

# Morphological comparison of the male genitalia of *Formica fusca* group (Hymenoptera: Formicidae) in Korea

Min-Soo Dong<sup>1</sup>, Sam-Kyu Kim\*

<sup>1,\*</sup> Department of Applied Biology, Kangwon National University, Chuncheon 24341, Korea

## Abstract

Taxonomic significance of male genitalia have well known in many insects but largely ignored in ant taxonomy due to collecting difficulties of male. Nevertheless, recent studies showed that genitalic structure of male ant can be a good diagnostic character in species level, no attempt has been made on Korean ant using male genitalia. We were able to make many collections accompanying with males, rendering it to examine male genitalia in detail for the first time in Korea. As the beginning of the study of male genitalia of Korean ants, we provide morphological comparison between *Formica fusca* Linnaeus, 1758, *F. hayashi* Terayama & Hashimoto, 1996 and *F. japonica* Motschoulsky, 1866, in genitalic structure. Significance of male genitalia in Korean ant taxonomy is discussed. Photographs and description of male ants are provided in this study.

Key words: Ant, Formicidae, Genitalia, Taxonomy, Morphology

## Introduction

The ants belonging to *Formica fusca* species group are black-colored ants commonly found throughout Europe as well as parts of Southern Asia and Africa. It is generally very difficult to distinguish them from each other due to their high degree of morphological similarities. For this reason, many myrmecologists are struggling to identify them at the species level. As part of this effort, recent attempts have been made to use the male genitalia for taxonomic purposes. Therefore, we explored distinct characters from male genitalia of *Formica fusca* group known from Korea for the first time. We provides detailed images of male genitalia and characters for all species known from Korea in this study.

## Systematic accounts

Family Formicidae Latreille, 1809

Subfamily Formicinae Latreille, 1809

Tribe Formicini Latreille, 1809

Extant genera included: *Alloformica*, *Bajcaridris*, *Cataglyphis*, *Formica*, *Iberoformica*, *Polyergus*, *Proformica*, *Rossomyrmex*

Type-genus: *Formica* Linnaeus, 1758

Genus *Formica* Linnaeus, 1758

Type-species: *Formica rufa* Linnaeus, 1761

*Formica fusca* Linnaeus, 1758

**Diagnostic characters:** Numerous setae entirely covered mesoscutum (Fig. 1A). Petiole in lateral view relatively short (Fig. 3A). Apex of basimere slightly concave, not angulate (Fig. 3B); telomere in lateral view distinctly longer than high, with very short setae; post-dorsal margin of telomere curved abruptly; ventral margin of telomere slightly concave (Fig. 3B). Pygostyle digitiform entirely hairy with a single distinctly long seta (Fig. 3C). Digitus in lateral view claw-shaped, apex pointed; basal projection of cuspis well-developed, elongated; post-dorsal margin of valviceps round. Posterior margin of abdominal tergum IX straight in posterodorsal view (Fig. 4C).

**Remarks:** This species was previously known as *F. lemani* in Korea but we treated this species as a misidentification of *Formica fusca* by the following characteristics: 1. No more than 6 erect hairs (Radchenko, 2005) on the pronotum of worker. 2. Workers with less than 3 hairs in mid femur. However, according to Dlussky and Pisarski (1971), there are some variable individuals without any setae on the pronotum, which requires close examination. This species is common in mountainous highlands of more than 1000 meters.

*Formica hayashi* Terayama & Hashimoto, 1996

**Diagnostic characters:** Sparse setae on mesoscutum posteriorly, absent anteriorly (Fig. 1B). Petiole in lateral view reverse V-shaped (Fig. 3D). Apex of basimere slightly concave (Fig. 3E); telomere in lateral view distinctly longer than high, with very short setae; post-dorsal margin of telomere curved gradually; ventral margin of telomere slightly concave (Fig. 3E). Pygostyle digitiform entirely hairy with a single distinctly long seta (Fig. 3F). Digitus in lateral view claw-shaped, apex pointed; basal projection of cuspis well-developed, sharp; post-dorsal margin of valviceps round. Posterior margin of abdominal tergum IX trapezoid-shaped in posterodorsal view (Fig. 4F).

**Remarks:** Worker of this species can be distinguished from the morphologically similar species, *F. japonica* by the following characteristics: 1. posterolateral corners of head rounded in frontal view, 2. antennal scape long. 3. Absence of erect hairs on the 2<sup>nd</sup> gastral tergites excepting a row of hairs on the posterior margin (Terayama & Hashimoto, 1996). This species is common in mountainous areas, especially in Baekdudaegan.

*Formica japonica* Motschoulsky, 1866

**Diagnostic characters:** Many setae on mesoscutum posteriorly, absent anteriorly (Fig. 1C). Petiole in lateral view reverse V-shaped, apex blunt (Fig. 3G). Apex of basimere distinctly concave (Fig. 3H); telomere in lateral view distinctly longer than high, with very short setae; post-dorsal margin of telomere curved gradually; ventral margin of telomere slightly concave, almost straight (Fig. 3H). Pygostyle digitiform entirely hairy with a couple of long setae (Fig. 3I). Digitus in lateral view claw-shaped, apex pointed; basal projection of cuspis relatively gently projected, not acute; post-dorsal margin of valviceps round. Posterior margin of abdominal tergum IX convex in posterodorsal view (Fig. 4I).

**Remarks:** This species is the most common species in this group. Easy to see even in the city area.



Figure 1. Mesoscutum of male *Formica fusca* group in Korea (A-C); *F. fusca* (A), *F. hayashi* (B), *F. japonica* (C). Scale bar: A,B,C = 1 mm



Figure 2. Workers of *Formica fusca* group in Korea (A-C); *F. fusca* (A), *F. hayashi* (B), *F. japonica* (C).

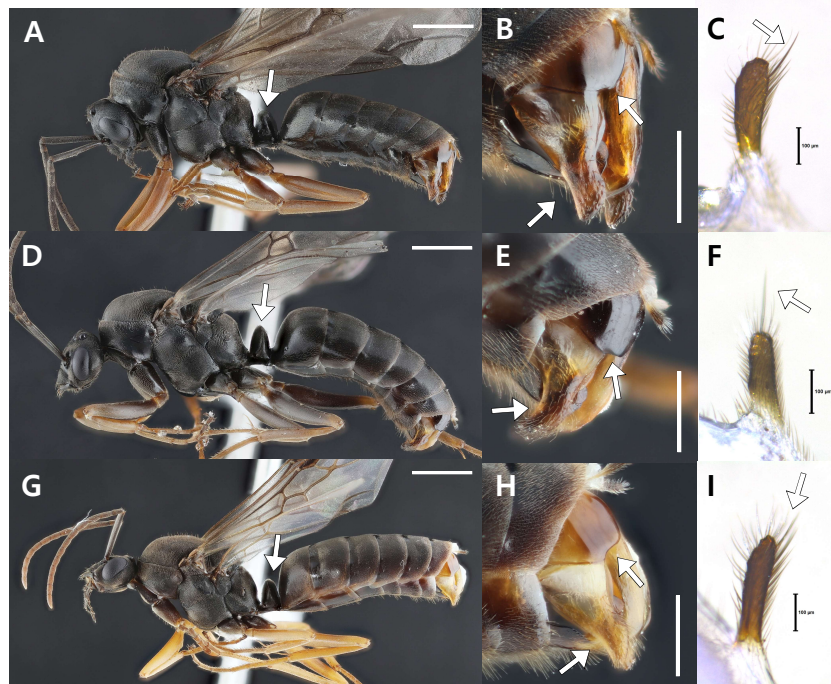


Figure 3. Morphological comparison of male *Formica fusca* group in Korea (A-I); *F. fusca* (A,B,C), *F. hayashi* (D,E,F), *F. japonica* (G,H,I). Lateral view of male, Lateral view of genital capsule and pygostyle, respectively. Scale bar: A,D,G = 2mm, B,E,H = 1mm

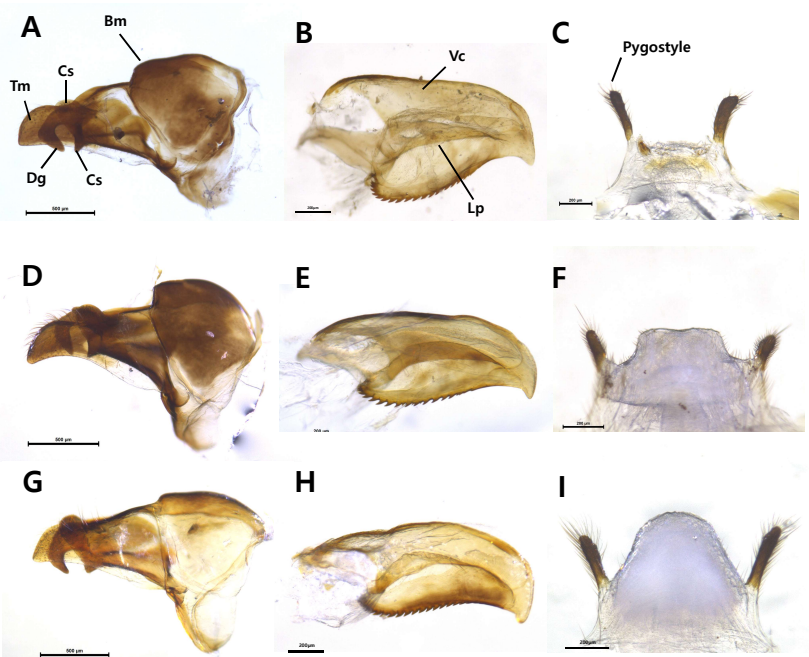


Figure 4. Dissected genitalia of *Formica fusca* group in Korea (A-I); *F. fusca* (A,B,C), *F. hayashi* (D,E,F), *F. japonica* (G,H,I). Paramere and volsella, penisvalva and abdominal tergum IX with pygostyle, respectively. Bm basimere, Cs cuspis, Dg digitus, Lp lateral apodeme of penisvalva Vc valviceps