

The male forceps and pygidium of *S.laminata* and *S.iheringi*, which are themselves remarkable similar (figs. 1, 4), are also very similar to those of the Neotropical *Marava machupicchuensis* and *M.bidentata*, both described in Brindle (1971b): in all four species these structures differ in only minor details, and the male genitalia of all four species show no great differences.

These similarities, particularly in the male genitalia, suggest that *Strongylopsalis* is much more closely related to the genus *Marava* than the present classification would indicate. The study of further specimens of both genera may enable a definite modification of the present classification to be made.

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Manuscript received 4th February, 1972

A taxonomic study of the ant genus *Lasius* Fabricius in the British Isles (Hymenoptera : Formicidae)

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SYNOPSIS

The taxonomic status of the species *Lasius mixtus*, *L. umbratus* and *L. rabaudi* is discussed. Keys are given to the males, females and workers of the seven British species of the genus, and taxonomic notes on these species are included.

INTRODUCTION

The genus *Lasius* has been subject to a certain amount of taxonomic confusion in recent years, and three of the species most directly involved are found in Britain. In his revision of the genus, Wilson (1955) synonymised the species *mixtus* Nylander and *umbratus* Nylander under the latter name but several European authors have considered these to be two distinct species. The species *rabaudi* described from a single alate female by Bondroit (1917), has also caused taxonomists several problems, and is considered to be separable with certainty from *umbratus* only in the female caste.

It is hoped that the present work will help towards a solution of these problems. A number of new characters have emerged, and the keys given by Collingwood (1964) to the workers and females of *Lasius* have been slightly modified in light of these. The key to the males has been completely re-worked.

I would like to express my thanks to the following: Mr B. Bolton (British Museum Natural History) for his constant help and advice; Mr E. Taylor (University Museum, Oxford) for providing access to the Hope Department collections of British *Lasius*; Mr C. O'Toole (University Museum, Oxford) for his loan of *Lasius* material from Ireland, and Dr J. F. Perkins (British Museum, Natural History) for first drawing my attention to the problem and for help and advice during the course of the work. Finally, thanks are due to Mr C. A. Collingwood (Ministry of Agriculture, Leeds) for reading the finished work, for the loan of specimens and for other assistance during the preparation of this paper.

The status of the species mixtus Nylander, umbratus Nylander and rabaudi Bondroit
 In his revision of *Lasius* Wilson (1955) synonymised the two species, *mixtus* and *umbratus*, under the latter name. Some European authors (e.g. Forsslund, 1957; Collingwood, 1957)

expressed concern and Boven (1959) ignored the synonymy altogether. Collingwood (1963) was the first to take a more detailed look at the two species, and provided some good characters for their separation. However, Bernard (1968) maintained Wilson's original synonymy in his keys to European ants.

Collingwood separated the species mainly by the presence of erect and suberect hairs on the scape and tibiae of *umbratus* and the lack of such hairs in *mixtus*. During the present work, over 500 females and workers of both species were studied and the difference proved sound in all cases.

Unfortunately, this character is not so consistent in the male, and it was necessary to look a little closer at this caste. Erect or suberect hairs were found on the scape and fore tibia in approximately only 20 per cent. of about 200 *umbratus* males studied, but were consistently found on the mid- and hind tibiae of all the specimens examined.

The structure of the mandibles in the males of both species also provided good characters. In *mixtus* the masticatory margin is more serrate than toothed. A full complement of five or more teeth was not found in any of the specimens studied; the mandible has a tendency to be variable, but the most usual form is two or three apically situated teeth, graduated downwards in size basally, and followed by a serrate or plain margin (fig. 1f). In *umbratus*, however, the masticatory margin is always fully toothed, with five or more distinct teeth (fig. 1g). In one series studied, the teeth were not very well formed, giving a crenulate rather than a toothed appearance (fig. 1h). Nevertheless, the distinction from *mixtus* was clearly apparent.

These distinguishing characters, in conjunction with those already given by Collingwood (1963), make it clear that *L. mixtus* Nylander is in fact a good species.

In his original description of *L. rabaudi*, Bondroit (1917) described a single winged female. His principal character for separation from *umbratus* was the shape of the petiole scale and the length/breadth ratios of various funicular segments. He described the scale as being; "High, broad. Not strongly thickened and very feebly emarginate in a strongly obtuse angle".

The ratios of the funicular segments were stated to be as follows:

"1st. (basal) segment $1\frac{1}{2} \times$ longer than the 2nd segment. 2nd segment $2\frac{1}{2} \times$ longer than broad at the broadest point, 10th segment $2 \times$ longer than broad at the broadest point, 11th (apical) segment a little longer than segments 9 & 10 together."

Wilson (1955) added the important character of the flattening of the scape in the female, stating that the scapes were: "conspicuously flattened, so that the minimum width of the scape is 0.10 mm., or less". Wilson tried to use this character for the workers, but admitted "considerable overlap" between *rabaudi* and *umbratus* on this point. He gave no information on the males, except to say that they seemed to be slightly smaller than those of *umbratus*.

Wilson also referred to the funicular segments of the female, saying that segment three was 1.47-1.87 times longer than broad compared to that of *umbratus*, which he describes as being 1.00-1.50 times longer than broad. Wilson stated that the shape of the scale was less variable than in *umbratus*, quadrate/subquadrate in front view and nearly as broad at the dorsal crest as at a level just below the frontal foramen. The dorsal crest he describes as having a rounded to angulate emargination. He gives no data on the scales of workers and males.

Collingwood (1963) stressed the flattening of the scape in the female and gave some description of the scale of the petiole which more or less coincided with that of Wilson

(1955). In the workers, however, he used the flattening of the scape as his principal character and, in the males, introduced the new character of a deep and distinct frontal furrow and rugose frontal triangle, compared to an indistinct furrow and smooth triangle in *umbratus*. Bernard (1968) offered little further information beyond stating that, in the females, funicular segments 2-5 were generally a little longer than those of *umbratus*.

After studying many nest series of alleged *rabaudi* from several different localities in both Britain and Europe, I have drawn the following conclusions.

Firstly, it becomes apparent that most of the characters used to determine *rabaudi* are variable both within the same caste and between different castes. For example, the character of the flattened scapes in the females is perhaps the most universally accepted means of determination; I have, however, found males and workers from the same nests as females with flattened scapes to be totally inseparable from males and workers of *umbratus*. The majority of workers associated with "flat-scape" females had no noticeable flattening of the scape and, despite careful searching, no other character that will consistently split them from *umbratus* could be found. The males are similarly difficult, and Collingwood's (1963) character of the deep frontal furrow and rugose triangle proved to be very variable, not only between different nest series with associated "flat-scape" females, but also between individuals from the same nest.

Secondly, there is great variation among individuals in the characters for determining the females. Specimens with flattened scapes have been found with funicular measurements indistinguishable from those of *umbratus*, and Bondroit's (1917) original description of the scale could equally apply to *mixtus* or *umbratus*. But perhaps the most significant evidence of all comes from specimens of *rabaudi* studied at the Hope Department of Entomology, Oxford. Two females on the same mount, bearing the label "Woking, 4.8.1915, Crawley Coll." were found to have very different scapes. One specimen had the scapes distinctly flattened, but the scapes of the other were identical to those of an average *umbratus*. Two more females, from the same nest in Berkshire marked "Wellington College. Aug. 1905", were determined by R.C.L.Perkins as *L. umbratus*. As before, one specimen had flattened scapes, the other had scapes of a normal *umbratus* type. In addition to these very marked variations within the same nest, there was considerable variation in scape width among all the females studied.

For species to be determinable in only one caste is not altogether satisfactory, but when the characters of that one caste show themselves to be unreliable, then, in the absence of better characters, grave doubts must be cast on the validity of the species. For these reasons therefore, I regard *L. rabaudi* Bondroit as a synonym of *L. umbratus* Nylander.

Keys to the species of *Lasius* found in Britain

Males

- 1 Mandibles with a single apical tooth. Masticatory margin curved and smoothly rounded basally (figs. 1a, 1b, 1c, 1d).....2
- Mandibles with two or more teeth. Masticatory margin straight and more or less right-angled basally (figs. 1e, 1f, 1g, 1h).....5
- 2 Tibiae and scapes with erect hairs (fig. 4e) **niger** (L.)
- Tibiae and scapes without erect hairs.....3
- 3 Wings clear. Cross-vein *m-cu* occasionally absent or poorly defined on one fore wing. Masticatory margin often strongly curved (fig. 1b) **alienus** (Foerster)

- Wings fuscous on basal half. Cross-vein *m-cu* always present on both wings.
Masticatory margin rarely strongly curved (figs. 1c, 1d)
- 4 Apical tooth situated distal of a cleft in the masticatory margin (fig. 1d).
Scale of petiole slender in side view and clearly indented dorsally (figs. 2f, 2g). Colour dark brown..... **brunneus** (Latreille)
- Masticatory margin entire (fig. 1c). Scale of petiole low and thick in side view, rounded dorsally and equipped with numerous erect hairs (figs. 2a, 2b). Colour shining black
- 5 Mid and hind tibiae with erect and suberect hairs (fig. 4e). Masticatory margin toothed or crenulate, usually with five or more distinct teeth (figs. 1g, 1h)

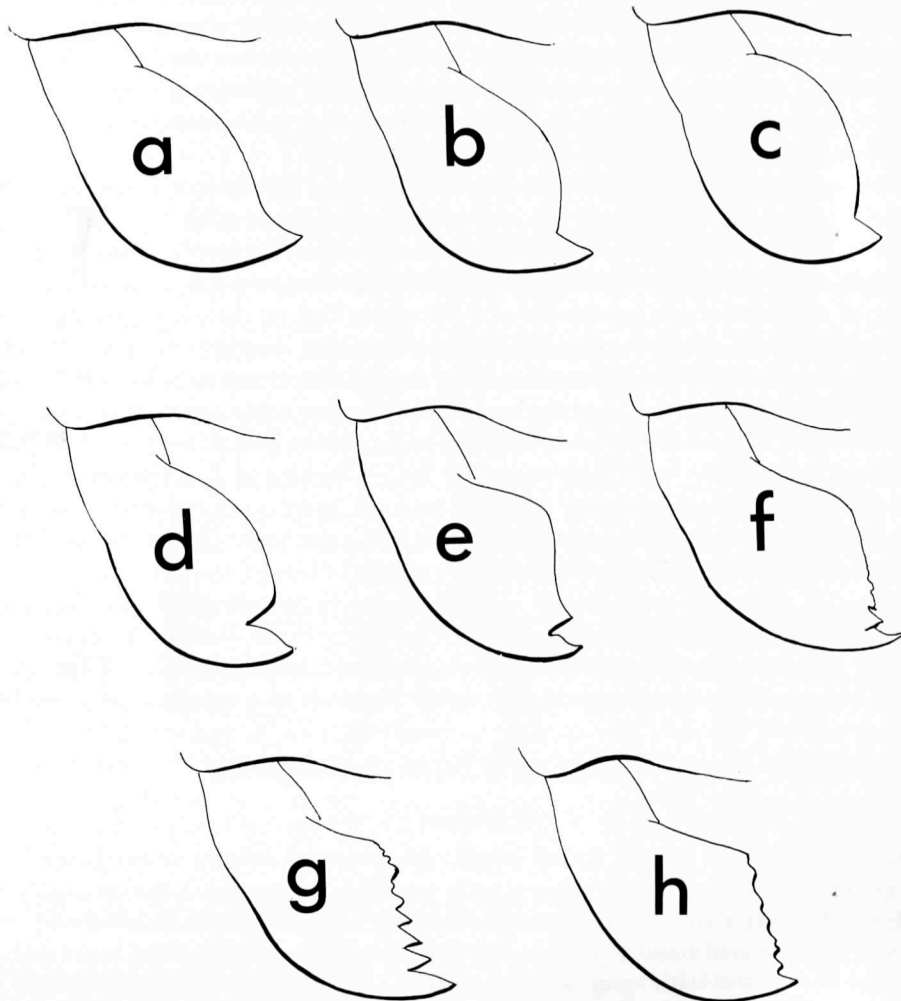


Fig. 1. (a-h) Male mandible structure: (a) *Lasius niger*; (b) *L. alienus*; (c) *L. fuliginosus*; (d) *L. brunneus*; (e) *L. flavus*; (f) *L. mixtus*; (g) *L. umbratus*; (h) *L. umbratus* (aberrant form).

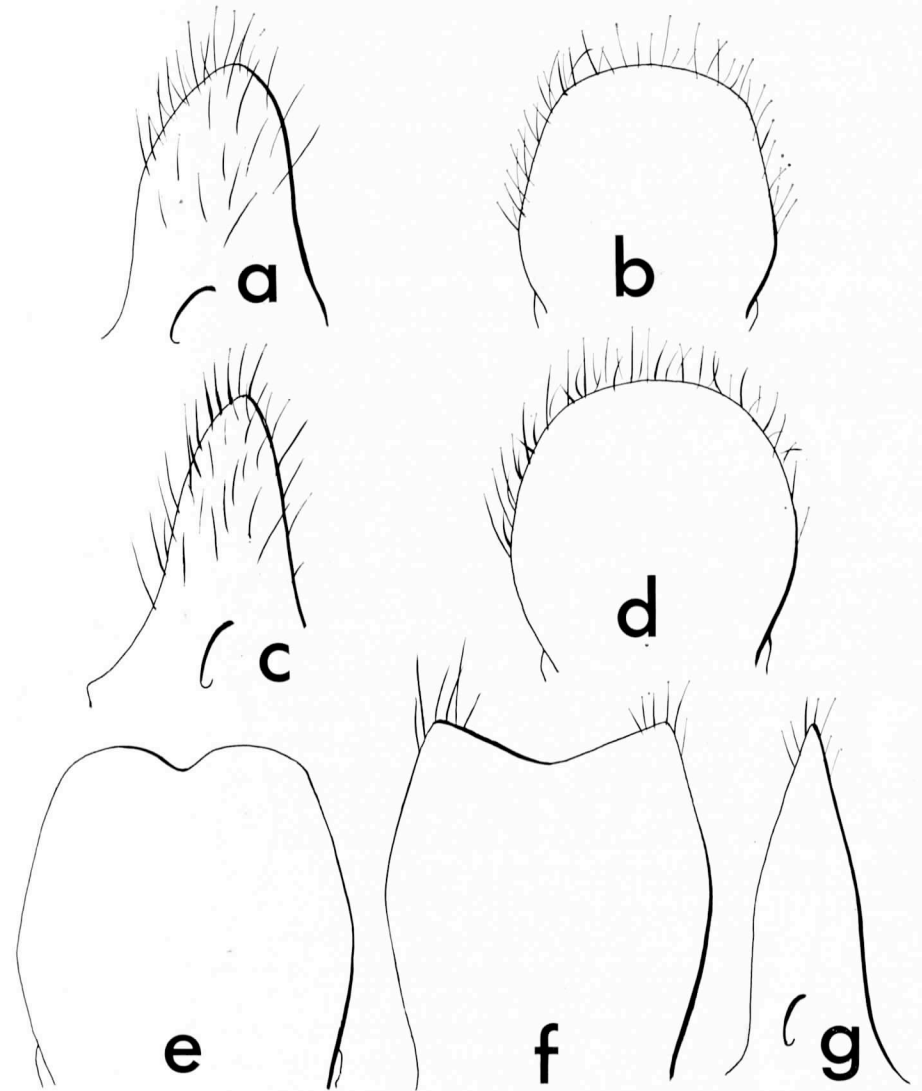


Fig. 2. Petiole scale structure (a-d) *Lasius fuliginosus*: (a) ♂, side view; (b) ♂, front view; (c) ♀, side view; (d) ♀, front view. (e-g) *L. brunneus*: (e) ♀, front view; (f) ♂, side view; (g) ♂, front view.

- Mid and hind tibiae without erect or suberect hairs. Masticatory margin with two or three apically situated teeth; the remainder of the margin forming a plain or serrate edge (figs. 1e, 1f)
- 6 Fore wings with cross-vein *m-cu* absent (fig. 4d). Wings clear or very faintly tinted brown on the basal half. Mandibles with an apical and a subapical tooth; the remainder of the margin very weakly serrate or at times somewhat concave and plain (fig. 1e)..... **flavus** (F.)

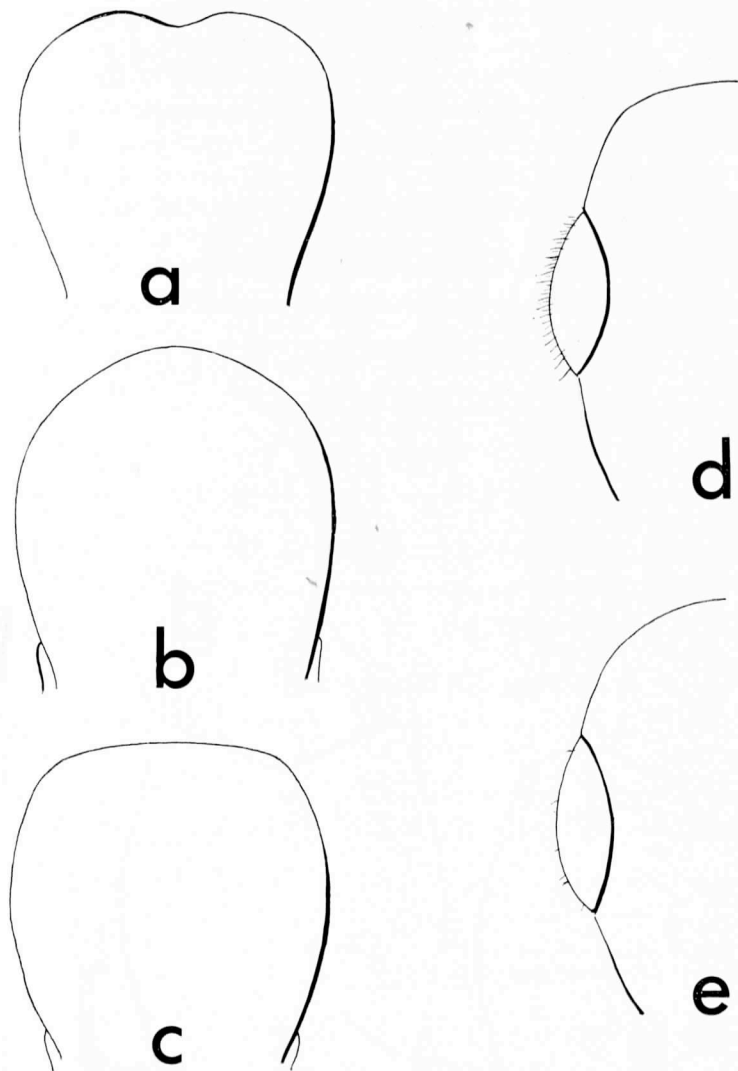


Fig. 3. (a-c) Petiole scale, front view: (a) *Lasius mixtus* ♀; (b) *L. alienus* ♀; (c) *L. flavus* ♀. (d) Eye of *L. flavus* ♀; (e) Eye of *L. brunneus* ♀.

- Fore wings with cross-vein *m-cu* always present. Wings fuscous basally. Mandibles normally with three apically situated teeth; the remainder of the margin serrate or plain, not concave (fig. 1f). (Occasionally only two teeth are present, as in *flavus*, but cross-vein *m-cu* is never absent.)

mixtus (Nylander)

Females

- 1 Maximum head width not less than the maximum width of the thorax.....
- Maximum head width less than the maximum width of the thorax.....

- 2 Colour shining black or very dark blackish-brown. Scale of petiole thick and rounded with numerous erect hairs (figs. 2c, 2d) **fuliginosus** (Latreille)
- Colour brown or dark brown. Scale not as described above 3
- 3 Scapes and tibiae with erect and suberect hairs (fig. 4e) **umbratus** (Nylander)
- Scapes and tibiae without erect or suberect hairs **mixtus** (Nylander)
- 4 Scapes and tibiae with erect hairs (fig. 4e) **niger** (L.)
- Scapes and tibiae without erect hairs 5
- 5 Wings clear. Frontal triangle indistinct or absent **alienus** (Foerster)
- Wings with basal half fuscous. Frontal triangle distinct 6
- 6 Eyes with short erect hairs (fig. 3d). Under surface of gaster distinctly paler than upper surface **flavus** (F.)
- Eyes without erect hairs, or with one or two minute hairs at most (fig. 3e). Gaster unicolorous dark brown **brunneus** (Latreille)

Workers

- 1 Colour shining black. Occipital border of head clearly emarginate (fig. 4a) **fuliginosus** (Latreille)
- Colour yellow to dark brown. Occipital border not emarginate 2
- 2 Colour yellow to yellowish-brown. Eye length not exceeding 0.22 mm. 3
- Colour medium to dark brown. Eye length not less than 0.30 mm. 5
- 3 Tibiae and scapes with erect and suberect hairs (fig. 4e) **umbratus** (Nylander)
- Tibiae and scapes without erect or suberect hairs, although appressed pubescence is normally present 4
- 4 Dorsal surface of gaster with short erect hairs, not exceeding 0.05 mm. in length. Scale of petiole usually with some sort of dorsal emargination, often in the form of a small central cleft (fig. 3a) **mixtus** (Nylander)
- Dorsal surface of gaster with long erect or suberect hairs, not less than 0.08 mm. in length. Scale not normally indented (fig. 3c) **flavus** (F.)
- 5 Tibiae and scapes with erect hairs (fig. 4e) **niger** (L.)
- Tibiae and scapes without erect hairs 6
- 6 Frontal triangle distinct. Scale of petiole distinctly indented dorsally (fig. 2e). Colour light brown on head and thorax with the gaster proportionately much darker. Scales with weak pubescence **brunneus** (Latreille)
- Frontal triangle indistinct or absent. Scale not normally indented (fig. 3b). Unicolorous dark brown. Scapes with strong pubescence **alienus** (Foerster)

Lasius brunneus (Latreille)

Formica brunnea Latreille, 1798, *Essai Fourmis de la France*: 41; ♀. Type locality: France

Male. The pre-apical cleft in the mandible and the broad, V-shaped emargination in the dorsal crest of the petiole scale, readily separates this species from the related species *niger*, *alienus* and *fuliginosus*. The pre-apical cleft (fig. 1d) warrants careful study as the cleft, at times, gives the impression of there being a second, pre-apical tooth.

Female. This caste keys out with *flavus* and *alienus* by having the head width less than that of the thorax and by lacking erect hairs on the scape and tibiae. However, it is

distinct from these two species in having fuscous wings, which separate it from *alienus*, and in lacking pilosity on the eyes, unlike *flavus* (figs. 3d, 3e).

Worker. The workers of this species are unique among the British *Lasius* in having the gaster always proportionately much darker than the head and thorax. The scale of the petiole is also distinctive among the *niger*, *brunneus*, *alienus* group in being always clearly indented dorsally (fig. 2e).

Lasius niger (Linnaeus)

Formica nigra Linnaeus, 1758, *Syst. Nat. Ed.* (10) 1 : 580 ; ♀. Type locality: Europe.

Male. This caste is immediately identifiable in having both a single, apical tooth on the mandible and erect hairs on the scape and tibiae.

Female and worker. As in the male, these two castes are readily determined by the presence of erect hairs on the scape and tibiae. They are distinct from *umbratus*—the only other species possessing this character—in that the *niger* female has a head width less than that of the thorax, and the *niger* worker is dark brown with eyes larger than those of *umbratus*.

Lasius alienus (Foerster)

Formica aliena Foerster, 1850, *Hymenopterologische Studien* (1) Formicariae. *Aachen ter meer*. 1 : 36–38 ; ♀♂. Type locality: Germany, Aachen, Lousberg.

Male. As with all the castes of *alienus*, the males are very close to *niger* and are only safely separable by their lack of erect hairs on the scape and tibiae. In addition, the fore wings of *alienus* often have cross-vein *m-cu* rudimentary or absent on one wing. The mandible is also sometimes different from that of *niger* in being broader with the masticatory margin more strongly curved (fig. 1b). I have, however, found several specimens of *alienus* in which these characters were not evident, so they should not be treated as totally reliable.

Female and worker. Both these castes are very close to *niger* and are safely separable only on their lack of erect hairs on the scape and tibiae.

Lasius fuliginosus (Latreille)

Formica fuliginosa Latreille, 1798, *Essai Fourmis de la France*: 36 ; ♀♀♂. Type locality: France

Male. Equipped with a mandible which is at times very similar in structure to those of *alienus* and *niger*, this caste is best separated by the shape of the petiole scale, which is quite distinct from those of all other British *Lasius* males (fig. 2a, 2b) and by the wings, which are fuscous basally in *fuliginosus*, not clear, as in the other two species.

Female. As in the male, the shape of the petiole scale is the most useful character to determine the species in this caste. The thickness of the scale, and its numerous erect hairs make it quite distinct (fig. 2c, 2d).

Worker. This caste is readily determined by the occipital margin of the head, which is clearly emarginate (fig. 4a).

The shining black colour of all three castes mentioned by many authors, and included

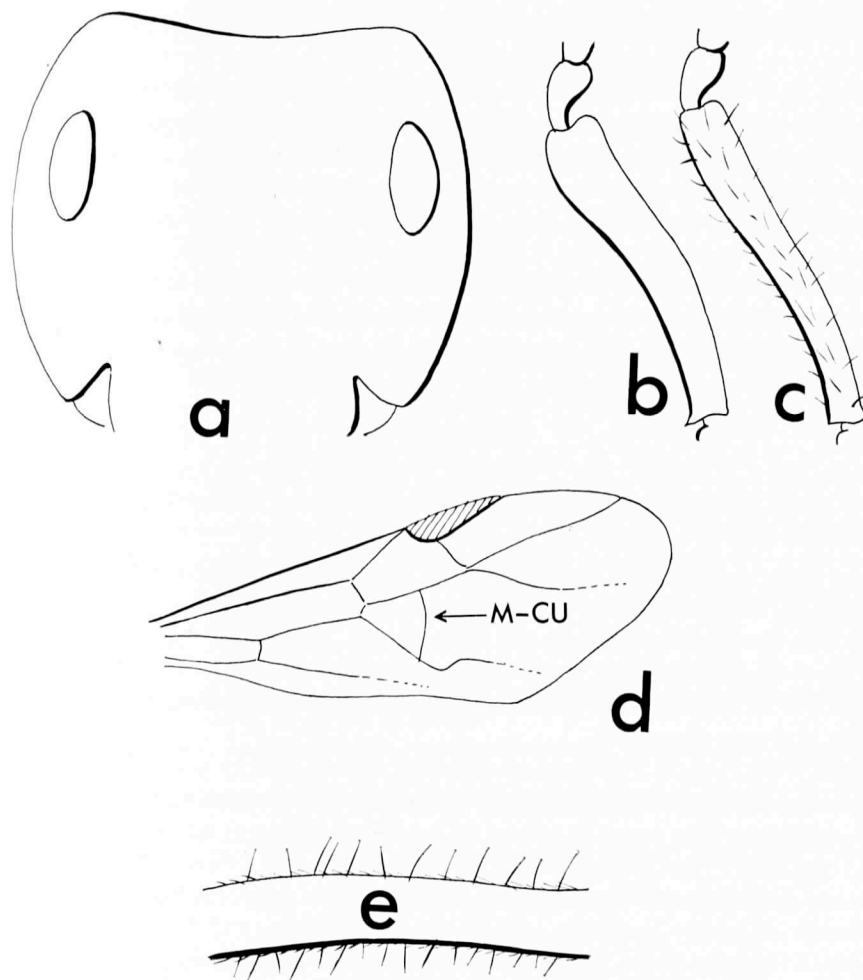


Fig. 4. (a) *Lasius fuliginosus* ♀. Front view of Head. (b) Scape of *L. mixtus* ♀. (c) Scape of *L. umbratus* ♀. (d) Fore wing of typical *Lasius* male, showing position of cross-vein *m-cu*. (e) Pilosity of typical *niger/umbratus* scape.

in the above key is certainly true of fresh specimens, but in many older specimens the colour had faded over the years to the more customary brownish-black of *niger* or *alienus*. Therefore, the age of the specimen should be taken into account.

Lasius umbratus (Nylander)

Formica umbrata Nylander, 1846, *Acta Soc. Sci. Fenn.* 2 : 1048–1050 ; ♀♂. Type locality: Finland, Helsinki.

Formicina rabaudi Bondroit, 1917, *Bull. Soc. ent. Fr.* 1917 : 177 ; ♀. Type locality: France, Amélie-les-Bains, Pyrénées Orientales. **Syn. n.**

Male. This caste is distinct among the males of British *Lasius* in having a mandible

with five or more teeth (fig. 1g) and in possessing erect and suberect hairs on the mid and hind tibia.

In one nest series studied, the males had mandibles with somewhat reduced teeth (fig. 1h) and wings which were strongly fuscous basally and had cross-vein *m-cu* absent on both fore wings. These characteristics were not observed in any other of the 100 number of males studied and they are regarded as an aberrant series.

Female. As the sole female *Lasius* having both a head width at least as great as the width of the thorax and erect hairs on scape and tibiae, the female of *umbratus* is readily identified. The antennal scape shows considerable flattening in several individuals as shown on p. 19, the character does not prove constant throughout a nest series.

Worker. This caste is easily separable from the rest of the *Lasius* workers by its yellow body and small eyes and by having erect hairs on the scape and tibiae.

Lasius mixtus (Nylander)

Formica mixta Nylander, 1846, *Acta Soc. Sci. Fenn.* 2 : 1050-1052; ♀. Type locality: Sweden, Upsala.

Male. Several characters distinguish this species in the male. The structure of the mandible (fig. 1f) immediately separates it from the *niger*-type males (*niger*, *brunneus*, *alienus*). The absence of erect hairs on the mid and hind tibiae and the presence of only two or three distinct teeth at most on the mandible makes it distinct from *umbratus*. The structure of the mandible is at times very close to that of *flavus*, but in *flavus* cross-vein *m-cu* is always absent.

Female. This caste is also close to *umbratus*, but is readily separable on the absence of erect and suberect hairs on the scape and tibiae, compared with the presence of such hairs in *umbratus*. The scape in *mixtus* is somewhat different to that of *umbratus* when viewed from above (figs. 4b, 4c), being shorter, broader and more curved.

Worker. Although this caste separates readily from *umbratus* on the same characters as the female, it is very similar in appearance to the workers of *flavus*. The difference in the length of the hairs on the dorsal surface of the gaster remains the only reliable character for dividing these two species. The hair-length measurements given in the key were obtained by measuring the hairs of approximately 50 workers of each species, selected at random from many different localities and nest series. The scale of the petiole in these specimens was also studied, and it was found that all the *mixtus* scales had some form of dorsal emargination, usually in the form of a small central cleft (fig. 3a), whereas in *flavus* there were no signs of any distinct emargination, apart from a broad, very shallow depression in a few individuals. This character has been included in the key, but as the scales of the workers in all British *Lasius* tend to be rather variable, it should be treated with caution.

Lasius flavus (Fabricius)

Formica flava Fabricius, 1781, *Species Insectorum* 1 : 491; ♂. Type locality: Northern Europe.

Male. Having virtually clear wings, with cross-vein *m-cu* always absent on both fore wings (fig. 4d) and a mandible with two apically situated teeth followed by a plain, at times concave, margin (fig. 1e) the male of *flavus* is immediately separable from all other British *Lasius*.

Female. In his keys to British ants, Collingwood (1964) separated *flavus* females from those of *alienus* and *brunneus* on the pale ventral surface of the gaster in *flavus* compared to the unicolorous gasters of the other two species. This is a somewhat difficult character to use, as it tends to be rather variable. Therefore I attempted to find another method of dividing these three species. As can be seen from the key, this was achieved by taking out *alienus* on its clear wings and indistinct frontal triangle so as to leave *brunneus* and *flavus* as a last pair, now readily separable on the new character of eye pilosity (figs. 3d, 3e).

Worker. This caste is very close to that of *mixtus*, and is separable on the length of the hairs on the dorsal surface of the gaster. This character and the differences in petiole scale shape between the two species are discussed in the note on *mixtus* workers (p. 26).

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