

## TAXONOMY AND DISTRIBUTION OF *FORMICA DUSMETI* EMERY, 1909 AND OF *F. FRONTALIS* SANTSCHI, 1919 (HYMENOPTERA, FORMICIDAE)

A. Tinaut (\*) and M<sup>a</sup>. D. Martínez-Ibáñez (\*\*)

### ABSTRACT

In the present work, we indicate the distribution of and taxonomic differences between *Formica dusmeti* and *Formica frontalis* (stat. n.). Morphological differences include a total absence of hairs in *F. dusmeti* as opposed to uniformly scattered hairs in *F. frontalis*. These two species have similar coloration and hairless scapes and eyes.

In addition, we describe the male and female of *F. frontalis*, a species that was considered until now to be a subspecies of *F. truncorum*. We consider *F. frontalis* to be a separate species from *F. truncorum*, differentiated by a lack of hairs on the eyes, scapes and genae in the workers of the former. The males of *F. frontalis* are distinguished from *F. truncorum* by hairless eyes and scapes.

Finally, a key has been formulated for the workers in the *rufa*, *sanguinea* and *exsecta* groups of the genus *Formica* in the Iberian Peninsula.

**Key Words:** Taxonomy, Distribution, *Formica frontalis*, *F. dusmeti*, Hymenoptera, Formicidae.

### RESUMEN

#### Taxonomía y distribución de *F. dusmeti* Emery, 1909 y de *F. frontalis* Santschi, 1919 (Hymenoptera, Formicidae)

En este trabajo se señalan las diferencias existentes entre *F. dusmeti* y *F. frontalis* (stat. n.) y su distribución. Estas diferencias estriban en la ausencia total de quetas en *F. dusmeti* y la presencia de numerosas quetas uniformemente distribuidas en *F. frontalis*. Estas dos especies presentan en común la coloración y la ausencia de quetas en escapo y ojos.

Describimos el macho y la hembra de *F. frontalis*, especie que era considerada hasta ahora como subespecie de *F. truncorum*. En este artículo la elevamos a especie y la diferenciamos de *F. truncorum* por la ausencia de quetas en los ojos, escapos y genas de las obreras. Los machos se diferencian también por la ausencia de quetas en ojos y escapos.

Por último se realiza una clave para las obreras de la Península Ibérica de las especies de *Formica* de los grupos *rufa*, *sanguinea* y *exsecta*.

**Palabras clave:** Taxonomía, distribución, *Formica frontalis*, *F. dusmeti*, Hymenoptera, Formicidae.

### Introduction

The genus *Formica* Linnaeus, 1758 contains over 150 species worldwide and its taxonomy leaves much to be resolved. This genus is subdivided

variously, depending on the author, into subgenera (Wheeler, 1913) or species-groups (Creighton, 1950; Collingwood, 1979; Agosti, 1989). In all of these systems, the group *rufa* is one of the most problematic to categorize. This group holds around 50

\* Departamento de Biología Animal y Ecología. Universidad de Granada. 18071 Granada

\*\* Departamento de Biología Animal. Universidad Complutense de Madrid. 28040 Madrid.

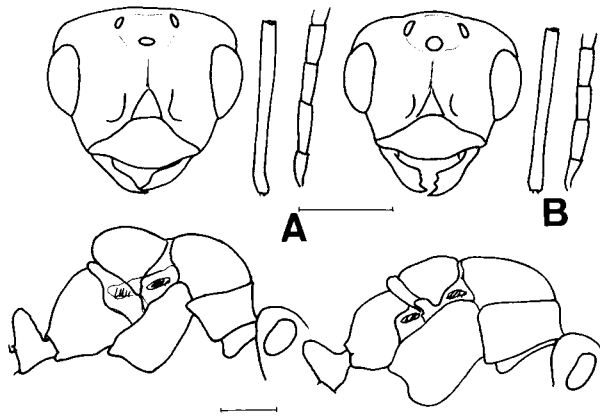


Fig. 1.— Head, scape, funiculus and thorax of the male of A: *F. frontalis* and B: *F. truncorum*. (scales = 1 mm).

Fig. 1.— Cabeza, escapo, funículo y tórax del macho de A: *F. frontalis* y B: *F. truncorum*. (escalas = 1mm).

species distributed preferentially in boreal regions (Bolton, 1995).

*Formica dusmeti* was described as a subspecies of *F. rufa* Linnaeus, 1758 by Emery (1909) on the basis of three workers collected in Peñalosa (sic!) (Peñalara ? in Spain). Bondroit (1918) gave this ant species status, citing the absence of hairs on the eyes, head and thorax, characters previously pointed out by Emery (1909). Later, Bondroit (1920) described the female using a specimen from the Sierra de Guadarrama (Spain). This description appears to have escaped the notice of Santschi (1932a), given that this author again described the female, this time with material from Soure (Portugal), adding a very brief commentary on the male. In some cases, his descriptions are too brief, and, furthermore, he considers *F. dusmeti* to be a subtype of *F. truncorum*, as *F. frontalis*, and perhaps thereby starting a confusion between the three species.

*Formica frontalis* was described as a variety of *F. truncorum* Fabricius, 1804 by Santschi (1919) on the basis of specimens from Pozuelo de Calatrava (Spain). The characters which were used to distinguish the former were: “a dark spot in the frontal region, gaster darker, almost black, finer pilosity on the gaster, with hairs longer and somewhat more scattered than in the species type”. Currently *F. frontalis* is considered to be a subspecies of *F. truncorum* (Bolton, 1995).

The keys prepared for formicids of the Iberian Peninsula by Collingwood (1978) cover 9 species for the *rufa* group and other closely related ones (*sanguinea* and *exsecta*). These include *F. dusmeti*

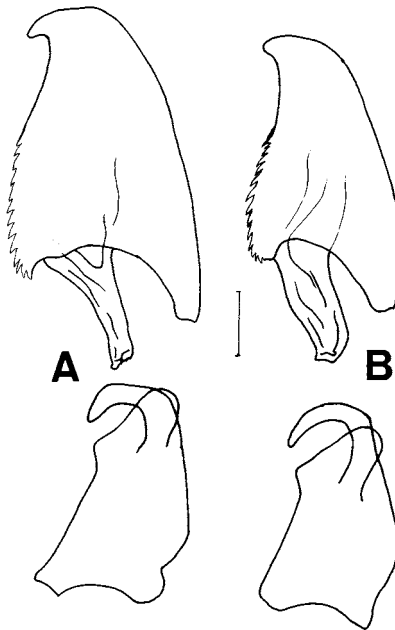


Fig. 2.— Sagitta, volsella and lacinia of the male of A: *F. frontalis* and B: *F. truncorum*. (scale = 0.25 mm).

Fig. 2.— Sagitta, volsella y lacinia del macho de A: *F. frontalis* y B: *F. truncorum*. (escala = 0,25 mm).

but not *F. truncorum* or *F. frontalis*. In a previous work by Collingwood and Yarrow (1969), again only *F. dusmeti* is mentioned, stating that this ant “is the Iberian counterpart of the Eurasian *F. truncorum*....” A few lines later appears the statement, “*F. dusmeti* is very much less hairy than *truncorum*,” suggesting that the two species (*F. dusmeti* and *F. frontalis*) were confused as one.

In the present study, we seek to clarify the differences between *F. frontalis* and *F. dusmeti*. In addi-

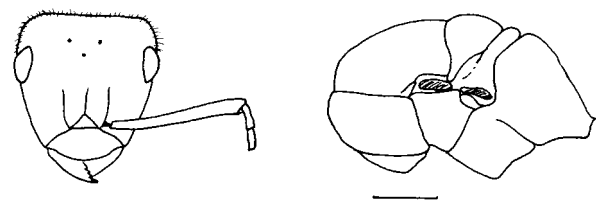
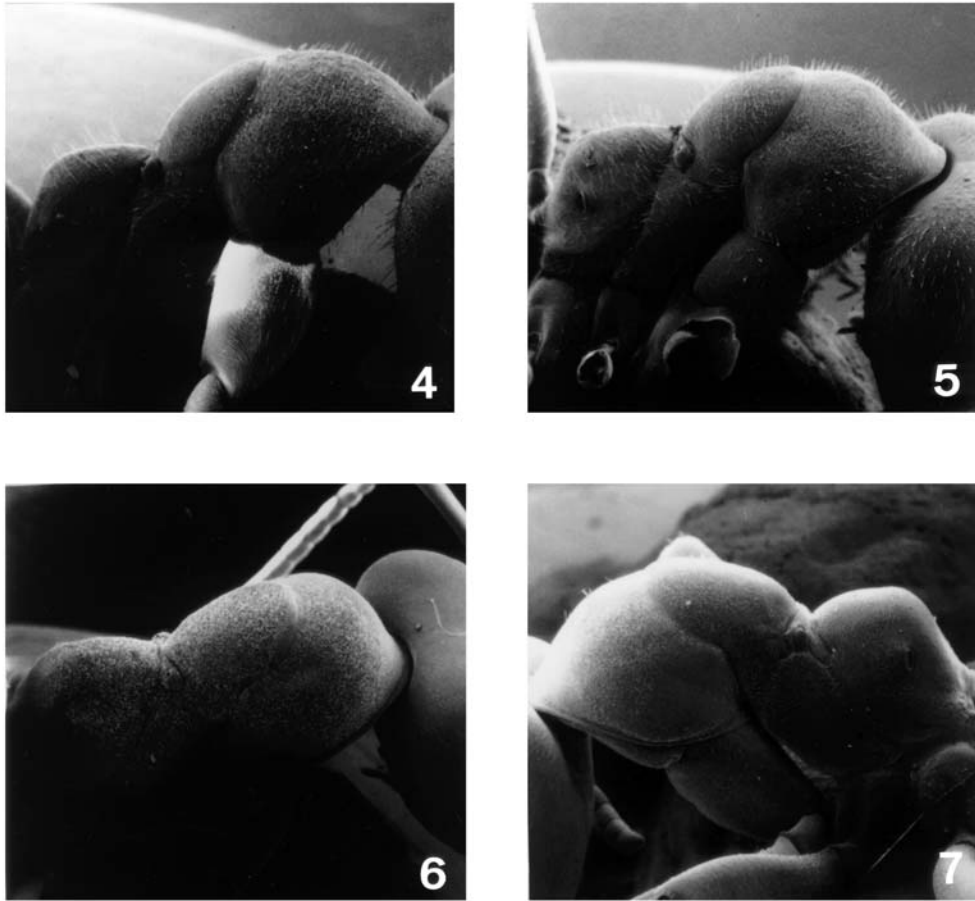


Fig. 3.— Head and thorax of a female of *F. frontalis*. (scale = 1 mm).

Fig. 3.— Cabeza y tórax de una hembra de *F. frontalis*. (escala = 1 mm).



Figs. 4-7.— General profile of *Formica frontalis* (4), *F. truncorum* (5), *F. dusmeti* (6) and *F. sanguinea* (7).

Figs. 4-7.— Perfil general de *Formica frontalis* (4), *F. truncorum* (5), *F. dusmeti* (6) and *F. sanguinea* (7).

tion, our discovery of sexuals of *F. frontalis*, not described until now enables firmer taxonomic positioning of *F. frontalis*. Finally, for the workers of the *rufa*, *sanguinea* and *exsecta* groups in the Iberian Peninsula, we have prepared a key, largely based on the key by Collingwood (1978).

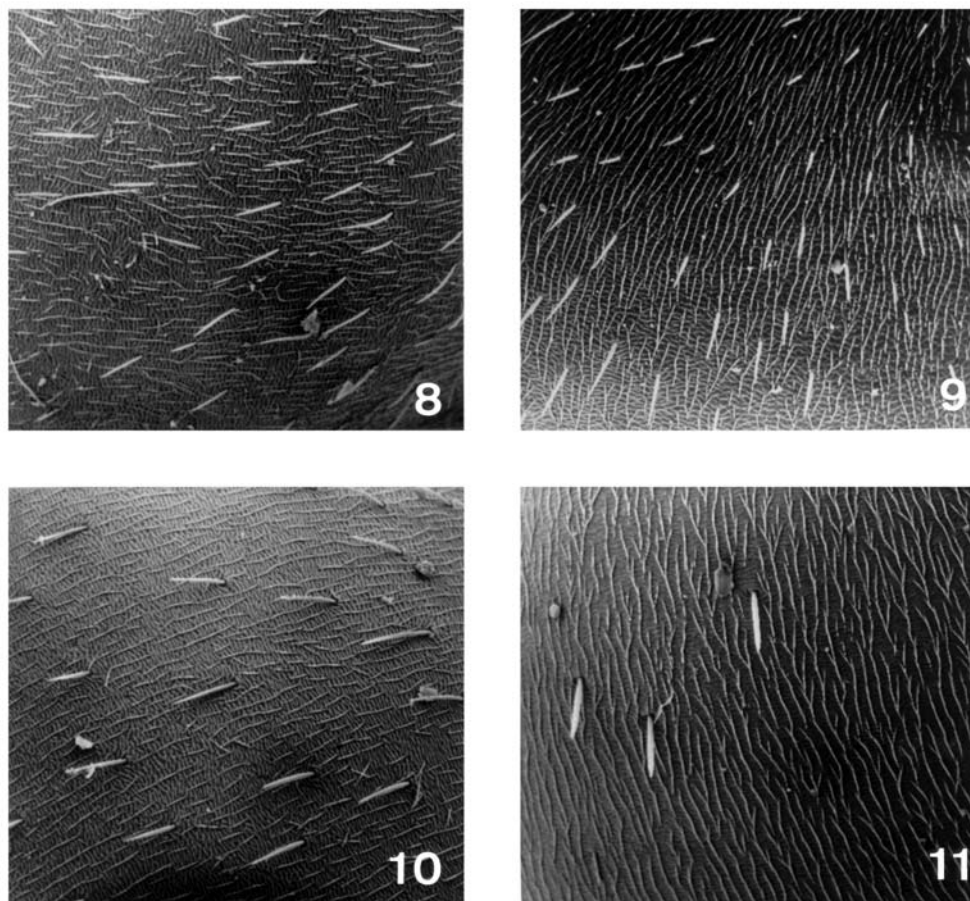
#### Material

The material studied comes primarily from collections in the National Museum of Natural Sciences in Madrid (MNCN), the University Complutense of Madrid (UCM) and the University of Granada (UG). In addition, we have used material provided by CA Collingwood and P Douwes. In

the collection in the MNCN, there are three specimens of *F. frontalis* labelled as “cotype,” from the Sierra de Guadarrama (Spain), two workers of this species from Pozuelo de Calatrava and two specimens of *F. dusmeti* from the Sierra de Peñalara. All these belong to the Dusmet collection and therefore correspond to the type series of *F. frontalis* and *F. dusmeti*.

#### Results

DESCRIPTION OF MALE *F. FRONTALIS* (FIGS. 1A AND 2A): (El Purche, Sierra Nevada. A. Tinaut leg. 2-VII-89). Head length:  $1.50 \pm 0.03$ ; Head width:  $1.32 \pm 0.04$ ; Scape length:  $1.61 \pm 0.05$ ; Thorax length:



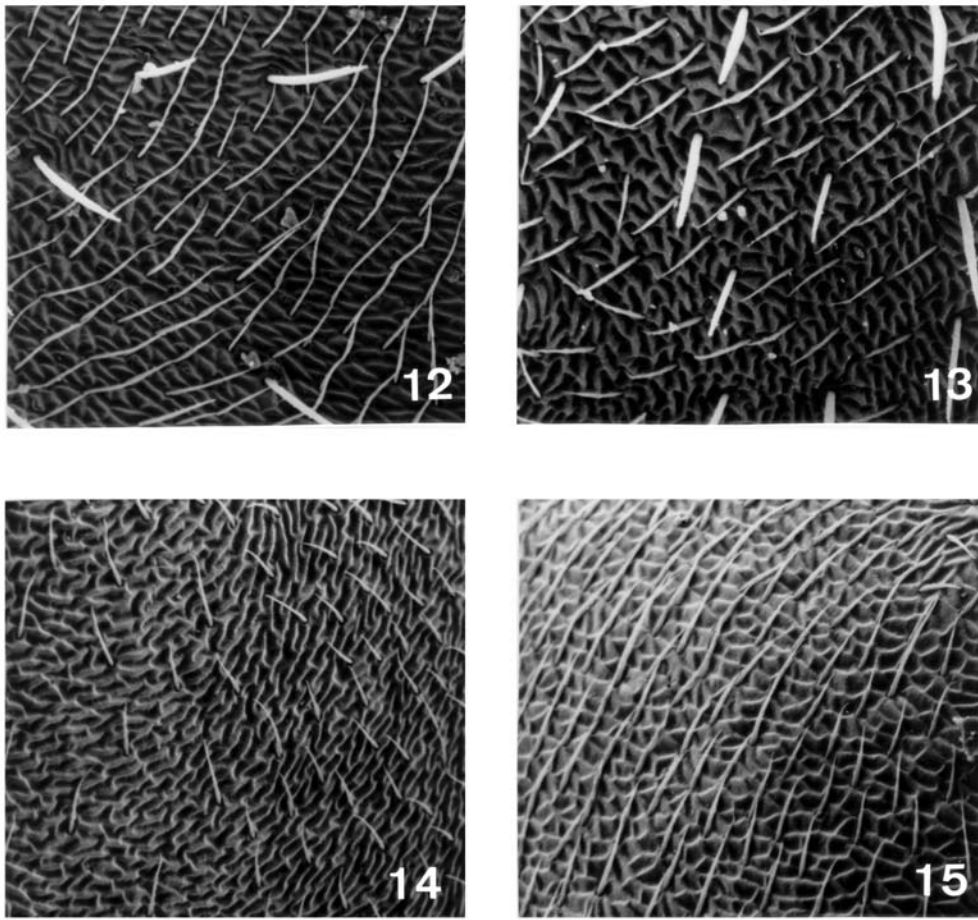
Figs. 8-11.— Detail of first segment of the gaster of *Formica frontalis* (8), *F. truncorum* (9), *F. dusmeti* (10) and *F. sanguinea* (11).

Figs. 8-11.— Detalle del primer segmento del gastro de *Formica frontalis* (8), *F. truncorum* (9), *F. dusmeti* (10) and *F. sanguinea* (11).

$3.6 \pm 0.14$ ; Thorax width:  $2.06 \pm 0.08$  ( $n=14$ , measures in millimeters). Colour black with femur, tibia and tarsus pale yellow or dark. Pubescence faint and sparse; hairs short and erect covering the entire body, though more sparse on the gaster, femora and tibiae and absent on the scape. Tegument dull. Wings dark brown, somewhat lighter at the apex. Head triangular. Mandibles with one or two teeth. Eyes hairless. Ocelli small. Surface dull. Hairs abundant in the occipital region and sides of face (gena), more scarce in frontal region. Ventral surface of the head with fine, subdecumbent hairs. Frontal triangle brilliant. Thorax domed, petiole with rounded apex. The genitalia is typical of the genus. Figure 2 shows exclusively the sagitta, volsella and squama, since only these show

small distinguishing details. In the discussion, we indicate the genital differences found between this species and *F. truncorum*. The specimens used for the description were collected from the inside of ant nests of this species. Specimens deposited in the collections of the authors, in MNCN in Madrid and in C.A.Collingwood collection.

DESCRIPTION OF THE FEMALE *F. FRONTALIS* (FIG. 3): (South slope of the Pico Majalasma. Cercedilla, Madrid. I. García Mas. leg. 19-IX-78 and El Purche, Sierra Nevada, Granada, A. Tinaut leg. 17-VIII-98). Head length: 2.26 mm; Head width: 2.15; Scape length: 2.07 mm; Thorax length: 4.15; Thorax width: 2.10. Bicoloured, as the worker. Thorax reddish



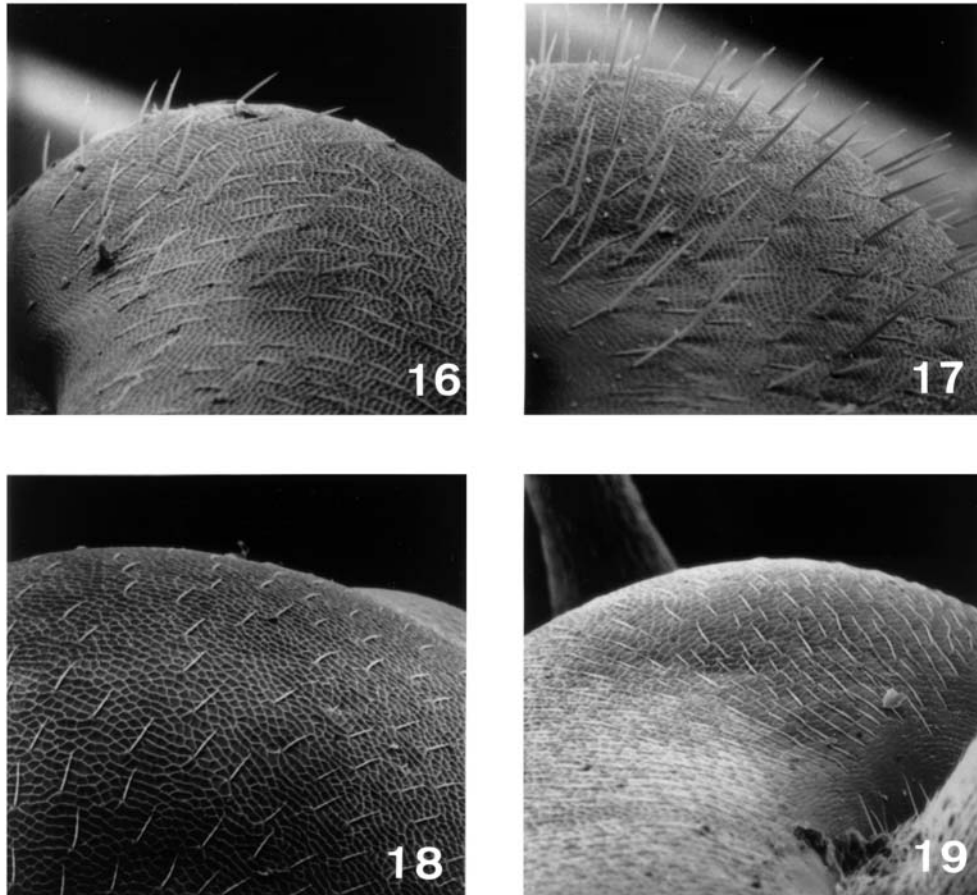
Figs. 12-15.— Detail of pronotum of *Formica frontalis* (12), *F. truncorum* (13), *F. dusmeti* (14) and *F. sanguinea* (15).

Figs. 12-15.— Detalle del pronoto de *Formica frontalis* (12), *F. truncorum* (13), *F. dusmeti* (14) and *F. sanguinea* (15).

except for blackish scutellum. Gaster black, except for the first, yellowish red segment. Head with dark spot in frontal area or absent. Pilosity short and abundant over body, except on scapes. Head with abundant semi-erect hairs on the occipital edge, frontal region, clypeus and mandibles. Frontal triangle brilliant. Eyes with some short hairs between facets or totally bare. Ventral surface of the head with hairs scattered and long. Thorax completely covered with hairs. Petiole with hairs on the edge and both sides, the anterior ones being longer than the posterior ones. The profile seen from the back slightly undulated. Abdomen with thicker pilosity on the first segment of the gaster, but present on all the gaster sternites. Legs with hairs on all articles,

thick on coxae, thinner on femora. Specimens deposited in the collection of the authors.

DIFFERENCES WITH *F. TRUNCORUM*: The characters considered by Santschi (1919) to distinguish the workers of *F. frontalis* from *F. truncorum* are, in our opinion, valid but not the most appropriate. Our photographs of the workers (Figs. 4-27) show the pilosity on the body of *F. truncorum* to be highly abundant and uniform, as well as on the head. In *F. frontalis*, head hairs are present on the entire occipital region, but scant or absent in the rest. On the ventral surface of the head region only long, subdecumbent hairs are present, while in *F. truncorum* the hairs, both on the ventral surface of the head and genae, are mainly short, suberect, and abun-



Figs. 16-19.— Detail occipital region of *Formica frontalis* (16), *F. truncorum* (17), *F. dusmeti* (18) and *F. sanguinea* (19).

Figs. 16-19.— Detalle de la región occipital de *Formica frontalis* (16), *F. truncorum* (17), *F. dusmeti* (18) and *F. sanguinea* (19).

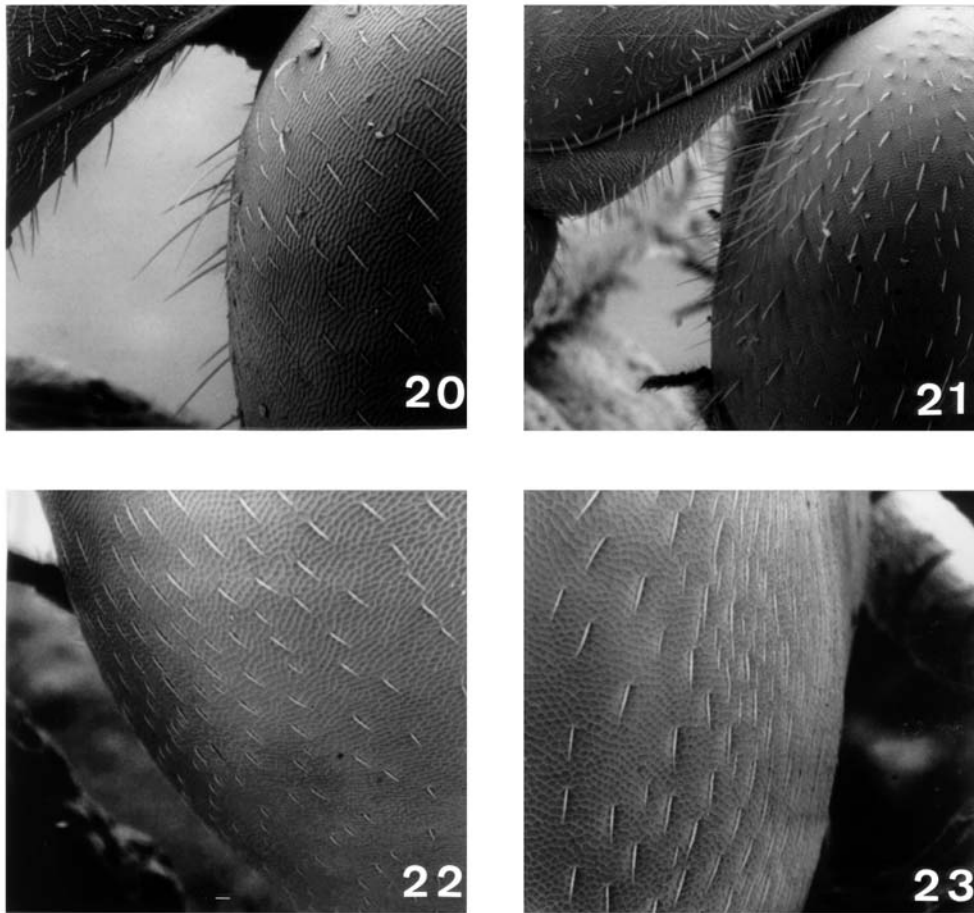
dant. By contrast with *F. truncorum*, the eyes and scapes of *F. frontalis* do not present erect hairs. This absence of hairs, together with hairless genae, makes the workers of this species closer to *F. rufa* or *F. sanguinea* than to *F. truncorum*.

In the males, we found major differences with respect to *F. truncorum*, and also in characters similar to those found in the workers. Thus, the absence of hairs on the scape and eyes provide a quite reliable distinction between the males of *F. frontalis* and *F. truncorum*. In addition, differences in the profile of the head and thorax, and in the number of teeth on the mandibles can be useful (Fig. 1).

The females of *F. frontalis* are more similar to those of *F. truncorum* and only the absence of hairs on the scape enable the two species to be distinguished.

#### Key for the workers of the *rufa*, *sanguinea* and *exsecta* groups in the Iberian Peninsula

1. Back of head and scale deeply excised ..... 2
- \* Head and scale not deeply excised ..... 3
2. Eyes with short microscopic hairs, maxillary palps extending beyond mid length of head .. *exsecta* Nylander, 1846
- \* Eyes hairless, maxillary palps not reaching midlength of head ..... *pressilabris* Nylander, 1846
3. Eyes without hairs or with hairs smaller than 4.44 mm, therefore invisible under a binocular ..... 4
- \* Eyes with hairs ..... 6
4. Front border of clypeus with a median notch ..... *sanguinea* Latreille, 1798
- \* Front border of clypeus without a median notch ..... 5
5. Thorax, scale, femoras and back of head with abundant short hairs ..... *frontalis* Santschi, 1919
- \* Thorax, scale, femoras and back of head without hairs ..... *dusmeti* Emery, 1909



Figs. 20-23.— Detail ventral surface of the head region of *Formica frontalis* (20), *F. truncorum* (21), *F. dusmeti* (22) and *F. sanguinea* (23).

Figs. 20-23.— Detale de la región ventral de la cabeza de *Formica frontalis* (20), *F. truncorum* (21), *F. dusmeti* (22) and *F. sanguinea* (23).

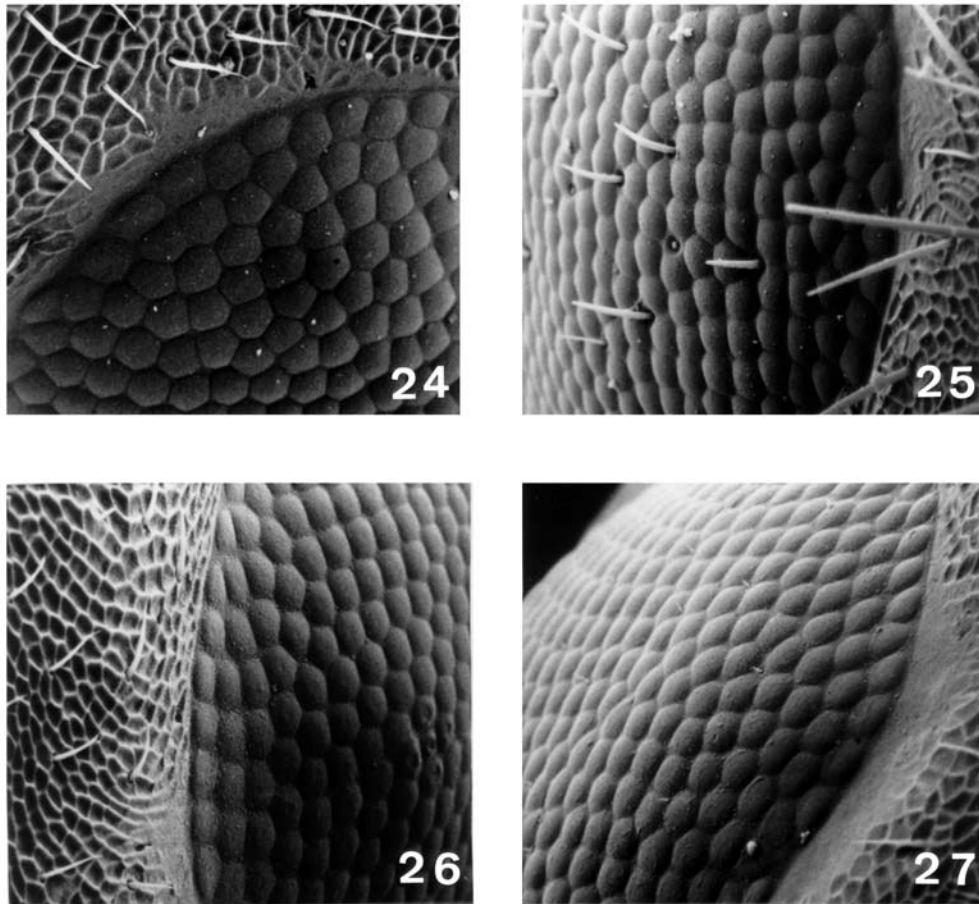
- 6. Back of head fringed with hairs ..... 7
- \* Back of head bare ..... 8
- 7. Gaster and all dark areas dense matt ..... 8
- ..... *pratensis* Retzius, 1783 (\*)
- \* Gaster and all dark areas moderately shining ..... 8
- ..... *lugubris* Zetterstedt, 1838
- 8. Ventral surface of the head hairs numerous ..... 8
- ..... *rufa* Linnaeus, 1761
- \* Ventral surface of the head bare ..... 8
- ..... *polyctena* Foerster, 1850

(\*) According to the criteria of Seifert (1992), we consider this species synonymous with *F. nigricans* Emery, 1909

DISTRIBUTION: From our own captures, the material reviewed in other collections, and the literature that

we have been able to confirm, the distribution of the two species under study would be (Fig. 28):

*Formica frontalis*. Alicante (De Haro and Collingwood, 1988), Ávila (S. Guadarrama, MNCN), Castellón (Morella, De Haro and Collingwood, 1991 and Collingwood, pers. com. 1998), Ciudad Real (Pozuelo de Calatrava, MNCN and Santschi, 1919), Granada (S. Nevada, S. Alfaguara, UG), Huesca (Espadaler, 1997a), León (Collingwood and Yarrow, 1969), Lérida (Sant Llorenç de Morunys, Espadaler 1997b), Madrid (Navacerrada, S. Guadarrama, UCM and Collingwood, pers. com. 1998), Orense (Collingwood and Yarrow, 1969), Segovia (La Granja, Collingwood and Yarrow, 1969), Teruel



Figs. 24-27.— Eyes of *Formica frontalis* (24), *F. truncorum* (25), *F. dusmeti* (26) and *F. sanguinea* (27).

Figs. 24-27.— Ojos de *Formica frontalis* (24), *F. truncorum* (25), *F. dusmeti* (26) and *F. sanguinea* (27).

(Espadaler, 1997a), Teruel (Javalambre, Collingwood, pers. com. 1998) and Zaragoza (Collingwood and Yarrow, 1969 and Espadaler, 1997a). In Portugal this species is known from Oporto and from Obidej (Collingwood, pers. com. 1998).

*Formica dusmeti*. Albacete (Cerro Peña Blanca, UG), Jaén (Sierra de Cazorla, Espadaler, 1997c), León (Villalbina, MNCN), Madrid (Peñalara, MNCN and Emery, 1909), Madrid (Sierra de Guadarrama, UCM, Collingwood and Yarrow, 1969, Martínez, 1984 and Martínez and Tinaut, 1996), Navarra (UG), Teruel (Tramacastilla, Espadaler, 1997a), Zamora (Cubillos, Galende, Collingwood, pers. com. 1998). Emery (1909) cites Peñalosa (Córdoba province) as the type locality for *F. dusmeti*. However, the two worker specimens included in the type material depo-

sited at the MNCN (Madrid) bear labels (Dusmet leg.) indicating Peñalara as the collecting location. Our data show that *F. dusmeti* is a frequent species at Peñalara, but it was never found at Peñalosa or surrounding areas.

These two factors suggest that Emery (1909) probably made a mistaken transcription of the locality (Peñalosa instead of Peñalara) and, thus, Peñalara should be considered as the correct type locality.

Species from the following locations remain to be confirmed: In Spain: Barcelona (Goetsch, 1942), Gerona (Goetsch, 1942), Madrid (Santschi, 1932b and Goetsch, 1942), Soria (Collingwood and Yarrow, 1969). In Portugal: Soure, Santarem and Jagueiras (Santschi, 1932 a). In all these cases, the species cited is *F. dusmeti*. The citation of *F. fron-*





Fig. 28.— Distribution of *F. dusmeti* (★) and *F. frontalis* (\*).

Fig. 28.— Distribución de *F. dusmeti* (★) y *F. frontalis* (\*).

*talis* for Algeciras (Cadiz) by Santschi (1930) is doubtful for either of the two species.

**Discussion**

The absence of hairs on the eyes in the males and workers supports the establishment of two groups of species: *F. dusmeti* and *F. frontalis* on the one hand, and *F. truncorum*, *F. pratensis* and *F. polyclena* on the other. *F. rufa* and *F. sanguinea* have very few hairs on the eyes, or the hairs are minute and not visible under low magnification (Fig. 27), and thus would occupy an intermediate position. The absence of hairs on the scape, or the type of dentition in the males would signify different groups of species, but in no case does *F. truncorum* appear to be closely related to *F. frontalis*. Therefore, we contend that *F. frontalis* should be considered a valid species, clearly separate from *truncorum*, based on the absence of the hairs on the eyes, scape and genae, and the different pilosity on the ventral surface of the head. The genitalia of *F. frontalis* and of *F. truncorum* show

small differences in the sagitta (Fig. 2), which is more convex in *F. frontalis* and the volsella is narrower and curved in *F. truncorum*. Therefore, the genitalia can also be used to differentiate the two species. However, until a more general study is performed, it would be hasty to divide the species into groups on the basis of these characteristics.

Agosti (1989) separated the two groups of species of *F. sanguinea* and *F. rufa*, and within this latter differentiated between the *rufa* complex and the *truncorum* complex. *F. rufa* has some hairs on the eyes, but *F. pratensis* and *F. lugubris*, included within the *rufa* complex, are densely hairy, as is *F. truncorum*. Hence, we incline more towards placing *F. dusmeti* and *F. frontalis* together with *F. sanguinea*, for the absence of hairs on the genas and scapes, despite the absence of the clypeal notch and the presence of minute hairs in the eyes of the former species.

The other problem which impelled us to undertake the present study is the confusion prevailing between *F. dusmeti* and *F. frontalis*. After scrutinizing the material mentioned above, we have no doubt in separating the workers of the two species, since *F.*

*dusmeti* is a completely hairless species, except for its gaster, and we found no specimen having intermediate characteristics which could raise confusion. The coloration, especially the dark spot on the vertex, is very similar for both species. This spot is highly variable, covering most of the surface of the head in smaller workers, reaching the occipital region. In addition, the pronotum also bears a spot that was almost black, roughly as in *F. pratensis*, for example.

The descriptions of the female and the male of *F. dusmeti* provided by Santschi (1932 a) are too sketchy to make useful comparisons.

Both species are known exclusively from the Iberian Peninsula; the citation of *F. dusmeti* in Norway (Forel, 1911) does not appear to be correct, and was doubted by Bondroit in 1920. The distribution in the Iberian Peninsula (Fig. 28), considering only the citations confirmed, presents no clear pattern, except that *F. dusmeti* appears to be limited to the northern half of the Iberian Peninsula, while *F. frontalis* is scattered throughout the peninsula. In the Sierra Nevada and neighbouring mountains, *F. frontalis* is scarce and some nests appear in woodlands of *Quercus pyrenaica* Willd, 1805 or *Q. rotundifolia* but the largest colony which we have found was, curiously, on a treeless slope situated at 1400 m in altitude and occupied by low shrubs, in which the nest was built. In other points of its distribution, it is frequent to find this species nesting under rocks, around which it deposits vegetal material. However, in no case, are the nests as apparent as in other species of the group.

*Formica dusmeti* is more linked to conifer woods, and its nests are more consistent in location, though sometimes also found under large rocks.

Finally the taxonomic status of this species, derived from this study, is:

***Formica frontalis* Santschi, 1919 stat. n.**

*Formica truncorum* var *frontalis* Santschi, 1919: 246. Worker. Pozuelo de Calatrava (Ciudad Real). Type-material examined.

*F. dusmeti*, sensu Collingwood and Yarrow, 1969: 95 partim (misidentification).

*F. dusmeti*, sensu Tinaut *et al.*, 1995: 433 (misidentification).

***Formica dusmeti* Emery, 1909**

*Formica rufa* ssp. *dusmeti* Emery, 1909: 188. Worker. Sierra de Peñalara (Madrid). Type-material examined.

*Formica dusmeti* Emery, (raised to species by Bondroit, 1918: 60).

*F. truncorum* st. *dusmeti*, Santschi, 1932a: 3.

*F. truncicola dusmeti*, Wheeler, 1913: 438.

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