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Ants of Chindo Island in Korea (Hymenoptera, Formicidae)

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ABSTRACT

The ants found in Chindo Island were investigated from July to October, 1994. We were interested in the ant fauna of this island because it is one of larger islands of Korea and being well supplied with subterranean water, quite different from other islands in this respect. Collections were examined from 11 sites of Chindo Is., of which 21 species of 15 genera under 4 subfamilies are classified and reported.

Key words: Ants, Formicidae, Systematic, Chindo Island, Korea

INTRODUCTION

Chindo Island is located in the South Sea, about 40 km from the administration unit of Haenam. It is a relatively large island with 7 mountains and 13 streams. These supply adequite water for plants and animals. In 1994, most islands experienced water shortages, but Chindo island is quite different from others in water supply. No taxonomic studies of ants have been done in this area to date, hence the ants found on Chindo Is. were investigated from July to October, 1994. We tried to cover as many collecting sites as we could reach in order to obviate bias resulting from small sample size.

Eleven sites were surveyed, approximately 250 ant nests were excavated and collections were moved to the laboratory during the research period. All collections were examined using the stereomicoscope and compared with voucher specimens from Natural History Museum, Great Britain. As taxonomic keys were made following the system of Collingwood (1979). As a result, 21 species of 15 genera under 4 subfamilies were identified. We thank Jack D. Large of the Department of English Education, Wonkwang University for proofreading the English of the final draft.

MATERIALS AND METHODS

About 15,000 ant specimens from 250 ant nests excavated in 11 collecting sites were moved to laboratory. Whenever ant nests were found, they were excavated by spade and ants were collected by aspirator. Initially being preserved in Bouin's solution (80% ethanol 150 ml, formaldehyde 15 ml, picric acid 1 g), for 2 or 3 days later they were moved to 95% ethanol. Specimen was identified by comparison with voucher specimens from Drs. Elmes and Collingwood in England, Rigato in Italy, Onoyama in Japan, and Mr. Wang in China. Taxonomic system follows Collingwood (1979), as does the terminology. Keys of subfamily and genera for the ants of this area were made for the assemblage of all.

SYSTEMATIC ACCOUNT

Key to Subfamilies of Formicidae

1. Pedicel with one nodal segment ····· 2
— Pedicel with two nodal segments ····· Myrmicinae
2. Gaster clearly constricted between first and second segments: final abdominal segment with strong sting ····· Ponerinae
— Gaster without constriction between first and second segment: sting absent ····· 3
3. Cloacal orifice is transverse slit and four abdominal segments are seen from above ····· Dolichoderinae
— Cloacal orifice is seen circular with hairs and five abdominal segments are seen from above ····· Formicinae

Subfamily Ponerinae Lepeletier 침개미아과

Key to genera of Ponerinae

1. Mesopleura with slopely running groove ····· *Ectomomyrmex*
— Mesopleura flat without groove and in profile pronotum and mesonotum convex ····· *Brachyponera*

Genus 1. Brachyponera Emery, 1901 왕침개미속

Brachyponera Emery, 1901, p. 43.

Type species: *Ponera sennaarensis* Mayr.

1. *Brachyponera chinensis* Emery, 1894 왕침개미

Brachyponera chinensis Emery, 1894, p. 460; Kim, 1970, p. 471; Collingwood, 1976, p. 300; Terayama *et al.*, 1992, p. 23; Kim *et al.*, 1993, p. 119 ; Kim *et al.*, 1994, p.294.

Euponera (Brachyponera) solitaria Smith, 1874, p. 404.

Ponera nigrata chinensis Emery, 1894, p.360.

Locality. Ssanggye temple.

Distribution. Korea, China, Japan, and New Zealnd.

Genus 2. *Ectomomyrmex* Mayr,1867 일본침개미속

Ectomomyrmex Mayr, 1867, p. 83.

Type species. ?

2. *Ectomomyrmex javanus* Mayr, 1867 일본침개미

Ectomomyrmex javanus Mayr, 1867, p. 84; Kim, 1970, p. 472; Terayama *et al.*, 1992, p. 23; Kim *et al.*, 1993, p. 119; Kim *et al.*, 1994, p. 295.

Pachycondyla (Ectomomyrmex) japonica Emery, 1902.

Pachycondyla japonicus: Wheeler, 1928.

Locality. Ssanggye temple.

Distribution. Korea, China, Japan, Taiwan, Sumatra, Java, Borneo, and Indochina.

Subfamily Cerapachinae 배잘록침개미아과

Genus 3. *Cerapachys* Fr. Smith, 1857 배잘록침개미속

Cherapachys Fr. Smith, 1858, p. 74.

Type species. *Cerapachys antennatus* Smith, 1858.

3. *Cerapachys humicola* Ogata 1983 배잘록침개미

Cherapachys humicola Ogata, 1985; Terayama *et al.*, 1992, p. 24.

Locality. Hyangdong.

Distribution. Korea and Japan.

Subfamily Myrmicinae Lepeletier,1836 두마디개미아과

Key to Genera of Myrmicinae

1. Post petiole attached to dorsum of first abdominal segment ····· *Crematogaster*
— Post petiole attached to anterior face of first segment ····· 2
2. Clypeus protruded like a tomb from anterior area of antennal base ····· *Pristomyrmex*
— Clypeus not protruded like a tomb····· 3
3. Antennae six segmented ····· *Strumigenys*
— Antennae more than ten segmented ····· 4
4. Clypeus with two vertical protruded lines. Head and thorax with concave areas but without rugosities ····· 5
— Clypeus with one vertical protruded line or rugosities····· 6
5. Antennae ten segmented and club two segmented ····· *Solenopsis*
— Antennae twelve segmented and club three segmented····· *Tetramorium*
6. Antennal club three segmented and as long as sum of other segments or longer than it ····· *Pheidole*
— Antennal club five segmented and shorter than sum of other segments ····· *Aphaenogaster*

Genus 4. Aphaenogaster Mayr, 1853 황개미붙이속

Aphaenogaster Mayr, 1853, p. 107.

Type species. *Aphaenogster sarous* Mayr, 1903.

4. *Aphaenogaster famelica* (Smith, 1874) 황장다리개미

Ichnomymex famelicus Smith, 1874, p. 405.

Stenamma (Aphaenogster) famelicum: Wheeler, 1906.

Aphaenogaster famelica: Mayr, 1878, p. 669.

Aphaenogaster ruida: Collingwood, 1976, p. 302.

Aphaenogaster famelica: Kim, 1970, p. 475; Collingwood,1981, p. 26; Kim and Kim, 1982, p. 104; Kim and Kim, 1983, p. 72; Terayama *et al.*, 1992, p. 26; Kim *et al.*, 1993, p. 122; Kim *et al.*, 1994, p. 296.

Locality. Ch'osang, Hyangdong, Jŏpdo.

Distribution. Korea and Japan.

Genus 5. *Crematogaster* Lund, 1831 꼬리치레개미속

Crematogaster Lund, 1831, p. 132.

Type specis. *Formica scutellaris* Oliver, 1791.

5. *Crematogaster brunnea teranishii* Santschi, 1930 검정꼬리치레개미

Crematogaster brunnea teranishii Santschi, 1930, p. 265; Terayama *et al.*, 1992, p. 31; Kim *et al.*, 1993, p. 122.

Locality. Ssanggye temple.

Distribution. Korea and Japan.

6. *Crematogaster osakensis* Forel, 1900 노랑꼬리치레개미

Crematogaster osakensis Forel, 1900, p. 369.

Crematogaster sordidula var. *japonica* Forel, 1912.

Crematogaster osakensis: Teranish, 1940, p. 4; Kim, 1963, p. 102; Kim, 1970, p. 478; Collingwood, 1976, p. 303; Terayama *et al.*, 1992, p. 31 ; Kim *et al.*, 1993, p. 122; Kim *et al.*, 1994, p. 297.

Crematogaster sordidula osakensis: Kim and Kim, 1982, p. 4; Kim and Kim, 1983, p. 10, 11.

Locality. Jŏpdo.

Distribution. Korea, China, and Japan.

Genus 6. *Monomorium* Mayr, 1855 집개미속

Monomorium Mayr, 1855, p. 452.

Type species. *Monomorium mimutum* Mayr, 1855.

7. *Monomorium chinense* Santschi, 1925 중국집개미

Monomorium minutum var. *chinense* Santschi, 1925, p. 86.

Monomorium chinense: Bolton, 1989; Terayama *et al.*, 1992, p. 29; Kim *et al.*, 1993, p. 123; Kim *et al.*, 1994, p. 298.

Locality. Paengmok, Geumkap, Ch'ŏngryong.

Distribution. Korea, China, and Japan.

Genus 7. *Pheidole* Westwood, 1841 혹개미속

Pheidole Westwood, 1841, p. 87.

Type species. *Atta providens* Sykes, 1835.

8. *Pheidole fervida* Fr. Smith, 1874 극동혹개미

Pheidole fervida Fr. Smith, 1874, p. 406.

Pheidole fervida var. *kawazna* Teranishi, 1940.

Pheidole fervida: Collingwood, 1940, p. 4; 1976, p. 302; Kim, 1963, p. 102; Kim, 1970, p. 477; Kim and Kim, 1983, p. 69; Kim, 1986, p. 85; Terayama *et al.*, 1992, p. 27; Kim *et al.*, 1993, p. 124; Kim *et al.*, 1994, p. 299.

Locality. Ssanggye temple, Kwangjŏn, Ch'ŏngryong.

Distribution. Korea, China, and Japan.

Genus 8. *Pristomyrmex Mayr*, 1866 그물등개미속

Pristomyrmex Mayr, 1866, p. 903.

Type spcies. *Pristomyrmex pungens* Mayr, 1866.

9. *Pristomyrmex pungens* Mayr, 1866 그물등개미

Pristomyrmex pungens Mayr, 1866, p. 904.

Pristomyrmex pungens: Kim, 1970, p. 481; Collingwood, 1976, p. 303; Kim et Kim, 1982, p. 7; Kim and Kim, 1983, p. 58; Terayama *et al.*, 1992, p. 30; Kim *et al.*, 1993, p. 125 ; Kim *et al.*, 1994, p. 299.

Locality. Ch'osang, Paengmok, Ssanggye temple, Jŏnsŏl, Geumkap, Namsŏn, Kwangjŏn, Jŏpdo.

Distribution. Korea, China, and Japan.

Genus 9. *Solenopsis* Westwood, 1841 열마디개미속

Solenopsis Westwood, 1841, p. 86.

Type species. *Solenopsis fugax* Latreille, 1798.

10. *Solenopsis japonica* (Wheeler, 1928) 일본열마디개미

Formica fugax var. *japonica* Wheeler, 1928, p. 113.

Solenopsis japonica: Terayama *et al.*, 1992, p. 30; Kim *et al.*, 1993, p. 125; Kim *et al.*, 1994, p. 300.

Locality. Songjŏng.

Distribution. Korea and Japan.

Genus 10. *Strumigenys* Smith, 1860 비늘개미속

Strumigenys Smith, 1860, p. 71.

Type spcies. *Strumigenys mandibularis* Smith, 1860.

11. *Strumigenys lewisi* Cameron, 1877 비늘개미

Strumigenys lewisi Cameron, 1877, p.229.

Strumigenys lewisi: Kim, 1970, p.483 ; Kim, 1963, p. 103; Collingwood, 1976, p. 303; Kim and Kim, 1982, p. 22; Terayama *et al.*, 1992, p. 31; Kim *et al.*, 1993, p. 125; Kim *et al.*, 1984, p. 300.

Locality. Jŏnsŏl.

Distribution. Korea and Japan.

Genus 11. *Tetramorium* Mayr, 1855 주름개미속

Tetramorium Mayr, 1855, p. 423.

Type species. *Formica caespitum* Linné, 1758.

12. *Tetramorium caespitum* (Linné, 1758) 주름개미

Formica caespitum Linné, 1758, p. 581.

Tetramorium caespitum: Mayr, 1855.

Tetramorium caespitum semileve var. *jacoti* Wheeler, 1923, (syn. by Yasumatsu, 1962).

Tetramorium caespitum: Teranish, 1940, p. 4; Kim, 1963, p. 103; Kim, 1970, p. 482; Collingwood, 1976, p. 304; 1981, p. 27; Kim and Kim, 1982, p. 8 ; Kim and Kim, 1983, p. 65; Kim, 1986, p. 85; Terayama *et al.*, 1992; Kim *et al.*, 1993, p. 126; Kim *et al.*, 1994. p. 300.

Locality. Ch'osang, Paengmok, Hyangdong, Songdong, Songjŏng, Jŏpdo, Ch'ŏngryong.

Distribution. Korea, China, Japan, United Kingdom, and Europe.

Subfamily Formicicinae Lepeletier 불개미아과

Key to Genera of Formicinae

1. Antennal insertions set at a distance behind posterior clypeal margin····· *Camponotus*
— Antennal insertions more or less contiguous with posterior clypeal margin····· 2
2. Eyes at or in front of midlelength of sides of head;petiole inclinded forward, petiole nodal or scale form and overhung by first gaster tergite·····*Paratrechina*
— Eyes behind midlelength of sides head; petiole nodal or as a vertical scale not overhung by first gaster····· 4
4. Propodeal spiracle ellipsed or slit like set at a distance from posterior propodeal declivity. Funiculus segments from two to five long or longer than segments from six to eleven··· *Formica*
— Propodeal spiracle broadly oval or circular, set close to or at the posterior propodeal margin ····· *Lasius*

Genus 12. *Camponotus* Mayr, 1861 왕개미속

Camponotus Mayr, 1861, p. 35.

Type species. *Formica ligniperda* Latreille, 1802.

13. *Camponotus japonicus* Mayr, 1866 일본왕개미

Camponotus japonicus Mayr, 1866, p. 855.

Camponotus pennsylvanicus var. *japonicus* Emery, 1893, p. 268.

Camponotus herculeanus japonicus var. *sanguinea* Karawajew, 1929.

Camponotus herculeanus var. *koreanus* Teranishi, 1940, p. 74 (syn. by Yasumatsu and Brown, 1951).

Camponotus japonicus: Kim, 1963, p. 104; Kim, 1970, p. 484; Collingwood, 1976, p. 306; 1981, p. 29; Kim, 1986, p. 85; 1987, p. 13; Terayama *et al.*, 1992, p. 38; Kim *et al.*, 1993, p. 127; Kim *et al.*, 1994, p. 301.

Locality. Paengmok, Kwangjŏn, Namsŏn, Jŏpdo.

Distribution. Korea, China, Japan, Burma, and Phillipines.

14. *Camponotus jejuensis* Kim and Kim, 1986 제주왕개미

Camponotus jejuensis Kim and Kim, 1986, p. 139-144.

Camponotus jejuensis: Terayama *et al.*, 1992, p. 39; Kim *et al.*, 1993, p. 127; Kim *et al.*, 1994, p. 301.

Locality. Ssanggye temple.

Distribution. Korea.

Genus 13. *Formica* Linné, 1758 불개미속

Formica Linné 1758, p. 59.

Type species. *Formica rufa* Linné, 1758.

15. Formica fusca Linnaeus, 1758 검정불개미

Formica fusca Linnaeus, 1758, p. 580; Kim, 1986, p. 36.

Formica glebaria Nylander, 1846 (*non* Forel, 1904).

Formica fusca var. *fusca*: Forel, 1874.

Formica fusca fusca var. *pallipes* Kuznetzob-Ugamskij, 1929; Kim, 1987, p. 31; Terayama *et al.*, 1992, p. 37; Kim *et al.*, 1993, p. 128. (syn. nov.).

Locality. Jŏpdo.

Distribution. Korea and Japan.

16. Formica japonica Motschulsky, 1866 곰개미

Formica japonica Motschulsky, 1866, p. 39.

Formica fusca var. *japonica*: Emery, 1909.

Formica fusca japonica: Emery, 1925.

Formica japonica: Teranishi, 1940b, p. 6; Dlussky, 1967, p. 78; Kim, 1970, p. 489; Kim, 1987, p. 35; Terayama *et al.*, 1992, p. 37; Kim *et al.*, 1993, p. 128; Kim and Park, 1994, p. 302.

Locality. Hyangdong.

Distribution. Korea, China, Japan, Taiwan, Sakhalin, Mongolia, Manchuria, Europe, North America, and Africa.

17. *Formica yessensis* Forel, 1901 불개미

Formica truncicola var. *yessensis* Forel, 1901, p. 66.

Formica truncorum var. *yessensis*: Wheeler, 1906.

Formica yessensis: Collingwood, 1976, p. 304; 1981, p. 27.

Formica sp.: Kim and Kim, 1983, p. 129.

Locality. Ch'osang.

Distribution. Korea and Japan.

Genus 14. *Lasius* Fäbrius, 1804 풀잎개미속

Lasius Fäbrius, 1804. p. 415.

Type species: *Formica nigra* Linné, 1781.

18. *Lasius alienus* (Förster, 1850) 누운털개미

Formica aliena Förster, 1896, p. 71.

Lasius alienus: Emery, 1878; Collingwood, 1976, p. 305; 1981, p. 27; Kim, 1986, p. 86; 1987, p. 36, 71 ; Kim *et al.*, 1993, p. 129; Kim *et al.*, 1993, p. 129; Kim *et al.*, 1994, p. 302; Kim and Lim, 1994, p. 119.

Locality. Ch'osang, Songjŏng, Ssanggye temple, Kwangjŏn, Jŏpdo.

Distribution. Korea, China, Japan, Europe, and North America.

19. *Lasius niger* (Linné, 1781) 고동털개미

Formica niger Linnaeus, 1781, p. 580.

Formica niger Linnaeus: Collingwood, 1981, p.27; Kim, 1987, p. 59 ; Terayama *et al.*, 1992, p. 35; Kim *et al.*, 1993, p. 129; Kim and Lim, 1994, p. 120; Kim *et al.*, 1994, p. 302.

Locality. Hyangdong, Ssanggye temple, Ch'ŏngryong.

Distribution. Korea, China, Japan, Sakhalin, Siberia, Europe, and North Africa.

20. *Lasius meridionalis* (Bondroit, 1919) 나도황개미

Formica meridionalis Bondroit, 1919.

Lasius umbratus var. *meridionalis*: Viehmeyer in Emery, 1922.

Lasius rabaud: Wilson, 1955.

Lasius meridionalis: Collingwood, 1981, p. 29; Terayama *et al.*, 1992, p. 36; Kim *et al.*, 1993, p. 129.

Locality. Hyangdong.

Distribution. Korea, Japan, and Europe.

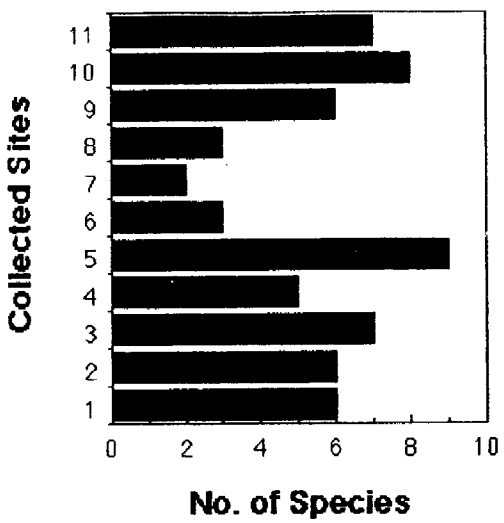

Fig. 1. Relationship between collected sites and number of speiceis.

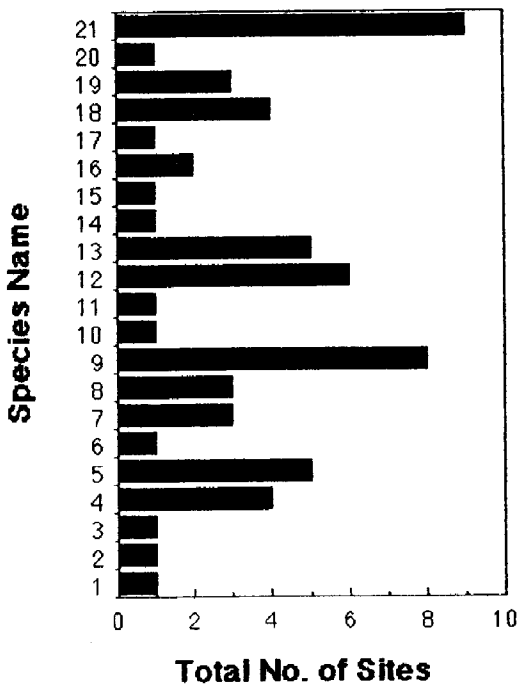

Fig. 2. Relationship between species and total number of collected sites.

Table 1. A list of ants from 11 sites of Chinndo Island.

Species No.	Species Name	Collected Sites 1	2	3	4	5	6	7	8	9	10	11	Total No. of Sites
	PONERINAE												
1	*Brachiponera chinensis*					●							1
2	*Ectomomyrmex javanus*					●							1
	CERAPACHINAE												
3	*Cerapachys humicola*			●									1
	MYRMICINAE												
4	*Aphaenogaster japonica*	●		●		●					●		4
5	*Crematogaster osakensis*		●						●	●	●	●	5
6	*Crematogaster teranishii*					●							1
7	*Monomorium chinense*		●					●				●	3
8	*Pheidole fervida*					●				●		●	3
9	*Pristomyrmex pungens*	●	●			●	●	●	●	●	●		8
10	*Solenopsis japonica*				●								1
11	*Strumigenys lewisi*						●						1
12	*Tetramorium caespitum*	●	●	●	●						●	●	6
	FORMICINAE												
13	*Camponotus japonicus*		●		●				●	●	●		5
14	*Camponotus jejuensis*					●							1
15	*Formica fusca*										●		1
16	*Formica japonica*			●								●	2
17	*Formica yessensis*	●											1
18	*Lasius alienus*	●			●					●	●		4
19	*Lasius niger*			●		●						●	3
20	*Lasius meridiomalis*			●									1
21	*Paatrechina sakurae*	●	●	●	●	●	●			●	●	●	9
	No. of Species	6	6	7	5	9	3	2	3	6	8	7	

Collected sites: 1-Cho'sang, 2-Paengmok, 3-Hyangdong, 4-Songjŏng, 5-Ssanggye temple, 6-Jŏnsŏl, 7-Geumkap, 8-Namsŏn, 9-Kwangjŏn, 10-Jŏpdo, 11-Ch'ŏngryong

Genus 15. *Paratrechina* Motschulsky, 1863 사쿠라개미속

Paratrechina Motschulsky, 1863, p. 13.

Type species. *Formica pygmae* Latreille, 1781.

21. *Paratrechina sakurae* (Ito, 1914) 사쿠라개미

Formica sakurae Ito, 1914, p. 43.

Paratrechina sakurae: Kim, 1963, p. 346; Kim, 1970, p. 486; Collingwood, 1976, p. 306; 1981, p. 29; Kim, 1987, p. 71; Terayama *et al.*, 1992, p. 34; Kim *et al.*, 1993, p. 129; Kim *et al.*, 1994, p. 303.

Locality. Ch'osang, Paengmok, Hyangdong, Songjŏng, Ssangge temple, Jŏnsŏl, Kwangjŏn, Jŏpdo, Ch'ŏngryong.

Distribution. Korea, Japan, and Europe.

DISCUSSION

In all, 21 species were collected in this area, out of 109 species which have been recorded in Korea to date. Therefore it can be said that 19% of the ants from Korea are found on this island.

Table 1 shows the ant species collected from 11 sites of this area. Figures 1 and 2 show the relationships between collected sites and number of species. The most productive sites for sampling were Ssanggye temple, where 9 species were collected; the collecting rate was 43% (9/21 × 100), conversely, Geumgap, Jŏnsŏl, and Namsŏn were the least productive, where just 2, 3, and 3 species, respectively, were found; the collecting rates were 9.5%, 14.3%, 14.3% (2/21, 3/21, 3/21) respectively (Table 1, Figs. 1 and 2).

The dominant species found were *Paratrechina sakure* (9 sites, 82%, 9/11 × 100) *Pristomyrmex pungens* (8 sites, 73%, 8/11 × 100) which were present in 9 and 8 sites. The most rare species were *Brachiponera chinensis, Ectomomyrmex javanus, Cerapachys humicola, Camponotus jejuensis, Solenopsis japonica, Strumigenys lewisi, Lasius meridionalis, Formica fusca,* and *Formica japonica*, which were found in only 1 site, each collection rate of 9% (1/11 × 100).

Unexpectedly *Formica japonica* was collected in only 2 sites and its collection rate was 18% (2/11 × 100), despite that species' dominance in inland sites. Examining all data of this research, no endemic species are found, although the ant fauna of Chindo Island are quite different from that of inland or of other islands, as shown in Figures 1 and 2.

REFERENCES

Bolton, 1987. A review of the *Solenopsis* genus-group and revision of Afrotropical *Monomorium* Mayr (Hym., Formicidae). Bull. Br. Mus. Nat. Hist., **20:** 37-38.

Bondroit, 1919. Les fourmis de France et de Belgique. Ann. Soc. Ent. Fr., 87, PP. 1-174.

Collingwood, C.A., 1976. Ants. Ann. Hist. nat. Mus. Hung., **68:** 296-309.

Collingwood, C.A., 1979. The Formicidae of Fennoscandia and Denmark. Fauna Ento. Scan., **8:** 85-165.

Collingwood, C.A., 1981. Ants (Hym., Formicidae) from Korea 2. Folia Ent. Hung. Rova. Kozle., **42**(24): 25-30.

Drusky, G.M., 1967. Ants of the Genus *Formica*. Izdatelstvo "Nauka" Moscow, 239 pp.

Emery, C.,1878. Catalogo delle formiche esistenti nelle collezioni del Museo di Genova. Parte seconda. Formiche dell'Europa e delle regioni limitrofe in Africa ed in Asia. Ann. Mus. Civ. St. Nat. Genova, **12:** 43-59.

Emery, C., 1893. Hymenoptera in C. Cavanna: Al Vulture ed al Pollino. Bull. Soc. Ent. Ital., **16:** 81-85.

Emery, C., 1893. Vol. VII: Formicidae (Heterogyna) in C.G. de Dalla Torre: Catallogus Hymenopterorum descriptorum systematicus et synonimicus. Lipsia, G. Engelmann, 8, 289pp.

Emery, C.,1893-94. Beiträge zur Kenntniss der nordamecikanischen Ameisenfauna. Zool. Jahr. Abth. Syst., **7:** 633-682, tav. 22, **8:** 257-360.

Emery, C., 1894. Alcune formiche dell'isola di Creta. Proc. Verb. Soc. Ent. Ital., **1894:** 7-10.

Emery, C., 1901. Notes sur less sous-famillesdes Dorylines et Ponerines (Famille de Formicides). Ann. Soc. Ent.. Belg., **45:** 32-54.

Emery, C.,1902. Note mirmecologiche. Renc. Acad. Sci. 1srt. Bologna, (n.s.), **6:** 22-34

Emery, C., 1909. Beiträge zur Monographie der Formiciden des palaeactischen Faunengebites. VIII. *Formica*, Dt. Ent. Zeitschr., pp. 179-203.

Emery, C., 1922. Il genera *Lasius* (F.) Mayr e particolarmente le forme mediterranee del gruppo *umbratus* Nyl. Boll. Soc. Ent. Ital., **54**(1): 1-2.

Emery, C., 1925. Hymenoptera, Formicidae, Formicinae. *In*: Genera Insectorum (ed. M.P. Wytsman), **137:** 1-50.

Fäbricius, J.C., 1804. Systema piezatorum, Brunsvinge Apur Fridericum Reichard, 440 pp.

Forel, A., 1874. Les fourmis de la suisse. Denkschr. Schweiz. Ges. Naturw., **26,** 452 pp.

Forel, A., 1900. Fourmis du Japon. Nids en toile. *Strongylognathus huberi* et voisins. Fourmiliere triple. Cyphomyrmex Wheeleri. Fourmis importees. Mitt. Schweiz. Ent. Ges., **10:** 267-287.

Forel, C., 1901. Formiciden des Naturhistorischen Museums zu Hamburg. Neue Callyptomyrmex Dacryon, Pod omyrma und Echinopla-Arten. Mitt. Nat. Mus. Hamburg, **18**(2): 43-82.

Forel, A., 1912. Quelques fournis de Tokio. Ann. Soc. Ent. Belg., **56:** 339-341.

Förster, A., 1850. Hymenopterologische Studien. Jahresber. hoh. Burgerschule Aachen. I. (Formiccariae), pp. 1-74

Karawajew, W., 1912. Ameisen aus dem Palearctischen Faunen Gebiete. Pyccke. Ent., **3:** 581-596.

Karawajew, W., 1929. Myrmekologische Fragmenter II. Mem. Ac. Sc. Ukraine (math. nat.) **13:** 203-218

Kim, B.J., 1986. A sytematic study of ants in Is. Ullungdo of Korea on the basis of exteranal fine feature. J. Nat. Sci. Wonkwang Univ., **5**(2): 84-94.

Kim, B.J., 1987. A systematic study of the subfamily Formicinae (Hym. Formicidae) from Korea., Ph. D. Thesis, Korea Univ., 45-67.

Kim, B.J. and C.W. Kim, 1983. A review of Myrmicinae ants from Korea on the basis of external fine features (Hym., Formicidae). J. Korea Natn. Acad., **22:** 51-90.

Kim, B.J. and C.W. Kim, 1986. On the new species *Camponotus jejuensis* (n. sp.) from Korea (Hym., Formicidae). Korean J. Ent., **16**(2): 139-144.

Kim *et al.*, 1993, Systematic study of ants from Chejudo province. Korean J. Entomol., **23**(3): 117-141.

Kim *et al.*, 1994. Systematic study on ants from coasts of Korean peninsula (Hym., Formicidae); Korean J. Entomol., **24**(4): 293-309.

Kim B.J. and K.H. Lim, 1994. Systematic study of Korean Lasius ants on the basis of electrophoretic data. Korean J. Entomol., **24**(2): 117-129.

Kim B.J. and J.Y. Park, 1994. Systematic study of Korean Formica ants on the basis of electrophoretic data. Korean J. Entomol., **24**(2): 131-143.

Kim, C.W., 1963. Hymenoptera of Korea. Thes. Hum. Sci. Korea Univ., **6:** 343-345.

Kim, C.W., 1970. Illustrated encyclopedia of fauna and flora of Korea., **11**(3): 463-492.

Kim, C.W. and B.J. Kim, 1982. A taxonomical study of the subfamily Myrmicinae (Formicidae) from Korea. Ann. Rep. Bio. Res of Jeonbug N. Univ., **3:** 95-110.

Kunzetzob-Ugamskiy,1929, N., Die Ameisen des Süd-Ussuri-Gebietes. Zool. Anz., **83:** 16-34.

Linnaeus, C., 1758. Systema Naturae, 10th ed., pp. 553-823.

Lund, 1831. Lerrew sur les habitudes de quelques fourmis de Bresil, adressee Audouin. Ann. Sc. nat. **23:** 113-138.

Mayr, G.L., 1853. Beiträge zur Kenntnis der Ameisen. Verh. zool. bot. Ver. Wien **2:** 100-114.

Mayr, G.L., 1855. Formicina austriaca. Verh. zool. bot. Ver. Wien, **5:** 273-478.

Mayr, G.L., 1866. Diagnosen neuer und wenig gekannter Formiciden. Verh. Zool.-bot. Ges. Wien, **16:** 855-986.

Mayr, G.L., 1867. Formicarium index synonymicus. Verh. zool. bot. Ver. Wien, **6:** 175-114.

Mayr, G.L., 1878. Beiträge zur Ameisenfaunna Asiens. A.B. Ges. B., **28:** 645-657.

Motschulsky, V., 1863. Essai d'un catalogue des insectes del l'île Ceylan. Bull. Mosc. Coc. Nat., **36:** 1-153, 421-42.

Nylander, W., 1846. Adnotations in monographiam Formicarium borealium Europe. Acta. Soc. Sci. Gennz., **2:** 875-944.

Nylander, W., 1856. Synopsis des Formicicides de France et d'Algerie. Ann. Soc. Nat. (zool): 53-74.

Ogata, K., Y. Hirashima, T. Miura, Y. Maeta, K. Yano, and J.K. Ko, 1985. Ants collected in pine forests infested by the pine neddle gall midge in Korea (Hymenoptera, Formicidae), Esakia, Fukuoka, (23) 159-163.

Ogata, K. and B. Bolton, 1989. A taxonomic note on the ant Monomorium intrudens F. Smith (Hymenoptera, Formicidae). Jpn. J. Ent., **57**(2): 459-460.

Santschi, D.F., 1925. Fourmis d'Espagne et autres especes palearctiques (Hymenopt.). Eos **1:** 339-369.

Santschi, D.F., 1930. Nouvelles experiences sur l'orientation des fourmis du genre Tapinoma. Casop, ceskoslav. Spol. ent. **27:** 46-53.

Santschi, D.F., 1937. Quelques fourmis Japonaies ine'dites. Mit. Schweiz Ent. Ges. **18:** 273-275.

Smith, F.,1857, Revision of essay on the British Formicidae. Tr. ent. Soc. London (2) **4:** 274-286.

Smith, F., 1860. Notes and observations on the British aculeate Hymenoptera. Ent. Ann., pp. 34-46.

Smith, F., 1862. Mr. F. Smiths Hymenopterous insects. J. Proc. Linn. Soc. Zool., **6:** 38.

Smith, F., 1874. Description of Tenthredinidae. Formicdae of Japan. Tr. ent. Soc. London, pp. 373-409.

Teranishi, C., 1940a. Distribution of the Oriental species of ants in Japan and Korea. Una. Man. Lef. Teranishi, pp. 31-49.

Teranishi, C., 1940b. On the ants of Korea. Una. Man. Lef. Teranishi, 30 pp.

Terayama *et al.*, 1992. A check list of Ants from Korea, with taxonomic notes. Bull. Toho Gakuen **7:** 19-54.

Westwood, 1841. An introduction to the modern classification of Insects 2, London (1840), Ameisen. pp. 21-2326.

Wheeler, W.M., 1906. The ants of Japan. Bull. Amer. Mus. Nat. Hist. **22:** 324-325.

Wheeler, W.M., 1922. Keys to the genera and subgenera of ants, Bull. Amer. Nus. Nat. Hist., **45:** 631-710.

Wheeler, W.M., 1928. Ants collected by professor F. Silvestri in Japan and Korea. Bull. Lab. Zool., Portici, **21:** 113-121.

Wilson, 1955. A monographic revision of the ant genus *Lasius*. Bull. Mus. Comp. Zool., **113:** 1-201.

Yasumatsu, K., 1962. Notes on synonymies of five ants widely spread in the orient (Hym., Formicidae) Mushi, **36:** 93-97.

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진도산 개미류의 계통분류학적 연구

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요 약

진도는 해남에서 약 40 km 정도 떨어져 있는 상당히 큰 섬으로서 많은 산과 하천이 있고 내륙지역에는 주로 농경지가 많은 특유한 섬이다. 또한 이 지역은 섬이긴 하지만 물사정이 좋아서 동식물들이 서식하기 좋은 지역이다. 저자들은 1994년 7월부터 10월까지 진도지역의 개미류를 채집하여 동정한 결과 4아과 15속 21종이 동정되어 보고한다.