

Systematic Study of Pheidolini (Hymenoptera: Formicidae: Myrmicinae) in Korea

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ABSTRACT Based on specimens of the tribe Pheidolini collected from South Korea, we identified five species under three genera. In this paper we provided the diagnostic characters of these five species and the list of six unconfirmed species recorded in South and North Korea.

Key words : Systematic, Formicidae, Myrmicinae, Pheidolini, Korea

적 요 한국산 Pheidolini족을 정리한 결과 북한의 *Aphaenogaster ruida*와 *Stenamma owstoni*를 포함한 4속 11종을 보고하며, 한국산 Pheidolini족과 각 속에 대한 검색표를 작성하였다.

검색어 : 한국산, 개미과, 두배자루마디아과, 흑개미족, 검색표

It is known that the world fauna of the tribe Pheidolini consists of 510 species in 4 genera. They are generally found under soil and stones, on the grass and on fallen rotten trees. The world fauna of four genera is represented as *Stenamma* 30 species, *Aphaenogaster* 80 species, *Messor* 90 species, and *Pheidole* 300 species.

Teranishi (1940) recorded 4 species for the first time in Korea; *Aphaneogaster schmidti*, *Messor aciculatus*, *Pheidole fervida*, and *P. kwazani*. Kim (1970) redescribed 4 species; *A. famelica*, *P. nodus*, *P. fervida*, and *M. aciculata*. Terayama et al. (1992) recorded 10 species; *A. famelica*, *A. schmidti*, *A. smithi*, *A. tipuna*, *M. aciculatus*, *P. fervida*, *P. indica*, *P. nodus*, *P. pilieri*, *S. owstoni*.

Although the 11 species of Pheidolini are known to be found in Korea, just five species were collected by authors. *A. ruida* and *S. owstoni* are endemic in North Korea.

MATERIALS AND METHODS

Materials for this study were collected in South Korea from 1981 to 1998. The samples were fixed in alcoholic Bouin's solution (150 ml of 80% ethanol, 15 ml of formaldehyde, and 1 g of picric acid) for two

or three days. Samples were moved to 85% ethanol to be preserved. Samples were examined microscopically using the Wild M8 stereo zoom microscope, and identified on comparison with the specimens from Dr. Onoyama in Japan and Dr. Rigato in Italy. Samples were described on the basis of external characters and 6 unconfirmed species were commented in the discussion. The plates of confirmed species were made based on external diagnostic characters, and the key was made of 5 confirmed and 6 unconfirmed species, following the system of Myrmecological Society of Japan (1992). Since most of specimens were worker caste, all informations were based on workers.

The abbreviation used in systemic account are as follows: CCB (Ch'ungch'ongbuk-do), CCN (Ch'ungch'ongnam-do), CJ (Cheju-do), CLB (Ch'ollabuk-do), CLN (Ch'ollanam-do), KB (Kyöngsangbuk-do), KG (Kyönggi-do), KN (Kyöngsangnam-do), KW (Kangwon-do), NK (North Korea).

SYSTEMATIC ACCOUNT

Tribe Pheidolini Emery, 1877 흑개미족
Type genus : *Pheidole* Westwood, 1839: 219.

Key to genera of Pheidolini

1. Antennal club composed of 3 segments and as

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- long as sum of other segments or longer *Pheidole*
 - Antennal club with 4 segments or indistinct 2
 2. Head more or less angled, head ventrally with long and thick setae; propodeal spines absent *Messor*
 - Head oval, head ventrally often with hair, but never with setae; propodeal spines present 3
 3. Antennal scapes long well beyond posterior margin of head in full-face view; petiolar node strongly raised *Aphaenogaster*
 - Antennal scapes shorter, at most slightly exceeding posterior margin of head in full-face view; petiolar node lower and less-strongly raised *Stenamma*

Genus 1. *Aphaenogaster* Mayr, 1853 장다리개미속

Type species : *Aphaenogaster sardoa* Mayr, 1853: 107.

Key to species of *Aphaenogaster*

1. In frontal view the head round posteriorly; middle tibia longer than head width; head more gently rounded behind the eye 2
- In frontal view the head with more straight posterior margin; middle tibia subequal to or shorter than head width 3
2. Propodeal spines broad basally and acute apically *famelica*
 - Propodeal spines long and stout *ruida*
3. Dorsal surface of pronotum smooth and shining *schmidti*
 - Dorsal surface of pronotum punctures and feeble striae 4
4. Body brown to dark brown and concolorous posterior portion of head and pronotal dorsum covered with punctures and opaque; shoulder of pronotum angulate; propodeal spines rather thick; dorsum of pronotum partly covered with weakly developed transverse striae *japonica*
- Body bicolorous, with reddish brown and dark brown; posterior portion of head and pronotal dorsum with superficial punctures and shining; shoulder of pronotum not angulate; propodeal spines thin *tipuna*

1. *Aphaenogaster japonica* Forel 일본장다리개미

Aphaenogaster schmitzi japonica Forel, 1911: 267.

Aphaenogaster (Attomyrma) syriaca japonica Emery, 1921: 60

Aphaenogaster (Attomyrma) smythiesi japonica

Wheeler, 1928: 101; Terayama et al., 1992: 26; Kim et al., 1993: 122; Kim et al., 1996: 122.

Previous Records : KG Kanghwado, Kyongsöng, Namsan, Tójokdo; KW Mankyöngdae, Naksansa, Söraksan, Tonghae; CCB Ch'ongju, Sobakesan, Songnisan, Woraksan; CCN Kyeryongsan; CLB Naejangsan, Tókyusan; CLN Hongdo, Odongdo K mundo, Pikúndo, Wando, Yudalsan; KB Kómosan, Sanju; KN Hansando, Kójedo, Namhaedo, Pusan, Yokchido; CJ Hallasan (Choi et al., 1993).

Localities of the Specimens Collected : KG Manguri, Kanghwado, Kimp'o, Koyang, Puk'ansan, Sihng; KW Ch'aksan, Kach'ibong, Kyebangsan, Paekdamsa, Söraksan; CCB Sobaeksan; CCN Kyeryongsan, S daesan, Sud ksa; CLB Chirisan, Ch'ónhosan, Iksan, Kaeamsa, Koch'ang, Kunsan, Kóm-sansa, Maisan, Moaksan, Muju, Naejansan, Och'öngdo, Sasöndae, Sónunsa, Tókyusan; CLN Changdo, Chöpdo, Daejin, Hajodo, Hwaomsa, Mudöngsan, Paegyangsa, Sónamsa, Ssanggyesa, Wando; KB Chikchisa, Naeyönsan, P'algonsan; KN Kayasan, Mukdo, Pokwangsa, Unmunsan, Yongmunsan, CJ rimok, Sóngpanak.

Specimens Examined : Och'öngdo (5.VIII.1993, Park).

Diagnostic characters : Total length of workers around 3~5 mm. Body color dark to light-brown; legs dark brown to dark yellowish brown. Scapes, mesosoma and legs relatively rather short compared to other Japanese *Aphaenogaster* species. Posterior border of head flat in frontal view. Occipital area opaque, covered with punctures. Dorsal surface of pronotum predominantly punctate medially, and with feeble, transverse marginal striae. Pronotal humeri angulate. Mesonotum distinctly raised, sometimes higher than pronotum and forming an angulate convexity covered with punctures and striae. Lateral areas of mesopleurae covered with punctures. Propodeal spines broad, their apices acute.

Remark : The ant is found on the plains of Korea, nesting in the soil or under stones in woodland or its margins. It has the dorsal surface of the pronotum almost completely transversely striate.

2. *Aphaenogaster tipuna* Forel 티푸나장다리개미

Aphaenogaster rothneyi tipuna Forel, 1913: 195.

Aphaenogaster (Attomyrma) rothneyi tipuna Emery, 1921: 59.

Aphaenogaster tipuna Santchi, 1937; Hung, Imai & Kubota, 1972: 1024; Terayama et al., 1992:

56; Kim et al., 1996: 123

Previous Records : CCN Wonsando; CLN Chindo, Ch'ongsando, Kómundo, Píkúndo, Pogildo, Soando, Taeh ksando, Wando (Choi et al., 1993)

Localities of the Specimens Collected : CCN Changhang; CLB Kunsan, Munyúdo, Myrúksan, Och'óngdo.

Specimens Examined : Kunsan (8.IV.1994, Park)

Diagnostic characters : Total length of workers around 3~5.5 mm. Head and mesosoma reddish brown; gaster dark brown. Scapes, mesosoma and legs relatively rather short compared to other species. Posterior border of head flat. Occipital area smooth and shining, covered with shallow punctures. Pronotum shining, with shallow punctures and feeble striae; humeri not angulate. Mesonotum raised but lower than pronotum, forming an angulate convexity covered with striae and punctures. Lateral portions of mesopleurae covered with reticulation and punctures. Propodeal spines slender.

Genus 2. *Messor* Forel, 1890 꽁구개미 속

Type species : *Formica barbara* Linnaeus, 1767: 962.

3. *Messor aciculatus* (Fr. Smith) 꽁구개미

Aphaenogaster aciculata Fr. Smith, 1874: 405; Teranishi, 1940: 4; Imai, 1966: 119; Onoyama, 1982: 325.

Stenamma (Messor) aciculatum var. *brunneicornis* Forel, 1901: 60

Stenamma (Messor) aciculatum Wheeler, 1906:

Aphaenogaster (Attomyrma) aciculata Emery, 1921: 57

Messor aciculatum Teranishi, 1925

Messor aciculatus Wheeler, 1928: ?; Kim, 1963: 343; Kim, 1970: 475; Collingwood, 1976: 303; Kim & Kim, 1982: 101; Kim & Kim, 1983: 73; Kim et al., 1993: 123; Kim et al., 1994: 298

Previous Records : NK Wonsan sea shore (Collingwood, 1976); KG Kanghwado, Namsan, Seoul, Suwon; KW Sóraksan; CCB Ch'ónju, Sobaeksan, Woraksan; CCN Kyeryongsan, Wonsando; CLB T kyusan; CLN Odongdo; KB Mangyangjóng, nyang, Shinkwang-myón, Songdo, Songnisan, Sóngyugul, KN Chirisan, Ch'ungmu, Hansando, Kójedo, Mae-muldo, Namhaedo, Pusan, Sayangdo, Yokchido; CJ Hallasan (Choi et al., 1993)

Localities of the Specimens Collected : KG Hwangsán, Shihyéng, Kangch'on, Kwangju, Iwangu, Wangbangsan; KW Kariwangsán, Kyebangsán,

P'yöngch'ang; CCN Ch'unjangdae, Kyeryongsan, Sudúksa; CLB Iksan, Kúmsansa, Moaksan, Nae-sosa, Óch'óngdo, Sasendae, Unjangsan; CLN Ch'óngsando, Hwáomsa, Kókúndo, Odongdo, Paegyangsa, Pogildo, Tolsando; KN Chinju; CJ Kirinorúm, Kwanúmsa, Sehwa.

Specimens Examined : Ch'ónsando (15.V.1998, Park).

Diagnostic characters : Total length of workers around 4~5 mm. Body color black. Head slightly longer than broad. Antennal scape slightly surpassing posterior border of head. Long hairs absent from ventral surface of head, those present about as long as other body hairs. Metanotal groove rather deeply impressed and distinct both dorsally and laterally. Dorsal- and declivitous faces of propodeum almost straight in lateral view, meeting at an angle of about 120 degrees, the junction rounded, without spines. Petiolar node nearly triangular in lateral view; postpetiolar node rounded. Tibial spurs of middle and hind legs simple. Almost all surfaces of body from mandibles to postpetiole rugose; the gaster entirely smooth and shining. Yellowish-white setae rather abundant over nearly the whole body.

Remark : This species is very similar to the related genus *Aphaenogaster*, and is distinguished by its wide head, the strongly curved external mandibular margins and the presence of long hairs on the ventral surface of the head. This species nest in grasslands and open places such as roadsides. The nest entrances open directly at the ground surface, often with surrounding mounds of crater-like form. These are harvester ants, which convey seeds as main food into the nests. *M. aciculatus* (Fr. Smith) alone is known from Korea. This species is monomorphic and peculiar in lacking a psammophore on the ventral surface of the head.

Genus 3. *Pheidole* Westwood, 1839 흑개미 속

Type species : *Atta providens* Sykes, 1835: 103.

Key to species of *Pheidole*

1. Antero-ventral margin of head in major (soldier) medially with 3 conspicuous, closely-approximate processes; in minor (worker), head with occipital margin flat in full-face view, posterior portion of frons distinctly sculptured 2
- Anteroventral margin of head in majors either without medial processes or with lower, less-approximate processes; in minors, head posteri-

- orly rounded in full-face view, posterior portion of frons smooth and shining 3
 2. Antennal scapes in majors relatively long, each measuring approximately 2/3 head length; mesonotum in minors more or less raised *fervida*
 - Antennal scapes in majors relatively short, each measuring approximately 1/2 head length; mesonotum in minors not raised, fused with pronotum into a single entity; head in majors as wide as long; clypeus in minors without a median carina *pieli*
 3. Postpetiole in both majors and minors larger than petiole *noda*
 - Postpetiole in both majors and minors smaller than petiole; in majors, posterior portion of head sculptured; in minors, mesonotum and anterior part of propodeum more or less raised *indica*

4. *Pheidole fervida* Fr. Smith 극동혹개미

Pheidole fervida Fr. Smith, 1874: 406; Forel, 1900: 285; Teranishi, 1940: 4; Ogata, 1982: 195; Imai, 1966: 119.

Pheidole fervida var. *kawazana* Teranishi, 1940; ?; Kupyanskaya, 1990: 124.

Pheidole fervida; Kim, 1963: 344; Kim, C. 1970: 477; Collingwood, 1976: 302; Kim & Kim, 1983: 71; Terayama et al., 1992: 27; Kim et al., 1993: 124; Kim et al., 1994: 299; Park, 1995: 49; Kim et al., 1995: 105; Kim et al., 1996: 122.

Previous Records : NK Kaeśong, Pakyon-Pokpo, Sagampo, Kōmgangsan, Pyōngyang, Sōkwangsa (Teranishi, 1940); KG Kanghwado, Seoul; KW Sóraksan; CCB Songnisan, Woraksan; CCN Ker-yongsan; CLB Chirisan; CLN Namhaedo, Naejangsan, Odongdo; KN Hansando, Kójedo, Yokchido; CJ Hallasan (Choi et al., 1993).

Localities of the Specimens Collected : KG Dök-chökdö, Kanghwado, Kwangréung, Mutđo, Shihüng; KW Chómpongsan, Chiákson, Hankyéong, Kap-ch'ón, Kariwangsang, Kyebangsang, Kyech'on, Nak-sansa, Odaesan, Paekdamsa, P'yóngch'ang, Sokye-bangsang, Sóraksan, Ullüngdo, Yulchön; CCB Yǒng-dong, Sobaeksan; CCN Ch'ilgapsan, Kwangdóksan, Kyeryongsan, Much'angp'o, Sudóksa, Taejón; CLB Chirisan, Iksan, Koch'ang, Kunsan, Kúmsansa, Maisan, Mirük-san, Moaksan, Muju, Naejansan, Óch'ongdo, Sónunsa, Tókyusan; CLN Changdori, Ch'uwolsan, Daejin, Wando, Mudúngsan, Odongdo, Paegyangsa, Sónamsa, Ssanggyösa; KB Chikchisa, Naeyönsan; KN Kayasan, Kójedo, Pokwangsa,

Unmunsan, Yongmunsan; CJ Chejushi, Hyópjae, Namwon, Yōngp'yōng, Sōngpanak.

Specimens Examined : Odongdo (29.IV.1994, Park).

Diagnostic characters : Total length of body around 3.5 mm in soldiers, around 2.5 mm in workers. Body color yellowish brown to reddish brown, gaster sometimes darker. In soldiers: gular dentition with 3 median projections; antennal scapes reaching back 2/3 the length of the head; pronotum and mesonotum usually separately raised, the mesonotal convexity variable. In workers: posterior portion of head flat and sculptured; antennal scapes exceeding posterior corners of head; mesonotum more or less raised; remaining features as given for soldier.

Remark : The gular dentition of the soldiers and the shape of the posterior part of the head in workers of *P. fervida* are similar to those of *P. pieli*, but is distinguishable from *P. pieli* by the shape of its mesonotum. Nests in rotting wood or under stones on the forest floor.

5. *Pheidole noda* Fr. Smith 흑가미

Pheidloe nodus Fr. Smith, 1874: 407; Forel, 1900: 268; Ogata, 1982: 196.

Pheidole nodus : Kim, 1963: 344; Kim, 1970: 476; Kim & Kim, 1983: 69; Terayama et al., 1992: 27; Kim et al., 1993: 125; Kim et al., 1996: 123

Previous Records : KG Seoul; KW Sóraksan; CCB Songnisan, Woraksan; CCN Kayasan, Kyeryongsan, Wonsando; CLB Chirisan, Naejangsan; CLN Odongdo, Paekyongsang, Pígümäo, Sónamsa, Yudalsan; KB Ullüngdo; KN Ch'ooongmu, Hansnado, Kójedo, Namhaedo, Pusan, Sarayngdo, Yokchido; CJ Hallasan (Choi et al., 1993).

Localities of the Specimens Collected : CJ Hyópjae, Namwon, Sögwp'o, Sóngsan.

Specimens Examined : Namwon (13.V.1992, Kim)

Diagnostic characters : Total length of body around 4.5 mm in soldiers, around 3 mm in workers. Head and gaster blackish brown, remainder reddish brown. In soldiers: gular dentition with paired lateral projections and obscure median projections; postpetiole larger than petiole. In workers: posterior portion of head rounded, with more or less distinct occipital carina.

Remark : This species is easily distinguished from other Korean *Pheidole* species by its large postpetiole. Found in open land and woodland or its margins. Colonies are large. Soldiers dissect

Table 1. Species composition of Pheidolini in the Korean peninsular

	KG	KW	CCB	CCN	CLB	CLN	KB	KN	CJ	NK
<i>A. famelica</i>	●	●	●	●	●	○	○	○	●	●
<i>A. ruida</i>										●
<i>A. schmidti</i>	●									
<i>A. japonica</i>	○	○	○	○	○	○	○	○	○	
<i>A. tipuna</i>				○	○	○	○	○	○	
<i>M. aciculatus</i>	○	○	●	○	○	○	●	○	○	
<i>P. fervida</i>	○	○	○	○	○	○	○	○	○	
<i>P. indica</i>				●	●	●	●	●	●	
<i>P. nodia</i>	○		○	○	○	○	○	○	○	
<i>P. piliei</i>										●
<i>S. ousontsi</i>										●●

○ : Localities of the specimens collected, ● : Reference records only

Table 2. Comparative diversity of tribe Pheidolini between world and Korea

	Total no. of species	No. of Aphaenogaster	No. of Messor	No. of Pheidole	No. of Stenamma
World	510	80	90	300	30
Korea	11	5	1	4	1
(South Korea)	(9)	(4)	(1)	(4)	(0)
(North Korea)	(6)	(2)	(1)	(2)	(1)
%	2.16	6.25	1.11	1.33	3.33

large food items and defend the nest and surrounds. The presence of hostile ants does not influence soldier production.

DISCUSSION

The total species of the Pheidolini in the Korean peninsular are 11 species of 4 genera including the 5 species of 3 genera confirmed and redescribed by authors and the 6 unconfirmed species of 3 genera; *A. famelica* (Collingwood, 1981), *A. ruida* (Terayama et al., 1992), *A. schmidti* (Teranishi, 1940), *P. indica*, *P. piliei* (Choi et al., 1983), *S. ousontsi* (Collingwood, 1976). Among them *A. ruida* and *S. ousontsi* were found only in North Korea (Table 1). The key of Pheidolini was made of not only confirmed species by authors, but also unconfirmed species, reported in references. The total species of Pheidolini in the world are 510 species of 4 genera, but 11 species of 4 genera, 2.16% are found in Korea peninsular (Table 2).

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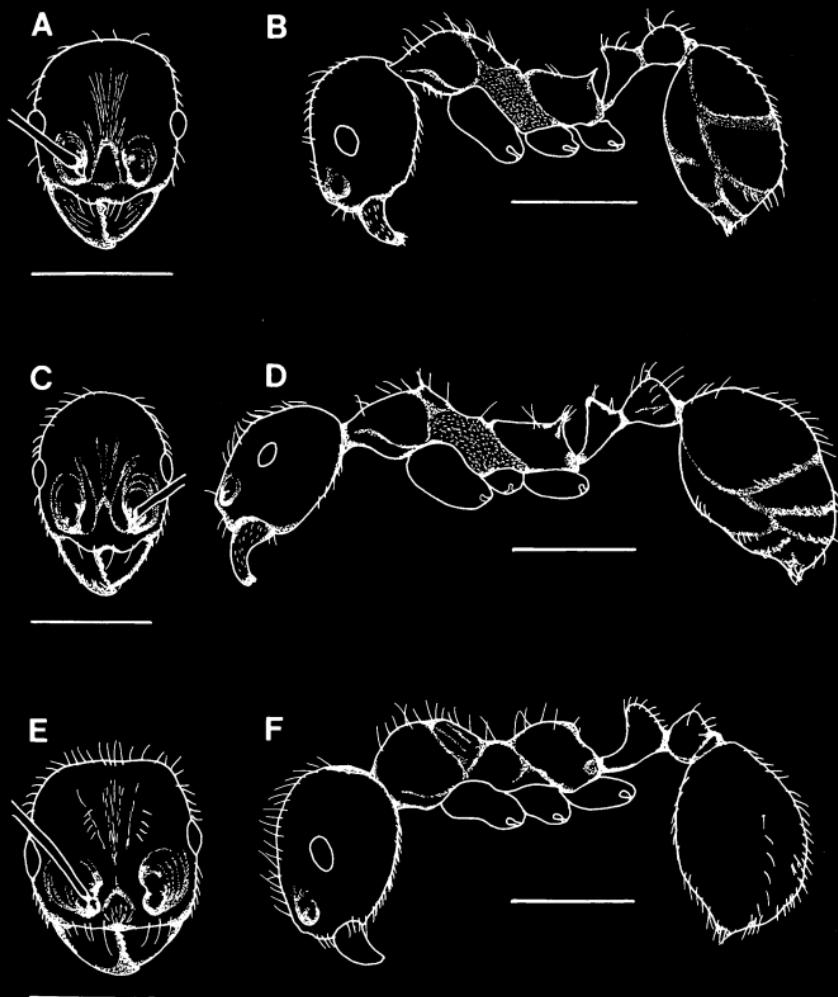


Fig. 1. A: Head of *Aphaenogaster japonica*, B: Profile view of *A. japonica*, C: Head of *A. tipuna*, D: Profile view of *A. tipuna*, E: Head of *Messor aciculatus*, F: Profile view of *M. aciculatus* (Scale : 1 mm).

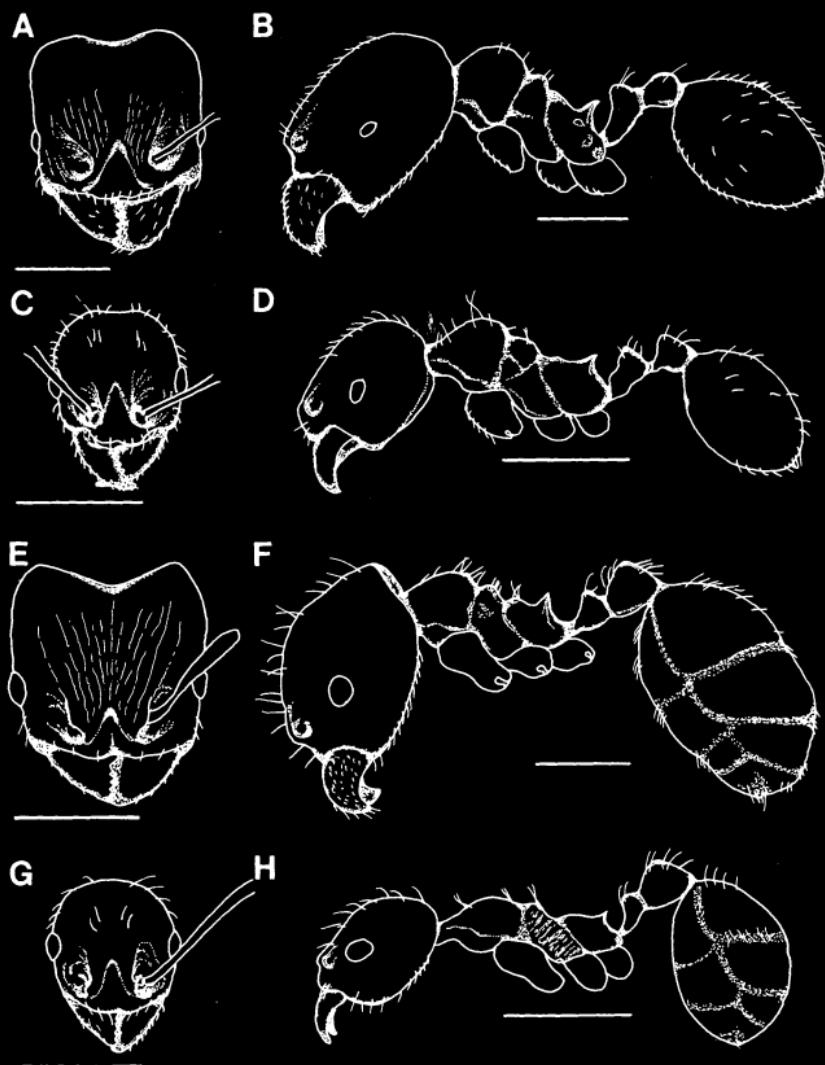


Fig. 2. A: Head of *Pheidole fervida* (S), B: Profile view of *P. fervida* (S), C: Head of *P. fervida* (W), D: Profile view of *P. fervida* (W), E: Head of *P. noda* (S), F: Profile view of *P. noda*, S, G: Head of *P. noda* (W), H: Profile view of *P. noda* (W) (S: soldier, W: worker; Scale: 1 mm).