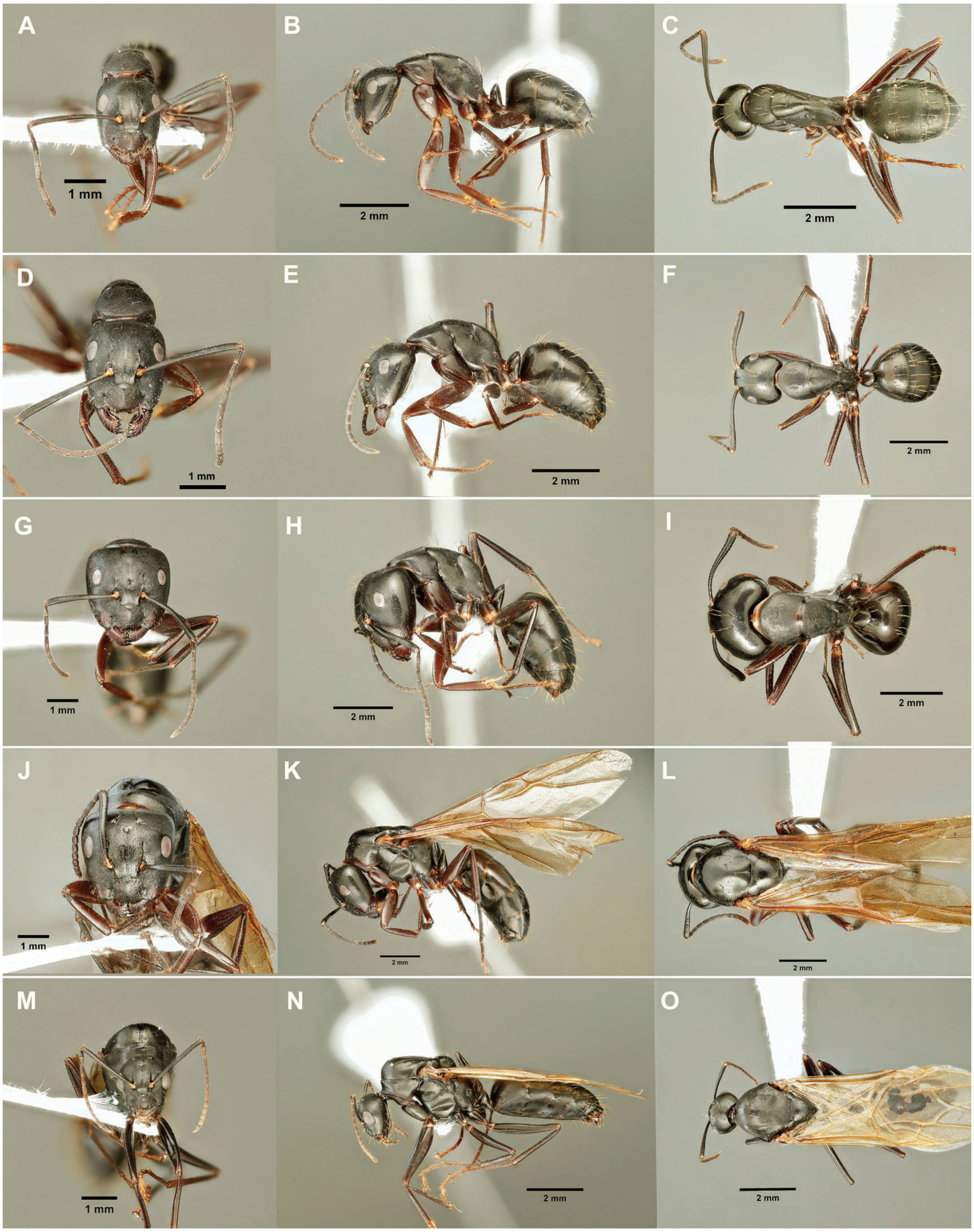

Fig. 20. Habitus of *Camponotus dorex* Fisher, 2025. A-C: Minor worker. A: Full-face view; B: Lateral view; C: Dorsal view. D-F: Intermediate worker. D: Full-face view; E: Lateral view; F: Dorsal view. G-I: Major worker. G: Full-face view; H: Lateral view; I: Dorsal view. J-L: Gyne. J: Full-face view; K: Lateral view; L: Dorsal view. M-O: Male. M: Full-face view; N: Lateral view; O: Dorsal view.

Camponotus dorex **Fisher, 2025 (Fig. 20)**

Morphology: Type specimens of *Camponotus dorex* are unavailable; however, the species can still be easily identified as their habitus is very distinct from other large *Camponotus* species of South Korea. The clypeal notch readily separates *C. dorex* from most other large South Korean *Camponotus* such as *C. japonicus* or *C. atrox*. The closely related *C. kiusiuensis* share a lot of features such as large body size, presence of clypeal notch, and have similar colony structure. The two species, however, are unlikely to be confused as *C. dorex* has black to reddish-black legs (light brown in *C. kiusiuensis*), lacks a distinct angle in the propodeum when seen laterally (always present in *C. kiusiuensis*), has denser setae and pubescence on the gaster, and is mainly diurnal (more nocturnal habits in *C. kiusiuensis*).

Another species closely resembling *C. dorex* is *C. amamianus*, which was originally described to be endemic to the Japanese Island of Amami. *Camponotus amamianus* is even more dissimilar to *C. dorex* as it also has black to reddish-black legs on top of the features *C. dorex* and *C. kiusiuensis* share. *Camponotus amamianus* can still be distinguished from *C. dorex* as *C. amamianus* is more polished, lacks standing setae on pronotum (2 to 4 on *C. dorex*), has lower petiole often not reaching or barely reaching the level of the propodeal spiracle in minor workers (always higher in *C. dorex*), and the mesosomal outline seen laterally is always much more gradual, as the plane of posterior propodeal face and pronotal dorsum meets in an obtuse angle (nearly perpendicular in *C. dorex*). Interestingly, *C. amamianus* was once recorded in Jeju Island, South Korea (Lyu and Um 2007). Considering the absence of *C. amamianus* in regions between the two islands, morphological features of the specimen in the paper, and the authors' failure to find the species in repeated surveys in Jeju Island, it is possible for the Jeju Island record to be a misidentification of *C. dorex*. Nevertheless, as we have not directly examined the voucher specimen, and as Jeju Island harbors many subtropical species that are not found elsewhere in South Korea (e.g., *T. nipponense*), we do not exclude the record in this study.

Ecology: *Camponotus dorex* is common throughout low elevation areas of South Korea. They are found nesting either in tree trunk cavities or in decomposing woods on forest floors. Colonies can vary in size from fewer than 100 workers to up to ~2000 workers where the queen is likely to be found. Smaller colonies are likely satellites of larger polydomous colonies as they consist mainly of male and female alates, relatively large workers comparable in size to those in major colonies, and some small number of larvae or pupae, but without eggs or dealate queens. Nuptial flights of *C. dorex* take place on sunny days from early April to early May, variable by region but always earlier than the local *C. japonicus* populations.

Remark: *Camponotus dorex* is currently considered endemic to South Korea, however, it is widespread within the nation found border to border, north to south. Notably, this species is very common in the city of Paju, where *C. dorex* can be found in areas only a few (≦ 5) kilometers from the country border from North Korea suggesting the species is likely also present in North Korea.

Table 2. List of species excluded from the South Korean ant record.

	Species	Reasons	References
1	*Aphaenogaster schmidti* Karavaiev, 1912	*Nomen dubium*	See Taxonomic remarks 1
2	*Camponotus herculeanus (*Linnaeus, 1758)	North Korean records	Terayama et al. 1992
3	*Camponotus ligniperda* (Latreille, 1802)	Reidentified as *C. atrox*	Yasumatsu and Brown 1951
4	*Camponotus obscuripes* Mayr, 1879	Reidentified as *C. atrox*	Choi et al. 1993; Yasumatsu and Brown 1951
5	*Chronoxenus wroughtonii* (Forel, 1895)	North Korean records (Likely misidentification); Indo-Malay species	Dubovikoff 2005; Kim and Kim 1999; Terayama et al. 1992;
6	*Crematogaster nawai*	Reidentified as *C. matsumurai*	Terayama et al. 1992

	Species	Reasons	References
7	*Ectomomyrmex astutus* (Smith, 1858)	Reidentified as *E. javanus*	See Taxonomic remarks 6
8	*Formica fusca* Linnaeus, 1758	Reidentified as *Formica* sp. 2	See Taxonomic remarks 4
9	*Formica lemani* Bondroit, 1917	Reidentified as *Formica* sp. 1	See Taxonomic remarks 3
10	*Formica lugubris* Zetterstedt, 1838	North Korean records	Terayama et al. 1992
11	*Formica pratensis* Retzius, 1783	Western Palearctic species	Seifert 2021
12	*Formica rufa* Linnaeus, 1761	Western Palearctic species	Seifert 2021
13	*Lasius alienus* (Foerster, 1850)	Western Palearctic species (Reidentified as *L. longipalupus*)	Seifert 2020; See Taxonomic remarks 5
14	*Lasius brunneus* (Latreille, 1798)	Western Palearctic species (Reidentified as *Lasius* sp.1)	Seifert 2020; See Taxonomic remarks 5
15	*Lasius rabaudi* (Bondroit, 1917)	Western Palearctic species (Reidentified as *L. distinguendus*)	Radchenko 2005; Seifert 2018
16	*Monomorium floricola*	Erroneous record (Formerly encompassing *M. intrudens*)	Terayama et al. 1992
17	*Myrmica kasczenkoi*	North Korean records; Reidentified as *M. excelsa*	Terayama et al. 1992; Radchenko 2005
18	*Myrmica lobicornis*	Reidentified as *M. jessensis*	Terayama et al. 1992
19	*Myrmica rubra* (Linnaeus, 1758)	Western Palearctic species;	Radchenko 2005
20	*Myrmica saposhnikovi* Ruzsky, 1904	Misidentification of other local *Myrmica lobicornis* group species	Radchenko and Elmes 2010
21	*Myrmica scabrinodis* Nylander, 1846	Western Palearctic species (Formerly encompassing *M. angulinodis*, *M. kaczenkoi*, and *M. saposhnikovi*)	Lyu 2006; Radchenko 2005; See Taxonomic remarks 8
22	*Paraparatrechina sauteri* (Forel, 1913)	Reidentified as *P. sakurae*	Taxonomic remarks 11
23	*Plagiolepis pygmaea* (Latreille, 1798)	Westen Palearctic species	Salata et al. 2018
24	*Prenolepis melanogaster* Emery, 1893	North Korean records (Reidentified as *Proformica mongolica*)	Radchenko 2005
25	*Solenopsis fugax* (Latreille, 1798)	West Palearctic species	Ogata 1991
26	*Tapinoma wroughtonii* Forel, 1904	North Korean records; Reidentified as *Technomyrmex gibbosus*	Radchenko 2005
27	*Tapinoma geei* Wheeler, 1927	North Korean records	Kim and Kim 1999
28	*Technomyrmex albipes* (Smith, 1861)	North Korean records	Kim and Kim 1999; See Taxonomic remarks 7
29	*Temnothorax aveli* (Bondroit, 1918)	North Korean records (Reidentified as *T. kaszabi*); South Korean record (Reidentified as *T. pisarskii*)	Radchenko 2005; Terayama et al. 1992
30	*Temnothorax serviculus* Ruzsky, 1902	North Korean records (Reidentified as *T. mongolicus*)	Choi et al. 1993; Radchenko 2005
31	*Temnothorax tuberum* Fabricius, 1775	Western Palearctic species; No supportive data in South Korea	Radchenko 2005; Terayama et al. 1992

Table 3. List of the dubious species.

	Species	Reasons
1	*Aphaenogaster tipuna* Forel, 1913	Likely misidentification; research in progress.
2	*Camponotus amamianus* Terayama, 1991	See the section on *Camponotus dorex* above.
3	*Camponotus fuscus* Kim & Kim, 1994	Type & Voucher materials unavailable.
4	*Camponotus jejuensis* Kim & Kim, 1986	Type materials unavailable; voucher suggests *Camponotus vitiensis*.
5	*Nylanderia yaeyamensis* (Terayama, 1999)	See Taxonomic remarks 9 below.

TAXONOMIC REMARKS

***Aphaenogaster schmidti* → *Nomen dubium*:** *Aphaenogaster schmidti,* originally described from the Korean Peninsula in "Tshaansa, Halbinsel von Korea", is recognized by the following combination of characteristics: general body structure similar to *A. gibbosa* Latr. (Currently *A. japonica*); detailed head measurements and shapes; specific shapes of the scutellum, epinotum; petiole and postpetiole, leg and antenna measurements; sculpture details of various body parts; color described as dark yellowish-reddish brown with some parts lighter, and a length of 4.5-5 mm (Karavaiev 1912).

However, we propose to designate this species as a *nomen dubium* for the following reasons: (1) Although a type specimen was designated in the original description, the precise number of specimens was not specified, and information on where the type material is stored is lacking. Subsequent research revealed that the type specimen is missing from the original author's collection, which means available type material currently absent (Radchenko et al. 2023). This absence of type material makes it impossible to verify the identity of the taxon. (2) The characteristics of *A. schmidti*, as mentioned in the original description, are extremely similar to *A. japonica*. Considering the morphological variation among *A. japonica* workers, the characteristics and figures described in the original publication probably fall within the range of variation observed in *A. japonica*. (3) *Aphaenogaster schmidti* has never been described or discovered by other researchers, either on the Korean Peninsula or in surrounding countries such as Japan and China.

Given the absence of type materials and the inadequate original description, designating a neotype is not feasible as it would not resolve the taxonomic uncertainty (Recommendation 75A - neotype designation should serve stability). These factors collectively support the designation of *A. schmidti* as a *nomen dubium*. This designation aligns with the spirit of the ICZN in promoting nomenclatural stability and clarity (Preamble and Article 1 of the ICZN). By recognizing *A. schmidti* as a *nomen dubium*, we acknowledge the existence of the name in literature while highlighting its uncertain taxonomic status, thereby preventing its uncritical use in future.

***Camponotus ligniperda* and *C. obscuripes* in South Korea → *C. atrox*:** Upon closer examination, it is evident that all previous records of *C. ligniperda* (Latreille, 1802) and *C. obscuripes* Mayr, 1879 in South Korea are misidentifications of *C. atrox* Emery, 1925 as mentioned in Yasumatsu and Brown 1951; 1957; Terayama et al. 1992; Choi et al. 1993. We could not find any specimens that can be considered as *C. ligniperda* or *C. obscuripes* in both field collecting and museum work in South Korea.

***Formica lemani* in South Korea → *Formica* sp. 1:** *Formica lemani* is regarded as a widely distributed pan-palearctic species with current records ranging from western Europe to the Kamchatka peninsula to the east. However, many of the ants previously recorded as *F. lemani* in Asia show differences in habitus compared to the European populations where the species was originally described, and it has been suggested there are multiple undescribed species (Seifert 2018). In South Korea, this species is primarily observed in the highland. (See Table 1.). As per the original description of *F. lemani*, a key diagnostic feature of this species is the presence of erect hairs on its prothorax. Compared to voucher specimens of *F. lemani* collected from Western Europe and Mongolia, the populations in South Korea and Japan are clearly different from both populations of *F. lemani*. Consequently, it is imperative to conduct a thorough examination of the South Korean and Japanese populations of *F. lemani,* as they exhibit a much-reduced number of erect hairs on the pronotum. This discrepancy warrants closer scrutiny to clarify the taxonomic status of these populations.

***Formica fusca* in South Korea → *Formica* sp. 2:** South Korean *Formica fusca* was first collected from Jeju Island. *Formica fusca* was originally considered an extremely wide-ranging species found throughout the Holarctic. Recent reexaminations on the species however proved the former single species is actually a complex of multiple species cutting down its once considered wide range (Schär et al. 2018). When examining voucher samples and figures in its description, it becomes quite evident that the *F. fusca* population in South Korea should be regarded as a taxonomically independent taxon. As mentioned above, in order to better understand the *F. fusca* group taxonomy, it is crucial to conduct research encompassing species throughout the Palearctic, rather than regional studies. Consequently, we have chosen to leave the species undetermined, rather than attempting to redefine their taxonomic position in this study.

***Lasius niger* group:** From Wilson's five species classifications (Wilson 1955) to Seifert's 57 species in depth taxonomic revision (Seifert 2020), the Palearctic *Lasius niger* group has undergone massive changes over the past decades. East Asian records of European species such as *L. niger, L. alienus,* and *L. brunneus* are an artifact of such changes of which *L. niger* records in Korea were previously reassigned to *L. japonicus*. We continue the reassigning and conclude previous records of *L. alienus* in South Korea consists of multiple species including *L. koreanus*, *L. longipalpus,* and *L. vostochni.* In the case of *Lasius* sp. 1 specimens, characterized by minimal body setae, smooth appressed pubescence, and broad head in larger workers, do not fit under any of the far east species discussed in Seifert 2020. Thus, we leave the species indeterminate, leaving it for future follow up studies.

***Ectomomyrmex astutus* in South Korea → *E. javanus* (Fig. 21):** Two species of *Ectomomyrmex* have been reported in South Korea: *E. javanus* and *E. astutus*. These records however are often mutually exclusive, including only one or the other in each literature. This is likely the result of different views on a single species between previous researchers in which our examinations on specimens from various locations in South Korea further support this idea. We also find this single species to be indistinguishable from *E. javanus* specimens collected in Tsushima Island, Japan, the type locality of *Pachycondyla* (*Ectomomyrmex*) *japonica* Emery, 1902, a junior synonym of *E. javanus*. This is also consistent with Lyu 2008 which noted "misidentification" on many previous records of "*Pachycondyla astuta* Smith 1858*"* in South Korea. We thus conclude *Ectomomyrmex* in South Korea to be a single species of *E. javanus*, and suspect the single species found in North Korea which Radchenko 2005 proposed to be *E. astutus* to be conspecific with the South Korean species. It should be noted that globally, *E. javanus* might still be a species complex and the exact species might change upon future global revisions.

Fig. 21. Habitus of worker of *Ectomomyrmex javanus* Mayr, 1867. A: Full-face view; B: Lateral view; C: Dorsal view.

***Technomyrmex albipes* group:** The *Technomyrmex albipes* group is a tropical clade of the genus *Technomyrmex* which includes multiple morphologically similar tramp species. Before the global revision of the genus in 2007, species such as *T. brunneus, T. difficilis, T. jocosus, T. pallipes,* and *T. vitiensis* were often misidentified as *T. albipes* (Bolton 2007). In the Korean peninsula, two male specimens of *T. albipes* were recorded in North Korea (Collingwood 1976; Radchenko 2005), which were later often included in lists for the whole peninsula (Kim 1996; Kim and Kim 1999). Such records were later reidentified to *T. brunneus* based on species distributions in adjacent regions (Mainland China, Japan and Taiwan) (Bolton 2007; Guénard and Dunn 2012), without actual examinations of the specimens. Moreover, native *T. gibbosus* was also sometimes misidentified as *T. albipes,* as seen in specimens included in Kwon et al. 2012, which lacks standing setae on the head, mesosoma, and gastral tergite 1 to 3, lighter in color, and have protruding eyes, all characteristic of *T. gibbosus*. Taken together, it is likely neither *T. albipes* nor *T. brunneus* have been established in South Korea. Interestingly, we instead found another tramp species of the *albipes* group, *T. vitiensis* in a greenhouse for tropical vegetation in Pocheon city, an Indomalayan species that has been reported in green houses of other temperate nations (see "Species newly reported from South Korea"). Therefore, we exclude previous records of *T. albipes* in South Korea but confirm the indoor presence of *T. vitiensis*.

***Myrmica*:** As mentioned in previous literature (Lyu 2006; Shin et al. 2020d; Terayama 1992), the genus *Myrmica* in South Korea has been poorly revised. Some species were previously reidentified as other species but were not properly updated in subsequent lists (*M. kaszenkoi*, *M. lobicornis*, *M. saposhnikovi*; see Table 2). Conversely, one species, *M. scabrinodis*, was erroneously included in the South Korean fauna despite the absence of any confirmed records. This error originated from earlier taxonomy, when *M. angulinodis*, *M. kaszenkoi*, and *M. saposhnikovi* were all treated as subspecies of *M. scabrinodis* (see Table 2).

In the case of *M. sulcinodis*, Terayama and collaborators (1992) noted that the South Korean records of this species correspond to the ants identified by Collingwood 1976 as *M. sulcinodis* from North Korea. Terayama et al. 1992 subsequently referred to these as *Myrmica* sp. A, stating that whether these ants are conspecific with the true *M. sulcinodis* from Europe and northern Asia remains uncertain. Thirteen years later, Radchenko 2005 confirmed that Collingwood's *M. sulcinodis* specimens were in fact misidentified individuals of *M. ademonia* and *M. ruginodis*.

Given this history, and based on our own collection data, in which *M. ademonia* was abundant across many sites in Zone 1 while *M. sulcinodis* was not found, we consider the South Korean records of *M. sulcinodis* as "Needs verification". Since Radchenko (2005) separately confirmed the true *M. sulcinodis* from the southernmost region of North Korea, not far from the border, we still consider it possible that at least some of the *Myrmica* sp. A specimens from South Korea mentioned in Terayama et al. 1992 may represent the true *M. sulcinodis*. However, we could not confirm this, as the voucher specimens of the earlier South Korean records could not be directly examined by either this study or Radchenko 2005.

A more complicated case can be found with *M. rubra* group species. According to Radchenko and Elmes 2010, only three species can be found in East Asia: *M. arisana,* which is endemic to Taiwan, and *M. kotokui* and *M. ruginodis*, which are widespread in the rest including South Korea. This view was later challenged as phylogenetic analysis using mitochondrial and nuclear marker sequences of Japanese *M. rubra* group specimens showed that the Japanese samples formed a paraphyletic clade which *M. arisana* and European samples of *M. ruginodis* and *M. rubra* nested within (Ueda et al. 2012), incongruent with the view of Radchenko and Elmes 2010, where *M. rubra* was known to be restricted to the western palearctic with the eastern most record being found west of lake Baikal, Russia. Since none of the further studies reestablished the taxonomic state of East Asian *M. rubra* group, we follow the view of Radchenko and Elmes 2010 and recognized only *M. kotokui* and *M. ruginodis* in South Korea. We also note that while worker specimens matching the keys of *M. kotokui* and *M. ruginodis* were both found in South Korea, the differences were not as discrete as suggested in Radchenko and Elmes 2010, and future research may prove different results.

Another complicated case can be found with *M. excelsa* complex within the *M. lobicornis* group. The complex itself is distinct as the posterior margin of the clypeus is raised into a sharp ridge in front of the antennal insertions, resembling ants in genus *Tetramorium* (Radchenko & Elmes 2010). Species identification within the complex was not always straightforward and South Korean populations of the complex were recorded as many now invalid names such as *M. carinata*, *M. taediosa*, and *M. cadusa* (Lyu 2006; Park 2003; Kim et al. 1997, respectively).

According to the synonymy provided by Radchenko 2005 and Radchenko and Elmes 2010, the valid species found in South Korea should be *M. excelsa* and *M. transsibirica*. Replacing previous records of synonymous species could however be problematic due to misidentifications, for instance, Lyu 2006 only recognized *M. carinata* (a junior synonym of *M. transsibirica*) and stated no specimen of *M. cadusa* (a junior synonym of *M. excelsa*) was found. The specimen picture of *M. carinata* mentioned in Lyu 2006 however shows strongly developed lateral carina on the antennal scapes, a key feature of *M. excelsa*. Our collection data show the opposite conclusion to that of Lyu 2006 as we found *M. excelsa* to be common in South Korea, notably the only *Myrmica* species that is often found in low elevations, but we could not confirm *M. transsibirica* with our collected samples. We maintain both *M. excelsa* and *M. transsibirica* in our species list; however, further confirmations should be made in future research.

***Nylanderia* (Fig. 22):** *Nylanderia* is a notorious genus for its challenging species identification and delimitations (Silva et al. 2023; Williams et al. 2022). Two native species were recorded in South Korea, *N. flavipes* and *N. yaeyamensis*. *Nylanderia flavipes* is a very abundant and widespread species in the east palearctic, introduced to other temperate parts in recent years (Wetterer 2011). *Nylanderia yaeyamensis* on the other hand is a more low-latitude species, originally described in the Yaeyama Islands of Japan as a non-sympatric counterpart of *flavipes* characterized by bright yellow body color (Terayama 1999). The species was also later reported in Taiwan (Terayama 2009) and southern continental China of close latitudinal ranges to the type locality (Silva et al. 2023). The South Korean record of *N. yaeyamensis* is based on populations found in Jeju Island (Lyu and Um 2007). *Nylanderia* found in the lower parts of the island (up to 800 m but more common in the lower areas) are remarkably brighter compared to the peninsular or high elevation Jeju Island specimens in both workers and reproductive females. Colony structure also differs. Typical *N. flavipes* colonies are known for their unique polydomous yet monogynous colonies, which is rarely reported in ants. Our observations concur with this finding, as peninsular populations were almost always monogynous or queenless, with the only exceptions being colonies in early stages, with some multi-queened cases possibly due to pleometrosis. In contrast, polygyny is very common in the light-colored variety with up to 24 queens in a single nest. Single queened and queenless satellite colonies are also common which the latter seem to be the main source of alate productions. COI barcoding also suggests cryptic diversity of *Nylanderia* in South Korea based on samples from multiple locations including the yellow population from Jeju (unpublished data). However, even if these bright colored populations in South Korea indeed represent a separate species from *N. flavipes,* there is little evidence they are conspecific to the ants from Japan. In fact, after direct comparison with specimens collected from Ishigaki Island (the type locality of *N. yaeyamensis*), we found notable differences in morphological features. Jeju Island specimens were always more pubescent in the area right above the eyes, which type locality specimens the pubescence were sparser, therefore the whole area appearing smooth. Similar differences were also seen in the antennal scapes with Jeju specimens always with higher number of appressed and semi-erect pilosity. Nevertheless, we do not draw a complete conclusion on the true identity of the *N. yaeyamensis* collected in Jeju Island for now, as *Nylanderia* species are known for having complicated species delimitations (Williams et al. 2022), and we do not find our new findings to be sufficient to redefine the species boundaries of *N. yaeyamensis*.

Fig. 22. Habitus of worker of *Nylanderia yaeyamensis* (Terayama, 1999) collected from Jeju Island. A: Full-face view; B: Lateral view; C: Dorsal view.

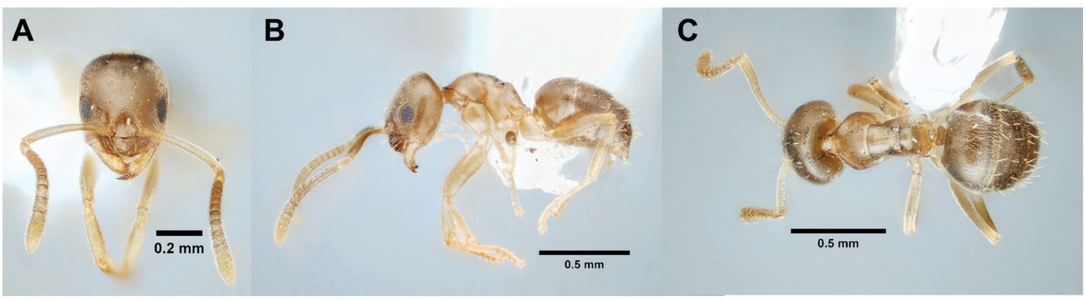

Fig. 23. Habitus of worker of *Paraparatrechina sakurae*. A: Full-face view; B: Lateral view; C: Dorsal view.

***Proceratium*:** Staab and collaborators (2018) revised the *Proceratium* genus found in China based on morphological data obtained from μCT imaging. Under the new criteria *P. itoi* in South Korea could potentially be a multispecies complex showing variations in as the shape of posterodorsal propodeal corners or ventral petiolar processes. These variations, however, proved to be quite continuously variable on our South Korean samples and thus we leave it for future studies and resign to the most evident species *P. itoi*.

Paraparatrechina sauteri **in South Korea → *P. sakurae* (Fig. 23):** Two species of *Paraparatrechina* have been recorded from South Korea: *P. sakurae* and *P. sauteri*. Outside South Korea, the former occurs in Japan and the alpine regions of southwest China, while the latter is distributed in Taiwan and the central and southern provinces of China. Our examinations of South Korean samples including specimens collected near the border with North Korea showed little evidence for these specimens to be heterospecific and are closer to the Japanese *P. sakurae* in features such as the dark color, wide head, small eyes, and larger size in comparison to *P. sauteri* (Forel 1913; Terayama 2013), therefore we conclude *P. sakurae* to be the only species of *Paraparatrechina* present in South Korea. Monograph of North Korean ants (Radchenko 2005) stated a similar conclusion of single species being present in North Korea but identified it as *P. sauteri* (as *Paratrechina sauteri*) instead of *P. sakurae*. This, however, is not based on morphological differences between *P. sakurae* and *P. sauteri* but because previous *P. sakurae* records from Collingwood 1976 were misidentification of *Nylanderia flavipes*. As a matter of fact, Radchenko (2005) did not recognize the differences between the two species and even suggested the possibility of *P. sakurae* being a junior synonym of *P. sauteri.* Since specimens inspected by Radchenko (2005) include samples collected near the South Korean border, it is conceivable that the single species from North Korea is also likely *P. sakurae,* making *P. sakurae* the sole peninsula-wide species, which is also congruent with *P. sauteri* being more subtropical species found in low elevations of lower latitude regions.

DISCUSSION

1. Distribution pattern

Over the past eons of rising and receding sea levels, the Korean peninsula served as a passage between the Eurasian continent and the Japanese archipelago (Millien-Parra and Jaegar 1999), which naturally became the main factor of the current assemblage of ants observed nowadays. Overall, the ant fauna of South Korea overlaps substantially with nearby regions, especially the main islands of Japan. According to previous research, the ant fauna of the Korean Peninsula exhibits the highest similarity to that of Honshu, Japan (Jaccard's coefficient: 0.512), a correlation attributed to the comparable geographical environment, climate, and vegetation found within the same latitudinal zone (Terayama et al. 1998). Some patterns can be seen reflecting the dispersal histories of the shared fauna. South Korean ants that are not found in Japan are often inland, mid to high elevation species (e.g., *Camponotus atrox*, *Lasius* spp., *Myrmica* spp., *Temnothorax* spp.), which can be explained by two main factors: (1) a lower likelihood of the species to spread via rafting; (2) challenges for the species to cross the land bridge of Tsushima Island during lower sea level periods as it is located in the very south east of the peninsula and would have only provided lowland environments. Species such as *Aphaenogaster famelica* while common throughout Japan are rare in South Korea, and only common in coastal areas of the southeast, suggesting its dispersal from Japan. In contrast, *Plagiolepis flavescens* and *Ectomomyrmex javanus*, which are found at all latitudes of Korea, are restricted to Tsushima Island and nearby southern regions (e.g., Hiroshima, Kyushu, Shikoku, and Nansei Islands) in Japan (Imai et al. 2003), which could be hypothesized to correspond to dispersal events from Korea to Japan. One should also expect for the South Korean fauna to be more similar to those of the Eastern Chinese provinces. Poor sampling in these latter regions and a distinct taxonomic history is likely hiding stronger composition affinities between the China and South Korea ant fauna. Future work conducted in China is thus likely to bridge this gap.

2. Endemism

Endemic species do not make much of the recognized fauna of ants in South Korea, as only six species are considered endemic. It should also be noted that even within the six valid endemic species, the identities of some species such as *Camponotus fuscus* and *Camponotus jejuensis* are uncertain: the type specimens are unavailable, and the original description lacks details distinguishing the species from variations of closely related species such as *C. quadrinotatus* or *C. vitiosus* respectively.

The low endemism level observed in South Korea is in accordance with the Rapoport's rule which poses that species of higher latitude or altitude require adaptation to marked seasonal changes, which in turn leads to wider climatic tolerance and hence wider geographic ranges compared to species from more stable climatic regions (Stevens 1989). The dynamic seasons of the Korean peninsula, combined with its small

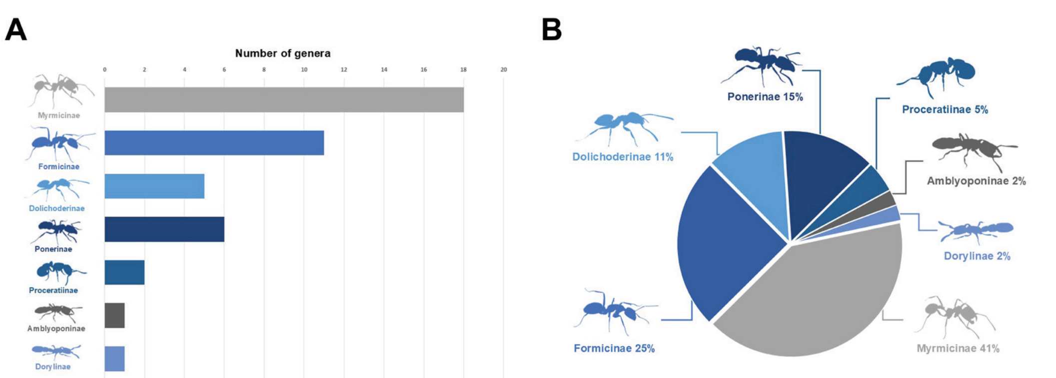

Fig. 24. Graphs showing the number of genera by ant subfamily in South Korea (A: Number of genera by ant subfamily; B: A pie chart illustrating the proportional distribution of ant genera across subfamilies).

size and constant connection to nearby regions, would limit ant endemism. Species originally described as endemics of South Korea have mostly been either synonymized under more wide-ranging species (e.g., *Myrmica cadusa* under *M. excelsa, M. hyongokae* under *M. jessensis*, *M. incurvata* under *M. angulinodis*) or were later confirmed outside Korea (e.g., *Dacatria templaris*, *Lasius koreanus*, *Myrmica koreana*, *Plagiolepis flavescens*, *Strongylognathus koreanus*). Similarly, species previously thought to be endemic to Japan, have since been recorded in South Korea (e.g., *Lasius productus, Vollenhovia nipponica, Strumigenys alecto, S. mazukoi*) (Cho et al. 2020; Dong and Kim 2020; Shin and Lyu 2020), and all seven newly recorded native species inhabiting the southern coastline of zone 3 (Table 1) of South Korea were previously only recorded in Japan, again emphasizing the close relation between the two regions, especially in the coastal lowlands. These results highlight the lower endemism in Japan than previously thought; a pattern also observed recently with increased taxonomic work conducted in Mainland China (e.g., Leung et al. 2023; Tang et al. 2019), with earlier indications of high endemism in Japan being in part the result of early pioneering taxonomic work rather than a biogeographic pattern. Ultimately, as new sampling efforts are deployed, resulting in new specimens becoming available, regional rather than national taxonomic treatments in East Asia should be favoured to clarify the taxonomic status and distribution of the species in the region.

3. Ants likely to be found in the future

Some ant taxa while never reported in South Korea to date, can be expected to be discovered in future. Two genera, *Proformica* and *Liometopum*, are reported in North Korea but are yet to be found in the South (Radchenko 2005). The widespread *Proformica mongolica* (Emery, 1901) is a dry open environment inhabiting species found in Mongolia, Russia, Northern China, and North Korea (Guénard and Dunn 2012; Bayartogtokh et al. 2014; Belokobylskij et al. 2017). In North Korea this species was found on a dry mountain slope, 1100 m above sea level in Ryanggang province (Radchenko 2005). *Liometopum orientale* Karavaiev, 1927 on the other hand is a forested area species reported in Primorsky Krai, Russia (Belokobylskij et al. 2017) and in North Korea, where in the latter the species were found in a pine-oak forest 780 m above sea level in Chagang province (Radchenko 2005). If these ants are to be found in South Korea, the high mountains of zone 1 would be the most likely area. It should be noted however, that as both species were found only in the northernmost regions of North Korea in high altitudes, the likelihood of these species also present in South Korea may not be high.

Two other lineages of ants can be expected in South Korea. Ants of the subfamily Leptanillinae are cryptic, with hypogaeic species found around the warm regions of the old world (Griebenow 2024). Due to their cryptic lifestyle records of these ants are limited, however recent studies utilizing dedicated methods for subterranean ants prove the diversity and abundance of these ants are higher than expected (Leong et al. 2018; Hamer et al. 2024). In Japan, three species of *Leptanilla* (*L. japonica* Baroni Urbani, 1977*, L. kubotai* Baroni Urbani, 1977*, L. morimotoi* Yasumatsu, 1960), and a single of *Protanilla Izanagi* Terayama, 2013*,* are reported in the main islands (Griebenow 2024) covering the whole latitudinal range of South Korea. The two genera are also known in Beijing, China (*L. taiwanensis* Ogata, Terayama & Masuko, 1995 and *P. beijingensis* Qian, Xu, Man & Liu, 2024: Man et al. 2017), an aberrantly north record for the thermophilic subfamily. Prevalence of the two genera in surrounding nations suggests the possible existence of the subfamily in South Korea.

Another genus likely to be found in South Korea is *Carebara*, specifically the species *Carebara yamatonis* (Terayama, 1996). This minute subterranean species inhabits the forest floor of Japan from the Kanto region southwards. It is common in Japan and even found on Tsushima Island, the suggested land bridge between Japan and South Korea, yet has never been collected in Korea (Imai et al. 2003). Many of the newly reported ant species in South Korea in recent years were subterranean ants discovered on the southern coast (zones 3 and 4) that are also found in Japan (Kwon et al. 2017; Dong and Kim 2020; Shin et al. 2020b; Shin and Lyu 2020). This not only shows the close relation of this habitat to that of Japan but also highlights the underestimated diversity of this particular area. Considering where *C. yamatonis* is found in Japan, we strongly suspect it could also be living on the southern coasts of Korea.

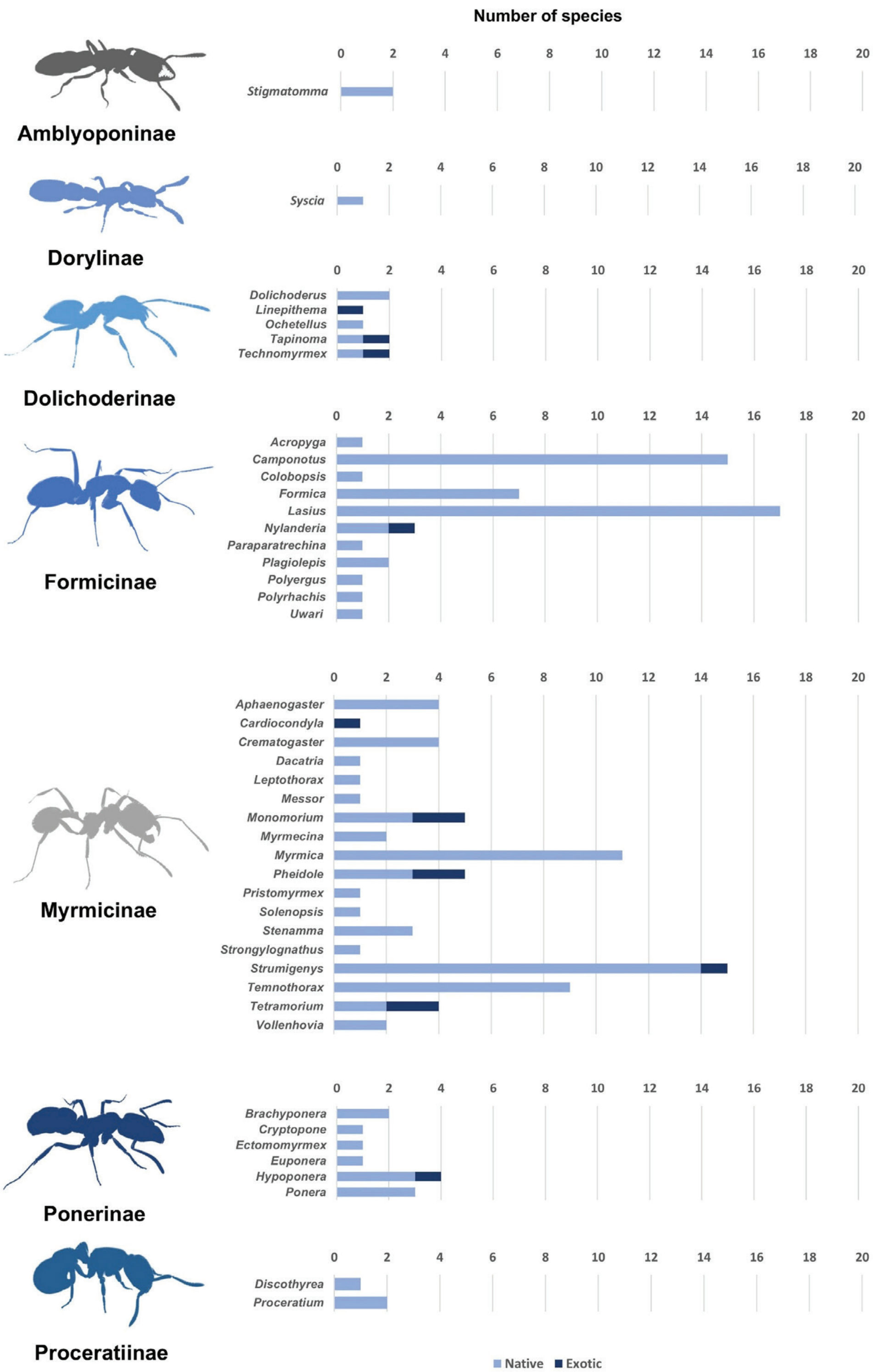

Fig. 25. Species richness of each ant genus in South Korea. Native and exotic species within each genus presented in light and dark blue respectively.

Table 4. Potential ant species expected to be discovered in South Korea with their known distributions and habitats

Subfamily	**Species**	**Latitude Range** (South Korea: 33.06°N - 38.37°N)	**Habitat Type**
Dolichoderinae	*Liometopum orientale*	North Korea, Russia (37.45°N - 43.00°N)	Highlands
Formicinae	*Proformica mongolica*	China, Mongolia, North Korea, Russia (36.59°N - ca. 55° N)	Highlands
Leptanillinae	*Leptanilla japonica*	Japan (35.15° N - 35.13°N)	Forest Floor
Leptanillinae	*Leptanilla kubotai*	Japan (33.55° N)	Forest Floor
Leptanillinae	*Leptanilla morimotoi*	Japan (30.52° N)	Forest Floor
Myrmicinae	*Carebara yamatonis*	China, Japan (35.13° N - 29.54° N)	Lowland Forest
Myrmicinae	*Lordomyrma azumai*	Japan (39.78N - 30.36°N)	Forest Floor

Similarly, *Lordomyrma*, particularly the species *L. azumai* (Santschi, 1941) could potentially be found in South Korea as well. This species has a patchy distribution and is considered rare in Japan, with its range extending from northern Honshu to Kyushu, and is the sole representative of the genus in Japan. The patchy, distribution and cryptic ecology of such genera can result in them being overlooked for extended periods, as was the case with the genus *Acropyga*, which was only recently discovered in South Korea (Kwon et al. 2017) after being undetected for a long time.

Additionally, genera with high diversity in South Korea, such as *Camponotus*, *Myrmica*, *Temnothorax*, and *Strumigenys* are likely to have more species awaiting discovery. These ants are also some of the most complicated ants to identify in South Korea, thus future revisions of the genus might result in additional species, as it was the case with South Korean *Lasius niger* group. The ant genus *Strumigenys* is particularly noteworthy; of the 15 species reported in South Korea, seven were discovered for the first time in the last five years (this study; Dong and Kim 2020; Shin and Lyu 2020). This surge in discoveries is likely to be largely due to the genus's cryptic nature and the historical bias in collecting methods. Recent improvements in leaf litter sampling have significantly contributed to these findings. Given that *Strumigenys* studies are often regional and identification is challenging due to subtle morphological differences (Tang et al. 2019), species reported from Southeast Asia or Japan may be more widespread (Tang & Guénard 2023) and may eventually be found in South Korea. Sampling and taxonomic limitations complicate the understanding of the distribution patterns of *Strumigenys* and should be noted in future studies. The number of *Strumigenys* species could also increase with future improvements in our understanding of their taxonomy, as it was the case with *S. lewisi* and *S. kumadori* (Dong and Kim 2020). For instance, in South Korea two distinct types of *S. mutica* (Brown, 1949) can be found where in some colonies the queens have long hairs along the dorsum and workers have short simple hairs scattered on the first gastral tergite. In other colonies the queens completely lack the long hairs while the workers have spatulate hairs on the first gastral tergite in distinct two rows. As mentioned in Tang et al. (2019), the former might represent a novel species.

4. Ants requiring conservation efforts

While some ants are among the most conspicuous, abundant insects, others seem rare and inconspicuous and in need of conservation efforts. In South Korea, a species can be protected by law by either: (1) Being enlisted in the endangered species list, managed by the Ministry of Environment (Wildlife Protection and Management Act 2021), or (2) Being designated as a national monument, as a species or a particular population plus its habitat, managed by the Cultural Heritage Administration (Cultural Heritage Protection Act 1962), both of which are independent to one another. Now, there are no designated ant species under government protections, most likely due to lack of understanding of the native ants and their characteristics. Here we provide some cases worth noting for future conservation.

4-1. High elevation species: Climate change is rapidly affecting ecosystems and its effect is becoming more and more evident in recent years, especially within temperate regions, and ants are in no exception (Talavera et al. 2015). Rising temperature can affect the fitness of ants both directly and indirectly such as by affecting their habitats or their symbiotic microfauna (IUCN 2023). In South Korea, the distributions of ant species is already shifting to higher elevations in the past years (Kwon et al. 2016). Our study did not include monitoring of particular species over time and therefore cannot provide evidence of such changes. Our findings, however, recognize species found only in high elevations (e.g., *Formica candida*, *Formica* sp. 1, *Formica* sp. 2, *Leptothorax acervorum*) and species that favor and are more common in the highlands (e.g., *Camponotus atrox*, *Myrmica* spp.). Changing climates will affect these species, forcing the ants both upwards and northwards, with the strongest impacts observed for species with limited dispersal abilities or with a lack of new habitats to expand to (e.g., top of mountains). This is especially concerning for species found in remote, alpine habitats, such as *Formica* sp. 2, currently only found above the timberline in Mt. Hallasan of Jeju Island. Without adjacent areas to recede to, these species face a direr threat of local extinction, a situation reported in other islandic-high-elevation ant species (Talavera et al. 2015).

4-2. Inquilines and other patchily distributed species: Inquilinous ants are socially parasitic ants that permanently live with but do not enslave their host species (Buschinger 2009). Usually, inquilinous species lose their ability to produce worker castes, relying on host species on almost every aspect of their life cycles. Due to their weak dispersal abilities and symbiotic relationships with their hosts, inquilines are rarely collected, have localized distributions, and are genetically vulnerable (Schrader et al. 2021; Trontti et al. 2006), with many inquiline species considered as threatened under the IUCN Red list (IUCN 2023). In South Korea, three species of inquilinous ants are recognized: *Strongylognathus koreanus*, *Vollenhovia nipponica*, and the putative novel species *Temnothorax* sp. 1. Within South Korea, all three species are highly restricted in distributions: *S. koreanus* in Saryando Island and Jeju Island, *Temnothorax* sp. 1 in Seoul, and *V. nipponica* in Jinju and Wonju (Kim et al. 2022), even though their hosts are among the most common ants of the nation. It is in no doubt these species will be especially vulnerable to habitat disruption, which we have already observed in certain sites.

Some ants also present patchy distributions, e.g., *Acropyga sauteri, Dacatria templaris, Stigmatomma caliginosum, Syscia humicola* and several *Strumigenys* spp. (e.g., *S. masukoi*, *S. rostrataeformis*). There is a remarkable scarcity of records for these species, despite the numerous studies conducted on ant distribution in South Korea. This scarcity could stem from an insufficient comprehension of local habitats or variations in collection methods, rather than the ants themselves being rare. Nevertheless, it remains crucial to emphasize the significance of closely monitoring these exceptionally rare ants and their habitats, as such efforts are pivotal for future conservation initiatives in the realm of biology.

4-3. Keystone species: Another main criterion for protection should be keystone species, species that exert disproportionate effects on ecosystems. Mound building ants of the genus *Formica* (Red wood ants) are one of the best examples of keystone ant species, as they form giant, permanent supercolonies that dominate the area, serving as significant predators on invertebrates (Wegnez and Mourey 2016). Nevertheless, red wood ants are facing dire challenges to their survival in recent years due to various complex factors such as loss of suitable habitat and climate change (Sorvari 2016). In extreme cases, populations have gone completely extinct, such as *F. pratensis* in the Great Britain island or *F. uralensis* in Switzerland (Cherix and Maddalena-Feller 1986; Nicholson 1997). As a result, in numerous European countries, these *Formica* ants are legally protected (Balzani et al. 2022). In South Korea only a single species *F. truncorum* is confirmed, which is known to have high impact on herbivorous insects, and acts as an auxiliary of biological control in pine forests (Dong 2017). This species, however, is decreasing in number due to habitat loss and fragmentation, as large stable forests are required to sustain their iconic mound nests, much like other mound-building *Formica* ants around the world. The South Korean population of *F. truncorum* faces an additional, unique threat: in Korean traditional medicine, workers of this species are used as a treatment for arthritis and erectile dysfunction. These multiple pressures from habitat loss and indiscreet collecting for medicinal purposes puts the South Korean population of *F. truncorum* at particular risk.

5. Introduced ants in green houses

Among the newly reported species in this study, five are alien ants: *Monomorium carbonarium*, *Nylanderia* sp. cf. *jaegerskioeldi*, *Pheidole parva*, *Technomyrmex vitiensis*, and *Tetramorium lanuginosum*, with the latter four found in greenhouses within the Seoul metropolitan area. All five alien species are well-known tramp ants that have established populations in other regions through anthropogenic means.

Greenhouses have for long provided unique opportunities for globe-trotting ants (Donisthorpe 1915; 1927). Indoor artificial environments, such as houses or warehouses, often provide stable temperature and humidity throughout all seasons. However, this haven is limited to ant species with biological traits adapted to live within the concrete walls. Greenhouses on the other hand provides the environmental benefits while retaining the outdoor conditions such as natural nest sites, vegetation for symbiotic homopterans, and numerous food sources, all of which were confirmed to be exploited by the four newcomers.

Pheidole parva and *T. lanuginosum* are also established in Japan which represent a likely candidate for importing these alien species into South Korea (Park SH et al. 2021; Park J et al. 2021). Outdoor populations of these ants in Japan are mainly restricted to regions of lower latitude than Seoul, and it is likely the ants have only been able to settle in higher latitudes (e.g., Seoul) because of the niches provided by heated greenhouses. Indeed, previously established species such as *T. melanocephalum* and *T. bicarinatum* were found outdoors in southern South Korea but were only found indoors at higher latitudes.

Within the limited artificial structures, however, the alien ants were very populous, replacing native greenhouse-loving species such as *N. flavipes* which was very common in other inspected greenhouses lacking other exotic ant species. It is also notable that the butterfly garden of Seoul, where three new alien species were recorded, all plants were bought from domestic plant shops and were not directly imported overseas, thus implying the ants have set foot in South Korea a considerable time ago and are spreading through ornamental plants.

These species should be carefully monitored, however, as increased possibility for these species to establish permanent outdoors will increase with ongoing climate change, potentially leading to future ecological or economic impacts (Tsang et al. 2025). Further investigations into greenhouses nationwide should be essential in future monitoring. We emphasize that while we found no established outdoor populations of the four new greenhouse ants (*Nylanderia* sp. cf. *jaegerskioeldi*, *P. parva, T. vitiensis*, and *T. lanuginosum*), future establishment cannot be ruled out. For instance, in higher latitudes (e.g., Seoul) *Tetramorium bicarinatum* is restricted to heated greenhouses, however the same species is well established outdoors along the southern shorelines, with colonies confirmed to overwinter outdoors. Therefore, the four species that are currently restricted to greenhouses could establish outdoors in the future in areas where the climate is mild enough. In this scenario, greenhouses may prove as steppingstones, accelerating the spread of the ants into outdoor environments (Tsang et al. 2025).

Another concern about greenhouses is their accessibility to the general public. The lack of regulation on established alien species has already resulted in cases of people releasing *Tetramorium bicarinatum* into places where it is not established. Compared to ports where exotic ant species are intercepted, greenhouses are much easier for people to visit. Given the popularity of *Pheidole* spp. and *Tetramorium* spp. among ant keeping hobbyists in South Korea, it is possible that without improved regulations, the pet trade could accelerate the spread of the alien ant species easily accessible through greenhouses.

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