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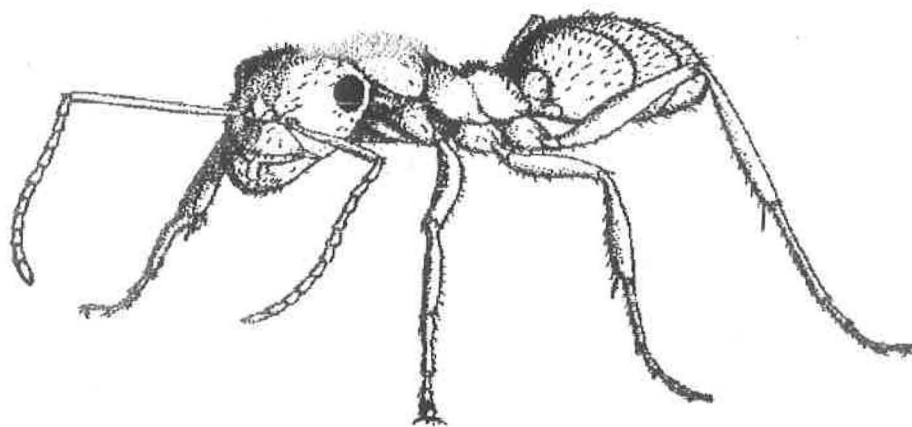


Suplemento nº 5 ao Boletim da
**SOCIEDADE PORTUGUESA
DE ENTOMOLOGIA**

CEDRIC COLLINGWOOD and **ANTHONY PRINCE**

**A GUIDE TO ANTS
OF
CONTINENTAL PORTUGAL**

(Hymenoptera: Formicidae)



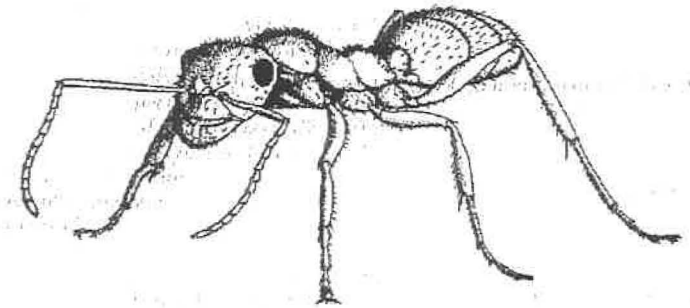
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A Guide to Ants of Continental Portugal (*Hymenoptera: Formicidae*)

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INTRODUCTION

Portugal, at the western edge of the Iberian Peninsula has had little published on ants until recent years. SANTSCHI, 1932 identified 28 species in the University of Coimbra Museum collection. SCHMITZ, 1955 enumerated about 50 species and COLLINGWOOD & YARROW, 1969, added a few more. Although the only key to the Iberian species up to the present time is given by COLLINGWOOD, 1978, a considerable body of information has been published by PAIVA, WAY & CAMELL, 1990 and CAMELL, WAY and PAIVA, 1996, from their studies of different types of woodland and their associated ant fauna, in areas south of the Tagus. De HARO & COLLINGWOOD, 1993, compared the species collected in western Spain and selected stopping off points in Portugal. TINAUT & RUANO, 1994 added two interesting rare species, *Chalepoxenus muellerianus* and *Strongylognathus huberi* from the Serra da Estrela and KUHLMAN, 1996 listed 15 species from the same area. The known ant fauna of Portugal now numbers over 100 species and this guide provide keys, illustrations and some basic information as a stimulus to collectors studying the insect fauna of this interesting country.

Ants are social insects living in communities of a few individuals to hundreds of thousands, according to the life style of the various species. Their social organisation and general abundance make them important in the ecosystem in many ways. The ant community is highly dependent on food exchange, or trophallaxis, between all inhabitants of a colony. Although surface active ants appear lively and spend much time foraging for food, more time is actually spent by individual workers within the nest; resting, grooming, constantly attending the brood and mouth to mouth food exchanging. Some species have symbiont arthropods living within the nest. These include species of isopods, psocids, mites and a variety of beetles which are adapted to ant life either as scavengers, parasites or as food source through interchange of attractive sugary body exudates. A comprehensive account of ants in a world context is given by HOLDOBLER & WILSON, 1990. Useful comprehensive and fully referenced accounts are also given by such works as DUMPERT, 1978 and SUDD, 1966. Morphological features used in the keys are illustrated in figures 1, 2 and 3. Keys are restricted to the female caste since males are less well known. In most species they are permanently winged, have one more antennal segment, and are commonly darker than the queens and workers.

KEY to SUBFAMILIES - queens and workers

- 1 - Peduncle with a single node or scale (Fig. 1).....2
- Peduncle with two distinct segments, the petiole and postpetiole (Fig. 2)
.....*Myrmicinae*
- 2 (1) - Apex of gaster has a projecting sting; first and second gaster tergites have a distinct constriction between them (Fig. 4).....*Ponerinae*
- Gaster has no projecting sting; the first and second gaster tergites are not

- separated by a constriction 3
- 3 (2) - Apex of gaster with a circular orifice, the acidopore (Fig. 25).....**Formicinae**
 - Apex of gaster terminating in a transverse slit (Fig. 20).....**Dolichoderinae**

Subfamily PONERINAE

Key to Genera and Species:

- 1 - Petiole with a toothlike ventral process (Fig. 4).....**Ponera coarctata** (Latreille)
 - Petiole with a simple rounded ventral projection.....**Hypoponera Santschi** 2
- 2 (1) - Head with a central median furrow which is continued as a fine distinct line to the occiput; antennal scape does not reach the posterior occipital margin
**H. punctatissima** (Röger)
 - Median furrow on head does not continue beyond the frontal ridges; antennal scape when laid back reaches the posterior occipital margin
**H. eduardi** (Forel)

Ecology and distribution:

Portugal is poor in recorded Ponerinae species, and there is no doubt that more intensive collecting would reveal more genera and species than are presented in the keys. *Ponera coarctata* is a South European species living in small colonies of 20-30 workers and often 2 or 3 queens. There is only one record for Portugal without locality. This ant. occurs in warm dry stony places in lowland areas. *Hypoponera eduardi* is widely distributed. Nests are deep in the ground and often populous, but the ant is usually found singly under stones, in warm semi shaded places. *Hypoponera punctatissima* is a tropical tramp species that has long been resident in Europe, where it occurs in rubbish dumps of organic fermenting waste and in heated buildings and glasshouses. The males are wingless, but winged queens are often taken in light traps and shallow pools. These ants are carnivorous living on captured and dead insects as well as norganic waste. Workers of these species are small, around 3 mm in length; but in the tropics and subtropics this subfamily include a vast array of species of very varied structure with sizes ranging from 2 to 24 mm.

Subfamily MYRMICINAE

Key to Genera:

- 1 - Postpetiole is attached to the dorsum of the first gaster segment; the petiole is flattened without a dorsal node; the gaster, seen from above, is broadly cordate (Fig. 11).....**Crematogaster** Lund
 - The postpetiole is attached medioventrally to the first gaster segment; the petiole is a distinct node; the gaster is more or less pyriform from above (Fig. 18) 2

- 2 (1) - Antennae 10 segmented with the two apical segments swollen to form a distinct club (Fig. 15)**Solenopsis** Westwood
 - Antennae 12 segmented 3
- 3 (2) - Mandibles falcate, narrowing to pointed apex without teeth (Fig. 17).....
**Strongylognatus** Mayr
 - Mandibles subtriangular with toothed masticatory border 4
- 4 (3) - Antennae with a distinct club of three enlarged segments (Fig. 18)..... 5
 - Antennae with an indistinct club of four or five segments (Fig. 6)..... 12
- 5 (4) - Eyes large, pointed towards and almost reaching the ventral surface of the head near the mandibles (Fig. 8)**Goniomma** Forel
 - Eyes rounded, placed at or near the lateral midline of the head 6
- 6 (5) - Head underneath with two strong carinae; petiole quadrangular; pronotum angulate; anterior margin of clypeus bidentate (Fig. 19).....**Myrmecina** Curtis
 - Ventral head simple without carinae; petiole peaked or rounded in profile, anterior clypeal margin simple 7
- 7 (6) - Postero-lateral border of clypeus ridged in front of the antennal insertions; sting with a lamellar appendage extending from the shaft (Fig. 14)
**Tetramorium** Mayr
 - Clypeus not raised into a ridge in front of the antennal insertions; sting without a lamellate appendage 8
- 8 (7) - Propodeum rounded posteriorly without spines or teeth; clypeus bicarinate (Fig. 18)**Monomorium** Mayr
 - Propodeum angled posteriorly or with spines or teeth; clypeus smooth or striated, not bicarinate 9
- 9 (8) - Dimorphic ants; large workers are broad headed with mandibles of two strong apical teeth separated widely from a small basal tooth; small workers have narrow heads and long multidentate mandibles (Fig. 9, 10)
**Pheidole** Westwood
 - Monomorphic ants with all workers in a colony of more or less even size and 5 denticles on each mandibles 10
- 10 (9) - Postpetiole cordate distinctly wider than long in dorsal view; alitrunk entirely without hairs (Fig. 12)**Cardiocondyla** Forel
 - Postpetiole not or only slightly wider than long in dorsal view; alitrunk dorsum with numerous hairs 11
- 11 (10) - Postpetiole with a toothlike ventral extension (Fig. 16).....
**Chalepoxenus** Menozzi
 - Postpetiole ventral surface simple without toothlike extension (Fig. 13).....
**Leptothorax** Mayr
- 12 (4) - Tibial spurs distinctly pectinate or at least minutely barbatulate
**Myrmica** Latreille

- Mid and hind tibial spurs simple.....13
- 13 (12) - Frontal carinae close set; petiole with elongate anterior stalk; clypeus bicarinate..... *Stenamna* Westwood
- Frontal carinae 1/3 head width or more; anterior penduncle short; clypeus not bicarinate..... 14
- 14 (13) - Metasternal process large; all species polymorphic with several sized workers in each colony; the large workers have broad heads and all workers and queens have broadly rounded mandibles (Fig. 7)..... *Messor* Forel
- Metasternal process inconspicuous or absent; most species are monomorphic and have elongate triangular mandibles (Fig. 6)..... *Aphaenogaster* Mayr

Genus *Mirmica*

Key to Species:

- 1 - Antennal scapes long and slender, gently curved near the base; frontal triangle smooth and shining; males have long scapes.....2
- Antennal scapes sharply bent near the base with or without a thickening or lamellar extension at the bend; frontal triangle striated at least in part; males have short scapes.....3
- 2 (1) - Petiole in profile with a large truncate dorsum; petiole and postpetiole rugose; infraspinal area with transverse striae; propodeal spines as long as the distance between their tips..... *ruginodes* (Nylander)
- Petiole in profile a small rounded dome or narrowly truncate; petiole shining without coarse sculpture; infraspinal area smooth; propodeal spines shorter than the distance between their tips..... *rubra* (Linnaeus)
- 3 (1) - Antennal scape simply curved without noticeable swelling or lamella; tibial spurs minutely barbatulate..... *aloba* (Forel)
- Antennal scape with at least a slight twist at the bend and often a distinct lamellar extension; tibial spur pectinate.....4
- 4 (3) - Petiole dorsum slopes to its junction with the postpetiole; postpetiole more or less cubical from above and only slightly higher than long in profile..... *specioides* Bondroit
- Petiole dorsum broadly truncate with a distinct step to its junction with the postpetiole; postpetiole wider than long in dorsal view and higher than long in profile (Fig. 5).....5
- 5 (4) - Antennal scape with a lamellar extension at the bend; anterior face of petiole flat..... *sabuleti* Meinert
- Antennal scape sharply bent without lamellar extension; anterior face of petiole more or less concave..... *scabrinodis* (Nylander)

Ecology and distribution:

This genus is represented by 8 species in South Western Europe. In Portugal the commonest species is *Myrmica sabuleti* (Fig. 5) which occurs in most woodlands north of the Tagus river. It is a robust species that lives mostly in discrete colonies of a few hundred workers and often 2 or 3 queens. *M. rubra* is less common in Portugal and tends to live in loamy soil along river banks. Nests of this species always have several to many queens and quite often occur in communities of nests that are aggressive to all other ant species. The sting is exercised freely and can be quite painful. European *Myrmica* are moderately sized orange brown ants. They are attracted to extra floral nectaries, oily seed elaiosomes, aphid exudates and other sugar substances, attack other arthropods including spiders for food and also scavenge for human food debris and insect corpses.

Genus *Aphaenogaster*

Key to Species:

- 1 - Yellowish inconspicuous ant with short funiculus segments..... *dulcinea* Emery
- Dark robust ants with all funiculus segments clearly longer than broad..... 2
- 2 (1) - Head only slightly longer than broad; gaster shining without sculpture..... *gibbosa* (Latreille)
- Head distinctly longer than broad; gaster dorsum finely and densely sculptured..... 3
- 3 (2) - Propodeal spines longer than their intervening width; antennae with four enlarged apical segments (Fig. 6)..... *iberica* Emery
- Propodeal spines short to very short; antennae with five enlarged apical segments..... *senilis* Mayr

Ecology and distribution:

Aphaenogaster iberica and *A. senilis* are large finely sculptured diurnal species. They nest in open ground and banks and develop populous single nest colonies of many hundreds of workers with single queens. These ants are aggressive, biting other insects with their strong many toothed jaws but unlike *Myrmica* species do not sting. They forage singly preying on other ants and arthropods but also transport petals into their nests as a source of sugar and starch. *A. gibbosa* is a smaller less sculptured species, but also common in open rocky habitats as well as open woodland nesting under stones. These three dark coloured ants are common throughout Portugal. The fourth species, the smaller pale coloured *A. dulcinea*, is more unobtrusive living in woodland in small nests in rotten wood.

Genus *Messor*

Key to Species:

- 1 - Propodeum with distinct short spines *lusitanicus* Tinaut
- Propodeum midly dentate, angulate or rounded in profile 2
- 2 (1) - Ventral surface of head with conspicuous long shaped hairs 3
- Ventral surface of head with scattered moderately curved and straight hairs 5
- 3 (2) - Alitrunk reddish contrasting with dark head and gaster; propodeum dentate or distinctly angulate in profile *maroccanus* Santschi
- Whole body uniformly black; propodeum never dentate 4
- 4 (3) - Dorsum of gaster shining; first tergite bare *bouvieri* Bondroit
- Dorsum of gaster with many hairs on all tergites *hispanicus* Santschi
- 5 (2) - Head and alitrunk coarsely striated; outstanding hairs on occiput extend round genae below eye level; body colour reddish brown *structor* (Latreille)
- Whole body smooth or head very finely striated; outstanding hairs on head in dorsal view restricted to occiput 6
- 6 (5) - Propodeum with dorsal and declivitous faces meeting at an angle; head of larger workers usually finely striated (Fig. 7) *capitatus* (Latreille)
- Propodeal outline smoothly rounded in profile; head mainly smooth and shining often red in largest workers *barbarus* (Linnaeus)

Ecology and distribution:

Messor species are seed gatherers often making long trails towards a suitable seed source which may be any one of a great variety of herb, grasses and shrub species. Unlike *Myrmica* and *Aphaenogaster*, *Messor* ants are polymorphic with many different sized workers in each colony. The major workers with their massive rounded mandibles crush the collected seeds to remove the husks which lie in scattered heaps around the nest entrances. Nests may be very populous and those of the conspicuous *M. barbarus*, in particular, are a common feature throughout southern Portugal especially along roadsides. *M. bouvieri* is almost as abundant but *M. lusitanicus*, a more slender species with short propodeal spines, and the bicoloured *M. maroccanus* are more local.

Genus *Gonioomma*

Key to Species:

- 1 - Eyes positioned near clypeal margin; clypeus broadly and weakly emarginate *blaci* (André)
- Eyes distant from clypeal margin by at least half their maximum length 2
- 2 (1) - Alitrunk and head strongly sculptured and dull *hispanicum* (André)
- Whole body shining with dilute sculpture *tunicum* Forel

Ecology and distribution:

Members of this genus are also seed gatherers, but are much smaller and less conspicuous than *Messor* (and unlike ants of that genus monomorphic), picking up seeds and other vegetable matter as individual foragers. They nest in the ground in bare soil. These ants are easily recognised by their large downward pointed eyes and well developed propodeal spines. They are general but not abundant throughout South Portugal. This genus is mainly restricted to Southwest Europe and North Africa.

Genus *Pheidole*

Pheidole pallidula (Nylander, 1849) (Figs. 9, 10)

Ecology and distribution:

Pheidole pallidula is the one native species of the genus found throughout Southwest Europe. Characteristically nests are found near pathways and on open ground with many small crater like openings. Species of this genus recruit rapidly towards a suitable food source which may include live and dead insects, food waste and other animal or sugary material.

Genus *Crematogaster*

Key to Species:

- 1 - Petiole quadrate in dorsal view with sides subparallel; antennal club two segmented *sordidula* (Nylander)
- Petiole rounded trapezoidal in dorsal view narrowing from front to rear; antennal club three segmented 2
- 2 (1) - Head and at least part of promesonotum red; dorsum of alitrunk with a distinct mesonotal keel *scutellaris* (Olivier)
- Body colour uniformly greyish to black; alitrunk sculpture dilute without a distinct mesonotal keel (Fig. 11) *auberti* Emery

Ecology and distribution:

C. scutellaris is a bicoloured species with a reddish head contrasting with the darker hind body. This species lives in or at the base of old trees, where the wood is partly rotten. In Europe, all *Crematogaster* species depend on the exudates of aphid species and *C. scutellaris* is characteristically seen trailing up and down mature trees, specially of cork oak, to collect aphid honeydew. This ant is common throughout Portugal. *Crematogaster auberti* nests in the soil often under stones in open ground. The ants cluster in a dense dark mass and when a nest is disclosed on lifting a stone do not,

unlike most other species, disappear agitatedly deeper into the nest, but remain stationary for several moments before moving slowly to protect themselves and their brood. *C. sordidula* is a smaller yellowish species living in small ground nests in grassy habitats.

Genus *Cardiocondyla*

Key to Species:

- 1 - Petiole node slightly wider than long; alitrunk brownish red *elegans* Emery
- Petiole oval in dorsal view; alitrunk clear red contrasting with dark gaster *batesii* Forel

Ecology and distribution:

Cardiocondyla species are small unobtrusive ants, length 2.3 - 3.2 mm. They live by general scavenging. Individual workers may be seen foraging over bare ground on warm days, specially after rain. Nests are the soil and have a very small entrance hole.

Genus *Leptothorax*

Key to Species:

- 1 - Antennae 11 segmented; scapes and tibiae with semi-erect hairs *acervorum* (Fabricius)
- Antennae 12 segmented; tibiae with decumbent hairs 2
- 2 (1) - Alitrunk profile deeply impressed; from above the mid-body is strongly waisted; dorsum has long fine pointed hairs *recedens* (Nylander)
- Alitrunk not deeply impressed or strongly waisted 3
- 3 (2) - Alitrunk with a distinct metanotal furrow *nylanderi* (Foerster)
- Alitrunk outline smooth without a distinct metanotal impression 4
- 4 (3) - Propodeal spines long and curved 5
- Propodeal spines short or very short, not curved 6
- 5 (4) - Body colour pale brown; petiole with long truncate dorsum *affinis* Mayr
- Body colour uniformly yellow; petiole short and sharply peaked in profile *racovitzai* Bondroit
- 6 (4) - Antennal clubs darker than rest of funiculus 7
- Antennal clubs unicolours pale with rest of funiculus 8
- 7 (6) - Gaster with a clear dark band (Fig. 13) *unifasciatus* Latreille
- Gaster with apical area dark but not in the form of a distinct band *tuberosum* (Fabricius)
- 8 (6) - Clypeus bicarinate with a shallow concavity between *clypeatus* Mayr

- 9 (8) - Clypeus partly striate or smooth but not bicarinate 9
- Propodeal spines very short, subdentate *corticalis* Schenck
- 10 (9) - Propodeal spines short but distinct 10
- Petiole profile with dorsal and anterior faces meeting at an approximate right angle *rabaudi* Bondroit
- Petiole peaked and rounded in profile *pardoi* Tinaut

Ecology and distribution:

There are many *Leptothorax* species in the Iberian Peninsula, but so far relatively few have been recorded from Portugal. The commonest species is the wide ranging *L. unifasciatus*. This nests variously under stones, in moss or under bark. *L. racovitzai*, a small uniformly yellow ant with relatively long curved spines, is typically found in small nests under loose bark of pine trees. A similar slightly larger species *L. affinis* lives in hollowed out twigs of living trees. Another common species, *L. recedens*, distinguished by its long hairs and strongly waisted appearance, nests in shady banks under pebbles or moss. All the species forage singly or, sometimes, in tandem running pairs and feed on mites and other small arthropods.

Genus *Tetramorium*

Key to Species:

- 10 - Petiole and post petiole coarsely striated *hispanicum* Bondroit
- Petiole and post petiole with at least centre dorsum unsculptured and shining...2
- 2 (1) - Head and alitrunk coarsely striated; petiole in profile a rounded cube (Fig. 14) *caespitum* (Linnaeus)
- Head finely striated; petiole in profile with a short truncate dorsum *semilaeve* André

Ecology and distribution:

All three *Tetramorium* species found in Portugal are relatively common and occur throughout the country. The smallest, *T. semilaeve* nests in dry stony banks and under south facing walls. The common European *T. caespitum* is generally found in the higher hills in Portugal. *T. hispanicum*, easily recognised by the strongly sculptured petiole and post petiole nodes, is abundant throughout Central and South Spain and Portugal and does not occur elsewhere in Europe. Stitz, 1917, named what may be this species as *T. ruginodis*, a year before Bondroit, 1918 described *T. hispanicum*, but the type of *T. ruginodis* has been lost all since its identity is uncertain the name *T. hispanicum* has been retained in all recent literature. All the *Tetramorium* species respond positively to fish and sugary baits, recruiting rapidly in numbers to such. Seeds are often collected for their oily elaiosomes, but unlike *Messor* not crushed for starch and eventual sugar conversion.

Genus *Solenopsis*

Key to Species:

- 1 - Body hairs long and profuse; the larger workers have coarse sculptured head; size range 2.2 – 3.1 mm 2
- Body hairs sparser; smaller species not exceeding 2.2 mm 3
- 2 (1) - In profile metanotal furrow makes a deep break in the alitrunk profile; clypeal teeth short, only centre pair projecting *monticola* Bernard
- In profile metanotal furrow visible but not or scarcely interrupting dorsal outline; clypeal teeth well developed *fugax* (Latreille)
- 3 (1) - Head longer than broad; subrectangular (Fig. 15) *latro* (Forel)
- Head short, nearly square *lusitanica* Emery

Ecology and distribution:

Solenopsis ants in Europe have long been known as thief ants. They are small to minute yellow ants but despite their size they are aggressive and sting viciously when attacked. Some species live in close association with larger *Formica* and *Lasius* ants and predate their brood. The small channels and entrance holes of *Solenopsis*' nests are impenetrable to the larger ants. *Solenopsis* are easily recognised by the dense aggregation of the workers, queen and brood within the nest.

Genus *Chalepoxenus*

Chalepoxenus muellerianus (Finzi, 1921) (Fig. 16)

Ecology and distribution:

Chalepoxenus is a genus whose members live in dulotic association with *Leptothorax* species. *C. muellerianus* was discovered in the Serra da Estrela (TINAUT & RUANO, 1994) with the usual host *Leptothorax unifasciatus*. *Chalepoxenus* workers make frequent raids, on nearby *Leptothorax* colonies carrying off brood to be reared as auxiliary workers. This species occurs throughout the Mediterranean area from the Iberian peninsula to the Balkans including Switzerland and Italy but records are few and the species is evidently rather rare.

Genus *Stongylognathus*

Stongylognathus huberi Forel, 1874 (Fig. 17)

Ecology and distribution:

This is another raiding slave making species living in association with one or other *Tetramorium* species in Central and South Europe. This species occurs in Central Spain

but is much less common than congener *S. testaceus* Schenck. Members of this genus are easily recognised by the toothless pointed sabre-like mandibles in queen and worker. It was discovered in Portugal in the Serra da Estrela by TINAUT & RUANO, 1994.

Genus *Monomorium*

Key to Species:

- 1 - Size small, 1.5 - 2 mm; first segment of antennal club distinctly shorter than second; alitrunk dorsum with hairs 2
- Size larger, 2.5 – 3 mm; first and second segments of the antennal club subequal; body colour brownish; alitrunk dorsum bare (Fig. 18) *subopacum* (Smith)
- 2 (1) - Head completely granulose; colour pale yellow; in heated buildings only..... *pharaonis* (Linnaeus)
- Head shining with dilute or no sculpture; colour black *carbonarium* Smith

Ecology and distribution:

Monomorium subopacum (Fig. 18) occurs here and there along the South coast nesting among warm rocks. It is also to be found in the neighbourhood of villages in the South. This small brown ant is a general scavenger living on detritus and rubbish. The smaller black *M. carbonarium* was taken once in a salt marsh on the north west coast near Viana do Castelo and there may well be other species in this group along the coasts of Portugal. The wide ranging little yellow cosmopolitan *M. pharaonis* is restricted to heated buildings such as bakeries and hospitals where it may become a domestic nuisance.

Genus *Myrmecina*

Myrmecina graminicola (Latreille) (Fig. 19)

Ecology and distribution:

Myrmecina graminicola is the soil member of this genus throughout Central and South Europe. It is a heavily sculptured and square shouldered ant often found under deep stones and occasionally in the nests of *Lasius*' species, where it probably attacks and feeds on the brood. This slow moving, cryptic species although widely distributed is not often seen above ground. It is readily attracted to meat baits.

Genus *Stenammina*

Ecology and distribution:

Ants of this genus have not yet been recorded from Portugal but its members are rather cryptic. They are reddish brown narrow bodied ants normally found as single workers in shaded woodland under deep stones or at the roots of trees where easily escape detection. There are at least three species in Spain.

Subfamily DOLICHODERINAE

Key to Genera and Species:

- 1 - Petiole scale well developed, standing clear from the gaster 2
- Petiole a reduced node concealed by overhanging gaster (Fig. 20) *Tapinoma* Mayr 3
- 2 (1) - Gaster dorsum with fine long hairs; head not narrowed anteriorly; mesonotum rather short and thick; maxillary palps with 2 or 4 segments (Fig. 21) *Bothriomyrmex meridionalis* (Roger)
- Gaster dorsum bare; head distinctly narrowed anteriorly, mesonotum relatively long and slender; maxillary palps long with six segments (Fig. 22) *Linepithema humile* (Mayr)
- 3 (1) - Polymorphic species - size range 3.2 - 5.2 mm; propodeum high; the dorsum, in side view, forming an approximate right angle at its junction with the mesonotum *nigerrimum* (Nylander)
- Monomorphic, total length not exceeding 4.2 mm; profile of propodeum lower, meeting mesonotum at an oblique angle 4
- 4 (3) - Anterior clypeal notch very shallow, always wider than deep *ambiguum* Emery
- Clypeal notch about as deep as wide or deeper 5
- 5 (4) - Clypeal notch distinction deeper than wide; funiculus segments clearly longer than wide *simrothi* Krausse
- Clypeal notch about as deep as wide; funiculus segments short *erraticum* (Latreille)

Genus *Tapinoma*

Ecology and distribution:

There are four species of this genus in Portugal. The provisionally named *T. ambiguum* may well be an undescribed species since the queens and workers are slightly larger than their counterparts in Central Europe. It is surprisingly common in southern woodlands, but is a less dominant ant than either *T. simrothi* or *T. nigerrimum* which are strong aggressive ants in the same environment.

Tapinoma nigerrimum, the commonest species throughout southern Portugal, is the largest of the Iberian species and also distinguished by the presence of larger and small workers in the same colony, unlike the monomorphic species. *T. simrothi* is abundant

throughout coastal North Africa and Middle East and like *Linepithema humile* is probably an invasive species mainly restricted to coastal areas in the Iberian peninsula. *T. erraticum* (Fig. 20) is a hillside submontane species.

Genus *Bothriomyrmex*

Bothriomyrmex meridionalis (Roger) (Fig. 21)

Ecology and distribution:

Bothriomyrmex was recorded as the species *meridionalis* by SCHMITZ (1955). Species of this genus are often found in mixed nests with *Tapinoma* species and there is some evidence to show that fecundated queens invade *Tapinoma* nests where they secure adoption by the workers, probably through some pheromonal or glandular attractive exudate. After that they proceed to replace the *Tapinoma* queen or queens, so that all subsequent brood reared in the nest being that of the parasite species. However, pure and populous nests of *Bothriomyrmex* are more commonly found and for that reason it is not certain as to how far the association with *Tapinoma* is obligatory.

Genus *Linepithema*

Linepithema humile (Mayr)

Ecology and distribution:

Linepithema humile (Fig. 22) is a non native species that has invaded the whole coastal area of Portugal and is present in all major townships and some villages. In the field, it is spectacularly abundant in pine plantations and commons generally in other woodland areas in the southern part of the country. It is polygynous and may develop huge colonies to the detriment of the local ant fauna, but seems to have arrived at a settled state as its present recorded occurrences are much the same as they were 30 years ago. Its present day distribution and environmental effects have been investigated by CAMEL *et al.*, 1996 and WAY *et al.* 1997.

Subfamily FORMICINAE

Key to Genera:

- 1 - Antennal insertions set at a distance behind the clypeal margin and the antennal and clypeal fossa are well separated *Camponotus* Mayr
- Antennal insertions set close to the clypeal margins with the antennal and clypeal fossa often confluent 2
- 2 (1) - Antennae 11 segmented 3
- Antennae 12 segmented 4
- 3 (2) - Propodeum and petiole bidentate *Lepisiota* Santschi
- Propodeum unarmed, petiole simply rounded; very small ants 1.5 - 2.5 mm *Plagiolepis* Mayr

- 4 (2) - Mandibles falcate, sharply pointed (Fig. 32) *Polyergus* (Latreille)
 - Mandibles coarsely dentate with a broad masticatory border 5
- 5 (4) - Propodeal spiracle set close to the posterior margin; ocelli absent or very small (Fig. 25) *Lasius* Fabricius
 - Propodeal spiracle set way from posterior margin; ocelli distinct in all castes ..6
- 6 (5) - Petiole a broad node; ventral head posterior of maxillae with long curved hairs (Fig. 34) *Cataglyphis* Foerster
 - Petiole an upright scale; ventral head posterior of maxillae with short straight hairs7
- 7 (6) - Mandibles with 7 or more teeth with the third tooth from apex distinctly smaller than the fourth (Fig. 30) *Formica* Linnaeus
 - Mandibles with 5 teeth evenly decreasing in size from apex to base so that the third tooth is larger than the fourth (Fig. 33) *Proformica* Ruzsky

Genus *Plagiolepis*

Key to Species:

- 1 - Funiculus segments 2 and 3 quadrate, subequal, shorter than segment 4 (Fig.23) *pygmaea* (Latreille)
 - Funiculus segment 2 quadrate much shorter than 3 or 4 which are subequal, longer than broad *schmitzi* Forel

Ecology and distribution:

Plagiolepis include at least two common and widely distributed species. They are small inconspicuous ants (length less than 3 mm) living in rotten wood, leaf litter and among rocks, mainly in woodland areas. They predate mites and other small arthropods, but unlike *Solenopsis* appear to be non aggressive to other ant species.

Genus *Lepisiota*

Lepisiota frauenfeldi (Mayr) (Fig. 24)

Ecology and distribution:

Lepisiota frauenfeldi is the only south west species of this genus. Workers are narrow bodied long legged diurnal ants actively predated other arthropods. Distribution in Portugal and Spain is very localised and restricted to south coastal areas.

Genus *Lasius*

Key to Species:

- 1 - Body colour evenly yellow to yellowish brown 2

- Body colour greyish to dark brown, in some species the alitrunk is lighter 4
- 2 (1) - Scapes and tibiae with suberect hairs *meridionalis* (Bondroit)
 - Scapes and tibiae with pubescence only 3
- 3 (2) - Monomorphic small eyed species - 20 facets *myops* Forel
 - Species with variably workers and larger eyes - 40 or more facets *flavus* (Fabricius)
- 4 (1) - Scapes and tibiae with very few or no erect hairs 5
 - Scapes and tibiae with many erect hairs 7
- 5 (4) - Frontal triangle and frontal furrow well marked and distinct; scapes and tibiae entirely without erect hairs 6
 - Frontal triangle and frontal furrow indistinct; at least hind tibiae with occasional hairs *alienus* (Foerster)
- 6 (5) - Head and alitrunk paler than dark gaster, arboreal species *brunneus* (Latreille)
 - Alitrunk clear yellowish red (Fig. 25) *emarginatus* (Olivier)
 - Alitrunk at most slightly paler than head and gaster 8
- 8 (7) - Suberect appendage hairs longer and sparser, alitrunk usually somewhat paler than gaster *grandis* Forel
 - Appendage hairs crowded, body evenly greyish to brownish black *niger* (Linnaeus)

Ecology and distribution:

Lasius species are generally abundant especially in wooded areas. The bicoloured *L. emarginatus* is frequent along ivied walls in the north part of the country but not found in the drier south. *L. brunneus* lives in the decayed parts of old oak trees but is unobtrusive and seldom seen outside the bark. *L. lasiodes* is a more local species that attends arboreal aphids although it nests in the ground in open woodland. It is very fugitive and rapidly disappears into the lower nest and leaf litter on disturbance. *L. grandis* is altogether more obtrusive and aggressive and occurs commonly in open places, parks and gardens, and in the neighbourhood of villages.

Yellow *Lasius* species are represented in Portugal by the small eyed *L. myops* which is common in dry woodland nesting under stones. *L. flavus*, so abundant through central and north Europe, is restricted to higher meadows in Portugal. Another species *L. meridionalis* is so far very local. In this species, fresh colonies are started by mated queens which after the mating flight loose their wings acid seek refuge, sometimes after a long isolation period, in nests of *L. alienus*. The invaded queen is sometimes killed, but occasionally may be accepted into the strange colony. She then seeks out and destroys the host queen and proceeds to lay eggs which are nurtured by the host species so that eventually the colony develops a pure *L. meridionalis* population.

This pattern of queen adoption by workers of an established colony of another species occurs in several boreal ant species where an unaided queen is unable to start and nourish a colony herself. *Lasius* species often have large marriage flights occurring

simultaneously over a wide area usually in humid warm weather in late summer. All *Lasius* species depend largely on aphid honeydew as their main food source but also make up their protein requirement by predation on small arthropods, including aphids.

Genus *Camponotus*

Key to Species:

- 1 - Front of head obtusely angled, truncated with the sides of the clypeus subparallel (Fig. 26)..... *truncatus* (Spinola)
- Front of head continuing same plane as the rest, not truncate; clypeus trapezoidal (Fig. 28, 29)..... 2
- 2 (1) - Dorsal surface of propodeum forming a distinct angle with the declivitous part 3
- Dorsum of propodeum rounds smoothly into the declivitous part 7
- 3 (2) - Metanotal impression very slight or effaced *gestroi* Emery
- Metanotal impression a deep furrow 4
- 4 (3) - Head and promesonotum reddish 5
- Head dark as gaster 6
- 5 (4) - Propodeum steeply but smoothly rounded posteriorly *sicheli* Mayr
- Propodeal dorsum forming a sharp angle with the declivitous face (Fig. 27) *lateralis* (Olivier)
- 6 (4) - Prothorax yellowish red contrasting with dark colour of the rest of the body *figaro* Collingwood & Yarrow
- Whole body shining black *piceus* (Leach)
- 7 (2) - Clypeus with a wide notch in the middle of the front border (Fig. 28) *fallax* (Nylander)
- Clypeus border entire without a median notch 8
- 8 (7) - Clypeus distinctly keeled with front border projecting beyond the side margins as a rectangular plate 9
- Clypeus not distinctly keeled; front border not projecting beyond the side margins *vagus* (Scopoli)
- 9 (8) - Genal margins with several projecting hairs 10
- Genal margins without projecting hairs 12
- 10 (9) - Body colour entirely black *aethiops* (Latreille)
- Mid-body yellowish at least in part 11
- 11 (10) - Hind tibiae with a distinct deeply etched longitudinal furrow *barbaricus* Emery
- Hind tibiae, simple or with shallow indistinct furrow *pilicornis* (Roger)
- 12 (9) - Gaster thickly pubescent, body dull without shine 13
- Gaster pubescence dilute, body shining at least in part 14
- 13 (12) - Propodeum and front of first gaster tergite orange yellow; hind tibiae distinctly channelled (Fig. 1, 29) *cruentatus* (Latreille)

- Whole body dull black; hind tibiae not channelled *micans* (Nylander)
- 14 (12) - Propodeum separated from mesonotum by a distinct rounded furrow; colour shining black *foreli* Emery
- Dorsal outline of alitrunk simple, unbroken; mid-body reddish or black *sylvaticus* (Olivier)

Ecology and distribution:

Camponotus species occur in variety in Portugal.

The largest species, *C. cruentatus*, is an aggressive ant usually occurring in large colonies in sun exposed banks. On disturbance the workers rush out to attack and bite fiercely the intruding ant or the inquisitive human. Other ants may be nearly as large but are more fugitive with their main activity during twilight hours. Such species include *C. aethiops*, *C. pilicornis* and *C. sylvaticus* which mainly nest under stones in open woodland. The black *C. vagus* is another large aggressive ant nesting in rotten wood but is much less common than the species mentioned above.

This genus includes a number of smaller ants like *C. fallax*, *C. sicheli*, *C. lateralis*, *C. piceus* and *C. truncatus*. These ants are mainly found in woodland, nesting in tree stumps or partially decayed branches. The common *C. lateralis* is of particular interest in that individual workers are often to be seen ascending trees in company with the much more numerous *Crematogaster scutellaris* workers. Since both species share much the same colour pattern the *C. lateralis* workers may be presumed to be protectively coloured against possible predators. These tend to avoid *Crematogaster* species which can expel a deterrent substance from their anal glands. Most *Camponotus* species depend largely on aphid honeydew but many species, including the large *C. barbaricus*, *C. cruentatus* and also the diurnally active *C. foreli*, will attack other insects for food. *C. foreli* will also raid nests of other ant species.

Genus *Formica*

Key to Species:

- 1 - Bicoloured ants, alitrunk red with varying amounts of dark patches, at least genae just above the mandibles and parts of the metapleurae reddish 2
- Body colour evenly greyish black to black 9
- 2 (1) - Anterior margin of clypeus with a distinct median notch (Figs. 2, 20) *sanguinea* Latreille
- Anterior margin of clypeus broadly rounded and entire 3
- 3 (2) - Occiput and all parts of the body with numerous erect hairs; petiole a thickened node, propodeum low and rounded *subrufa* Roger
- Body hairs sparse; petiole an upright scale; propodeal dorsum high with steeply inclined declivitous face 4
- 4 (3) - Frontal triangle dull, terminal segment of maxillary palps as long as the

- penultimate segment..... 5
- Frontal triangle reflecting light; terminal segment of maxillary palps shorter than the penultimate segment 7
- 5 (4) - Alitrunk dorsum with several erect hairs 6
- Alitrunk dorsum bare or at most with 2 to 4 short bristles on the promesonotum *cunicularia* Latreille
- 6 (5) - Erect hairs scattered over the alitrunk dorsum; general body colour greyish; fugitive woodland species..... *gerardi* Bondroit
- Upper surface of scale and promesonotum with several to many forward inclined hairs; alitrunk and most of head red; open ground robust species..... *rufibarbis* Fabricius
- 7 (4) - Alitrunk and head bright red; second and third funiculus segments twice as long as broad *dusmeti* Emery
- At least promesonotum and head dorsum with dark patches 8
- 8 (7) - Gaster pubescent and dull; dark patch on promesonotum well defined; occiput with short projecting hairs *pratensis* Retzius
- Gaster moderately shining; dark patch on promesonotum not dense or well defined; occiput without projecting hairs *rufa* Linnaeus
- 9 (1) - Prothorax with several stiff hairs; gaster pubescence long giving a silky appearance (Fig. 31) *decipiens* Bondroit
- Alitrunk dorsum bare; gaster pubescence dilute and general appearance more shining *fusca* Linnaeus

Ecology and distribution:

The common black ant *Formica fusca* is general in the northern woodlands giving place to similar species such as *F. cunicularia* on warmer more exposed sites. *Formica rufibarbis* in the same species group is a more brightly coloured ant with a mainly red head and alitrunk. This ant is more frequent along roadside verges. Both this and *F. decipiens* are more aggressive than the other species but all will attack other insects that come their way as well as exploiting sugary foods from extra floral nectaries and aphid honeydew.

Formica sanguinea is a large brightly coloured nest-raiding ant, that attacks other ant species, chiefly *F. cunicularia*, *F. gerardi* and *F. fusca*. Raids occur during the high summer, the nests of the smaller ants are overwhelmed by the fierce onslaught of the raiders which enter the nest and carry off the pupae and the larger larvae of the attacked victims. Some of the larvae and pupae are used as food but some are also reared in the *F. sanguinea* nest to live as auxiliary nurse workers so that it is customary when opening a *F. sanguinea* nest to find a minority of smaller darker workers together with the large red raider ants.

The robust wood ants *Formica rufa*, *F. dusmeti* and *F. pratensis* are rather rare and local in Portugal being more or less restricted to the northern wooded areas. These ants build their nests of twigs and leaf litter. They are also pugnacious and freely squirt formic

acid. *F. dusmeti* in particular is only known from a very few localities in the Northwest. In Portugal the species referred to here as *F. dusmeti* corresponds with the form described as var. *frontalis* Santschi because of the numerous body hairs which are absent in the *dusmeti* type but in all other respects the two forms look and act similarly with shallow nests of leaf litter among loose stones.

Formica subrufa is a very interesting species. Its morphology is unlike that of any other *Formica* species anywhere in the world. It like so many Iberian species is a true endemic and also occurs in the French part of the eastern Pyrenees but nowhere else in Europe. Yet it is a common and highly successful ant living in Portugal never attacked or enslaved by raiding species. It is an active diurnal predator on arthropods. All *Formica* species avidly attend aphids for honeydew but are also active predators on other insects.

Genus *Polyergus*

Polyergus rufescens (Latreille) (Fig. 32)

Ecology and distribution:

The single European species *Polyergus rufescens* is an aggressive slave raider ant attacking nests of *F. cunicularia*, *F. gerardi* and similar species (*Formica fusca* group) and bearing off their pupae to be reared in the *Polyergus*' nests. Workers of the host species are unable to feed themselves, or to rear brood, so are entirely dependant on the captured slave species. *Polyergus*' jaws are sharp and pincer like and well adapted for repelling and intimidating the raided *Formica* species. It is curious that *F. gerardi*, one of the most timid and fugitive ants of the *Formica* group, alters behaviour when brought up in a *Polyergus* nest and becomes much bolder. *Polyergus rufescens* occurs mainly in open woodland and dry pasture throughout Central and South Europe.

Genus *Proformica*

Key to Species:

- 1 - First gaster tergite with distinct pubescence (Fig. 33) *ferreri* Bondroit
- 2 - First gaster tergite shining with very sparse or without pubescence *nasula* Nylander

Ecology and distribution:

Proformica species are hard to identify with any accuracy because of much variation in pilosity and pubescence and the allometric differences in body proportions among different sized workers. Ants of this species are active predators but hunt singly and are both swift running and fugitive on disturbance. They also attend nectar sources. Nests are generally located on dry grassy hillside slopes and also occur quite high up as in the

Serra da Estrela (2000 m). A few individuals in the nest with much distended gasters act as living honey pots both receiving and giving out fluid food to the foraging workers and the other nest inmates.

Genus *Cataglyphis*

Key to species:

- 1 - Large dull black ants with numerous erect hairs over the whole alitrunk dorsum *hispanicus* (Emery)
- Smaller shining black ants with very few alitrunk hairs (Fig. 34).....
..... *ibericus* (Emery)

Ecology and distribution:

Cataglyphis hispanicus is a large black endemic species not found outside Portugal and Western Spain. This species thrives in dry pasture among cork oaks and is generally abundant throughout Portugal. The nest entrance is a single hole in the ground and individual workers run in and out during the day. The main food is insect-corpse which are piled up in galleries within the nest. Although the ants are large, vigorous and move rapidly and aggressively over the ground, they are actually fugitive and avoid close encounters with other ants.

C. ibericus is as widely distributed, but much less conspicuous ant. Probably it includes a complex of species. Workers are smaller than *C. hispanicus* and much less obtrusive but the life style is generally similar with ants making darting movements interspersed with longer runs while foraging often over many meters in search of dead and moribund insects. Both species occasionally take nectar.

COLLECTING, PRESERVING AND KEEPING ANTS

Ant specimens may be required for close examination and identification. When investigating a colony for this purpose, nest material may be thrown on to a sheet and individual ants picked off with a fine damp paint brush. They can be killed and preserved in a relaxed condition with ethyl acetate using a few drops in cotton wool in a glass tube.

Alternatively, for a more permanent storage, ants may be killed and preserved in ethyl alcohol 50-70%. For mounting specimens should be set by attaching them across the point of a triangular card using a suitable gum. For ready identification in the field a hand lens with 15-20 times magnification is useful. Locality and date labels should be attached to the pin under the mount.

Ants are relatively long lived insects. Workers may live for 18 months or more in captivity and queens of many species may live for many years. To collect enough living ants for an observation nest a small suction device or hand held pooter is useful. There

are many devices for keeping ant colonies in captivity. The essentials are the maintenance of humidity by using a water soaked pad of cotton wool. Glass or plastic containers with close fitting lids should be used or as an alternative, the vertical rims of the container may be painted with a proprietary non stick material. A suitable diet for most species would be dilute honey for carbohydrate and fruit fly larvae for protein. Ants should be kept at moderate room temperatures out of full sunlight to prevent hyperactivity and drying out. There are many techniques described in the literature and BRIAN, 1977 describes many such.

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FIGURES

Key for Figures Showing Morphological Features

Ac: Acidopore	Pd: Penduncle
Al: Alitrunk	Pe: Petiole
As: Antenna Socket	Pm: Propodeum
Cl: Clypeus	Pp: Post petiole
Co: Coxa	Pr: Pronotum
Fc: Frontal carina	Ps: Propodeal spiracle
Fe: Femur	S: Spine
Ff: Frontal furrow	Sc: Scape
Ft: Frontal Triangle	St: Sting
Fu: Funiculus	T1, T2, T3: Tergite 1, 2, 3
Ga: Gaster	Ta: Tarsi
Ma: Mandible	Tb: Tibia
Ms: Mesonotum	Tr: Trochanter
Mt: Metanotum	Ts: Tibial spur
Oc: Ocellus	

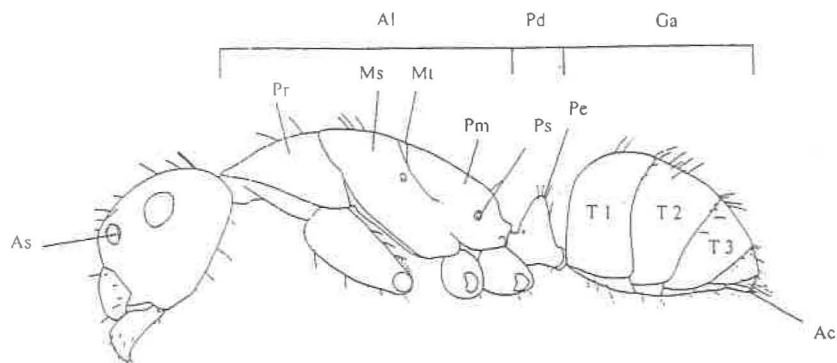


Fig. 1 - Profile *Camponotus cruentatus*

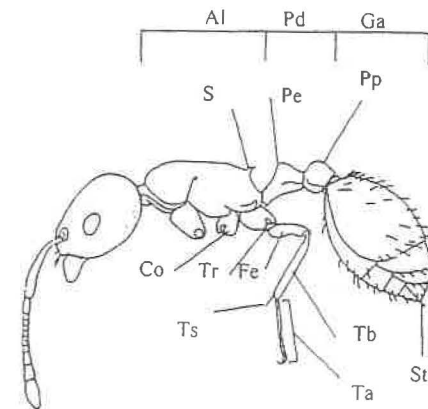


Fig. 2 - Profile *Leptothorax unifasciatus*

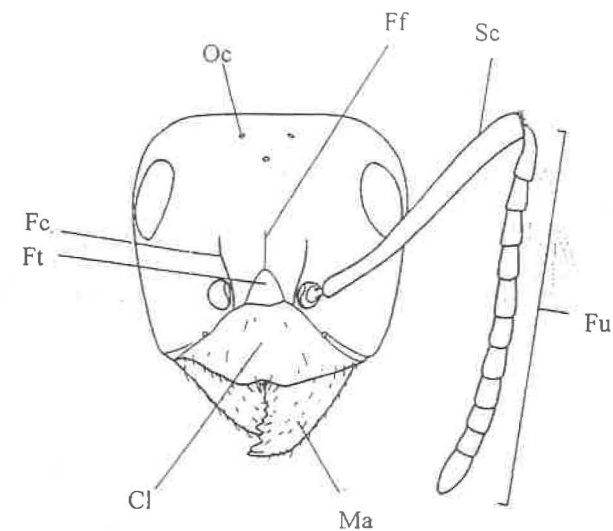


Fig. 3 - Head dorsal view of *Formica sanguinea*

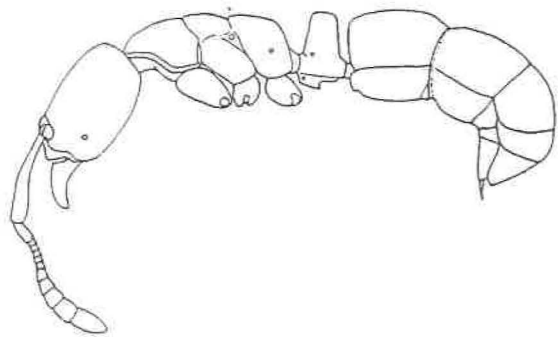


Fig. 4 - Profile *Ponera coarctata* ♀

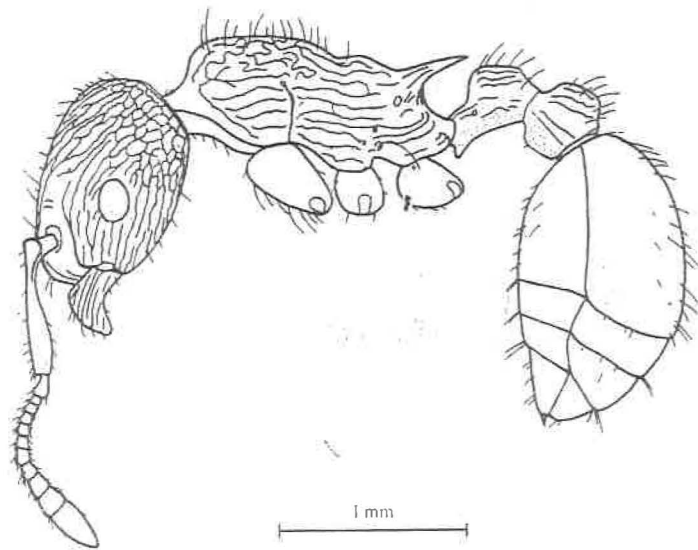


Fig. 5 - Profile *Myrmica sabuleti* ♀

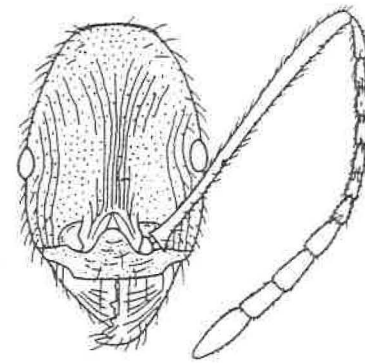


Fig. 6 - Head dorsum *Aphaenogaster iberica* ♀ (showing antennal config.)

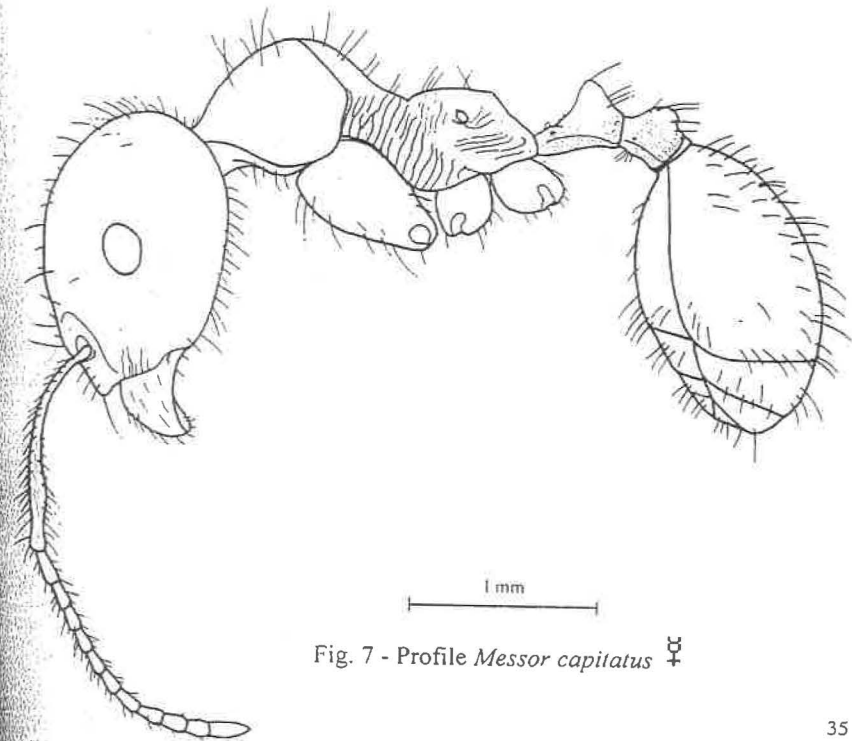


Fig. 7 - Profile *Messor capitatus* ♀

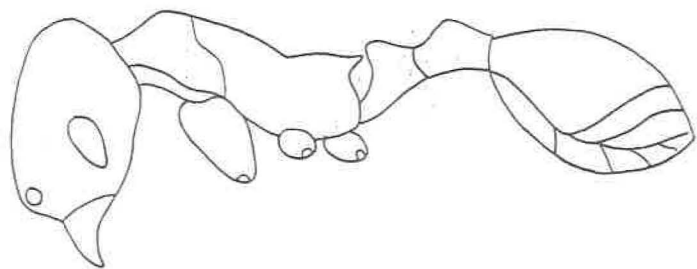


Fig. 8 - Profile *Goniomma hispanicum* ♀

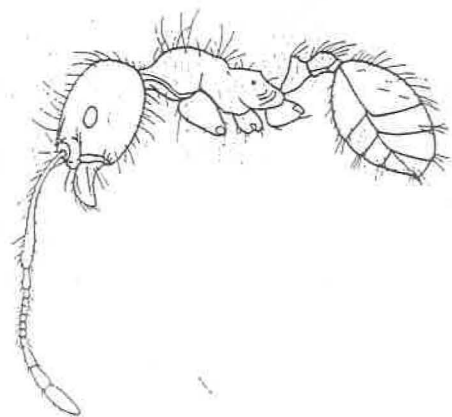


Fig. 9 - Profile *Pheidole pallidula* ♀, minor worker

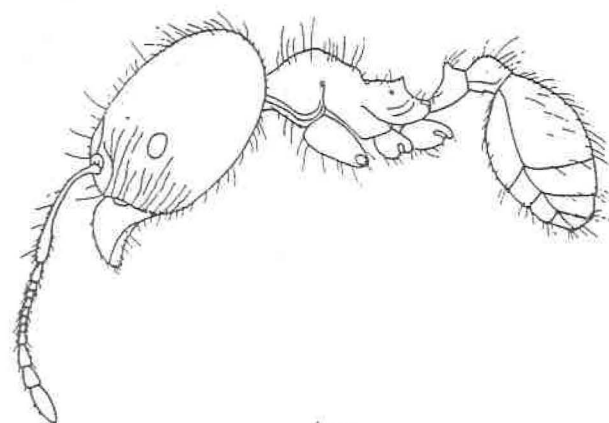


Fig. 10 - Profile *Pheidole pallidula* ♀, major worker

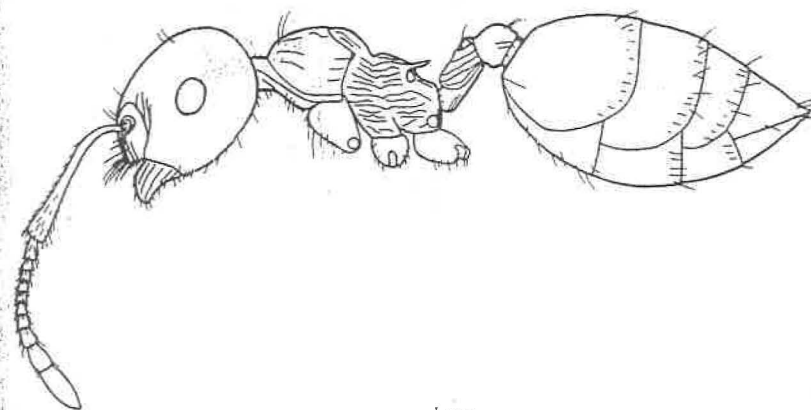


Fig. 11 - Profile *Crematogaster auberti* ♀

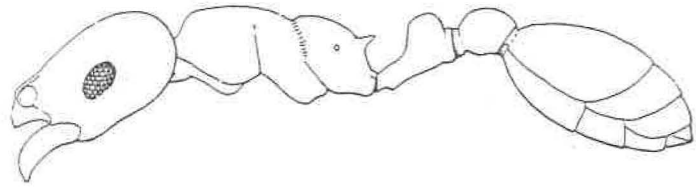


Fig. 12 - Profile *Cardiocondyla elegans* ♂

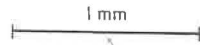
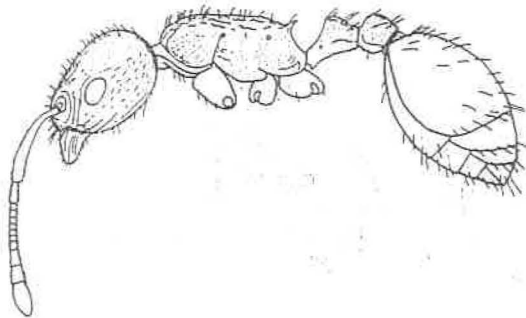


Fig. 13 - Profile *Leptothorax unifasciatus* ♂

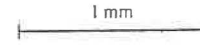
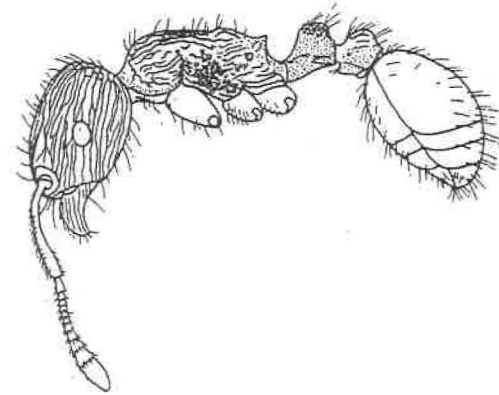


Fig. 14 - Profile *Tetramorium caespitum* ♀

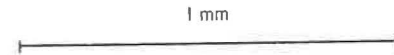
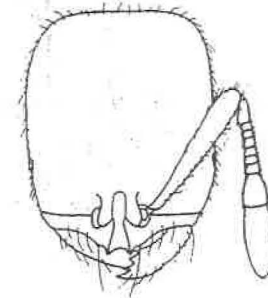


Fig. 15 - Head dorsum *Solenopsis latro* ♀ (showing antennal config.)

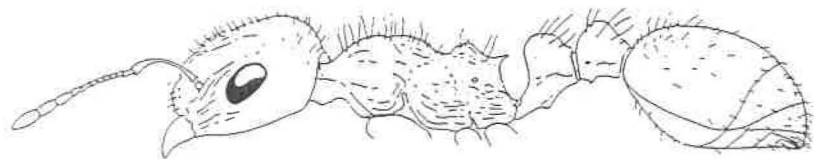


Fig. 16 – Profile *Chalepoxenus muellerianus* ♀

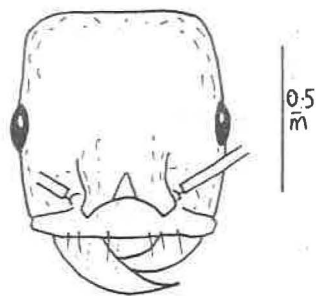


Fig. 17 – Head dorsal view *Strongylognathus huberi* ♀

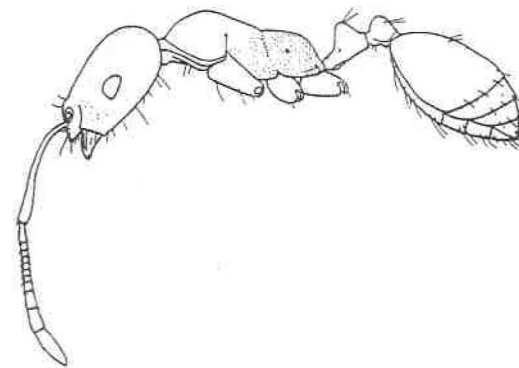


Fig. 18 - Profile *Monomorium subopacum* ♀

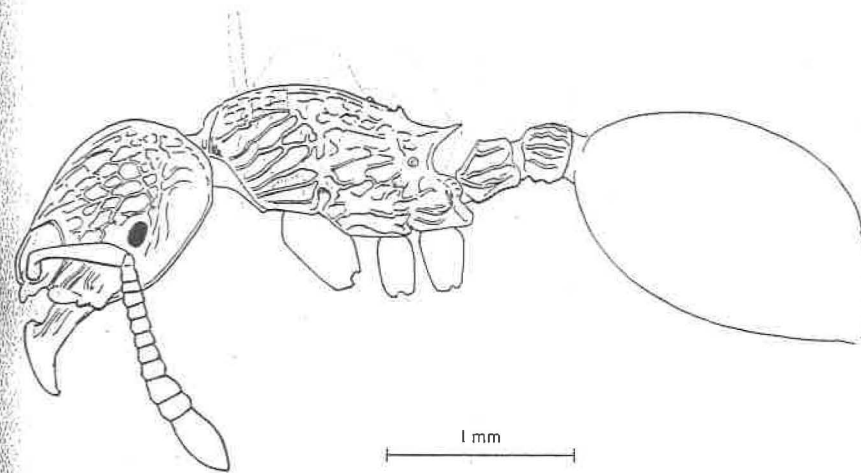


Fig. 19 – Profile *Myrmecina gramminicola* ♀

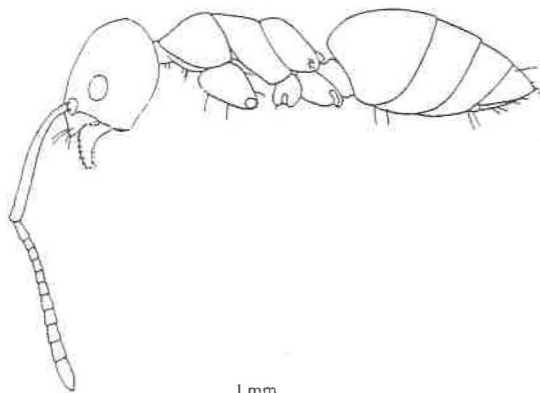


Fig. 20 - Profile *Tapinoma erraticum* ♀

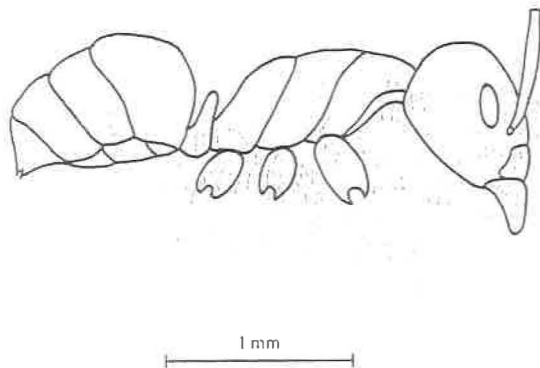


Fig. 21 - Profile *Bothriomyrmex meridionalis* ♀

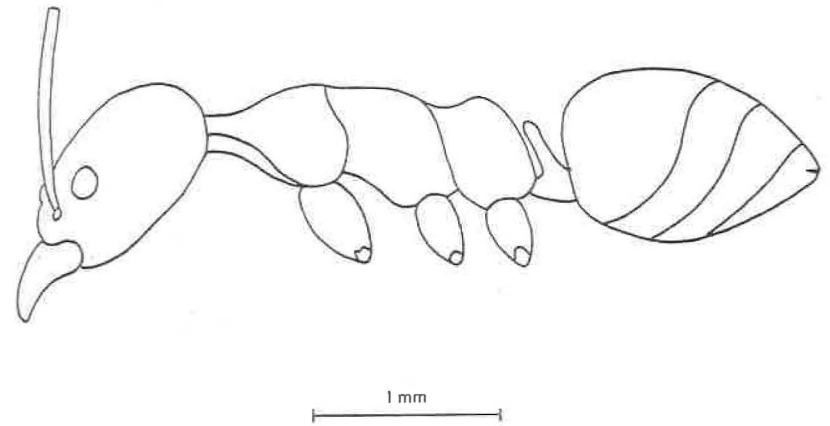


Fig. 22 - Profile *Linepithema humile* ♀

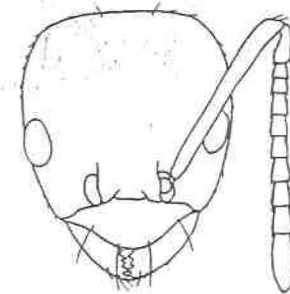


Fig. 23 - Head dorsum *Plagiolepis pygmaea* ♀ (showing antennal config.)

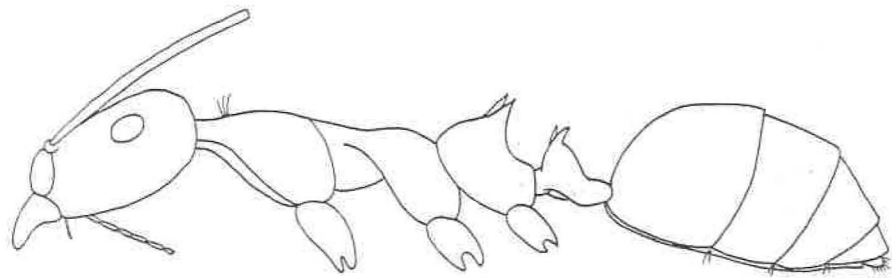


Fig. 24 - Profile *Lepisiota frauenfeldi* ♀

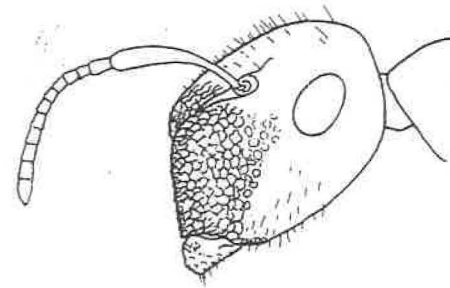


Fig. 26 - Profile head of *Camponotus truncatus* ♀

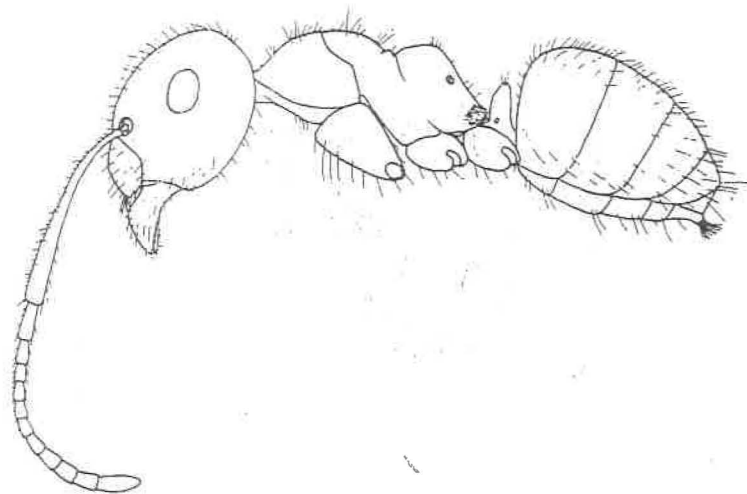


Fig. 25 - Profile *Lasius emarginatus* ♀

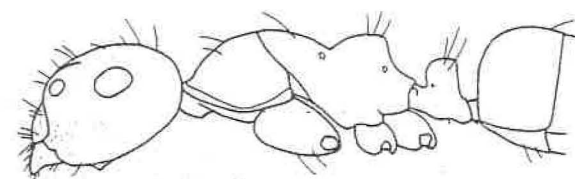
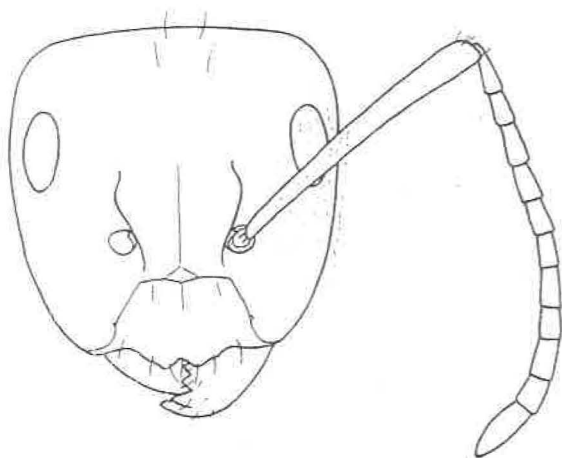
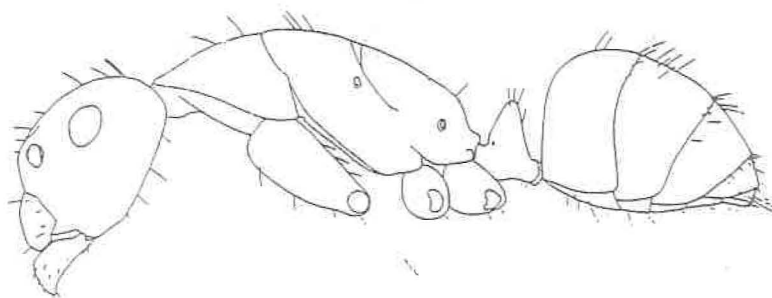


Fig. 27 - Profile *Camponotus lateralis* ♀



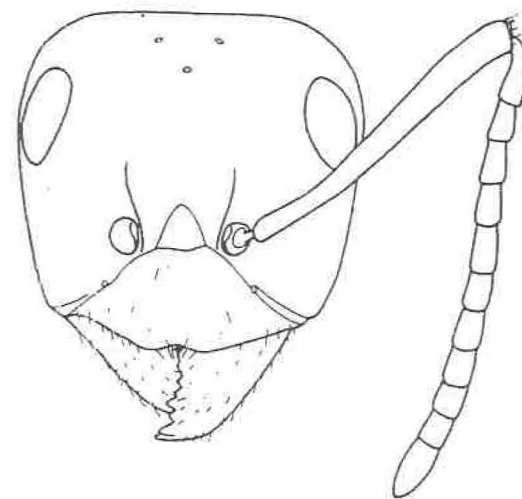
1 mm

Fig. 28 - Head dorsum *Camponotus fallax* ♀ (showing emarginate clypeus)



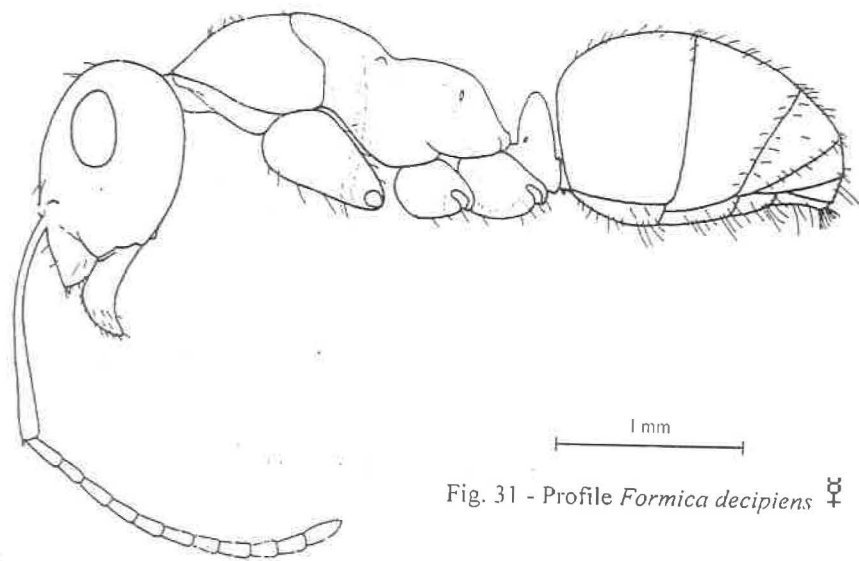
1 mm

Fig. 29 - Profile *Camponotus cruentatus* ♂



1 mm

Fig. 30 - Head dorsum *Formica sanguinea* ♀ (showing notched clypeus)



1 mm

Fig. 31 - Profile *Formica decipiens* ♀

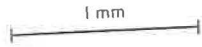
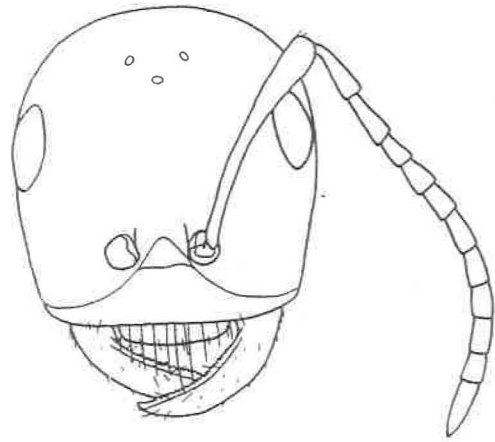


Fig. 32 - Head dorsum *Polyergus rufescens* ♀ (showing falcate mandibles)

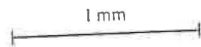
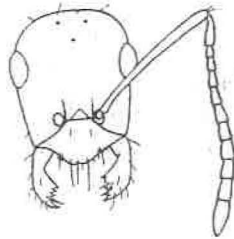


Fig. 33 - Head dorsum *Proformica ferreri* ♀

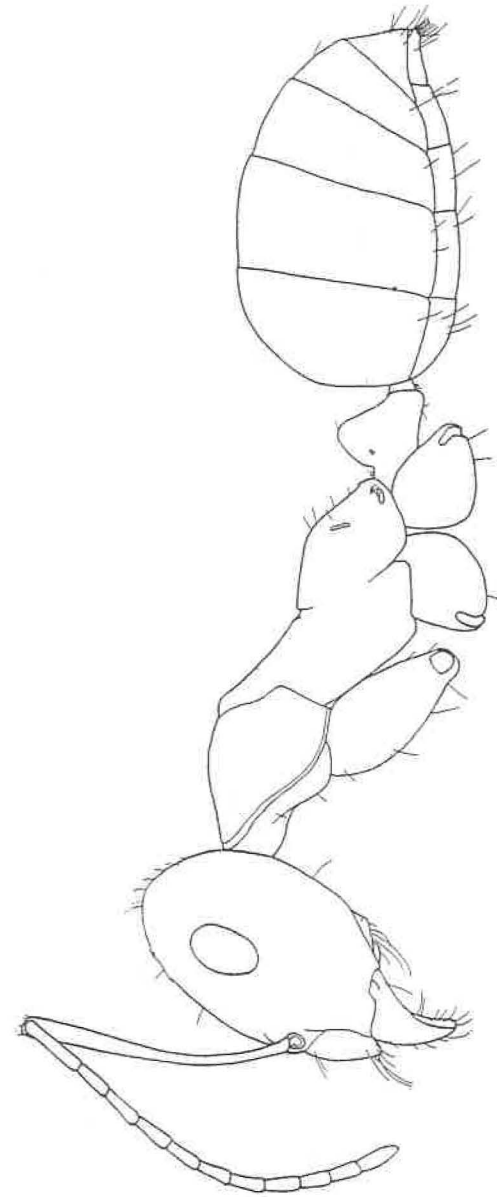


Fig. 34 - Profile *Cataglyphis ibericus* ♀