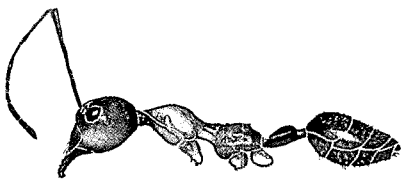
The Ants of Northern Australia

A guide to the monsoonal fauna



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CONTENTS

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INTRODUCTION

Ants are arguably the world's most familiar and ecologically important group of insects, and Australia is blessed with a remarkable diversity of them. Ants in Australia are attracting increasing research attention, both because of the many important roles they play in the Australian environment, and more recently because of their potential as indicators of the health of terrestrial ecosystems (Majer 1983; Greenslade & Greenslade 1984; Andersen 1990, 1997*a*). Unfortunately there remains a severe 'taxonomic impediment' (Taylor 1983) to their further study and use in environmental survey and monitoring. Up to three-quarters or more of the species are undescribed, and workable keys are unavailable for most described species. This is an unfortunate situation given that the characters used to identify ants, especially to genus and species-group levels, are far simpler than those used for most other major insect groups, and can soon be mastered by researchers without specialist entomological training.

The aim of this book is to enable professional researchers (including graduate students, academics and applied scientists) and knowledgeable amateurs to identify the ants occurring in monsoonal Australia, a region supporting an extremely rich but largely undocumented ant fauna. This is not an introductory book on ants for the novice. Several overviews of the general biology of Australian ants already exist (Greenslade 1979; Andersen 1983, 1991*a*; Taylor 1991; Shattuck 1999), and a comprehensive account of ant biology is superbly presented by Hölldobler & Wilson (1990). Readers interested in a comprehensive guide to Australian ant genera are referred to Shattuck (1999), and to Bolton (1994) for a world treatment. Greenslade (1979) gives a more detailed account of the genera of the southern Australian arid zone, and a guide to ant species and species-groups of cool-temperate southern Australia is provided by Andersen (1991*a*). Shattuck (1999) lists all described species known from Australia: a comprehensive catalogue of these is provided by Taylor & Brown (1985), and of all the world's species by Bolton (1995*a*).

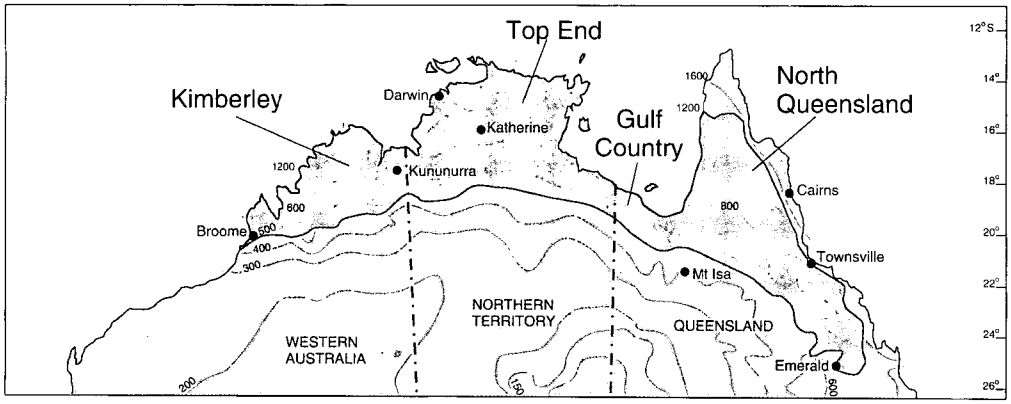


Fig. 1 ***Monsoonal zone in northern Australia (dark shading), with annual rainfall shown in mm***

The monsoonal zone is that part of tropical Australia with a highly seasonal climate: temperatures are high throughout the year, but rainfall is very heavily concentrated (up to 90% of annual total) into a summer wet season, from about December to April. The region encompasses all of northern Australia outside the humid zone of northeastern Queensland. It is formally defined here as that part of northern Australia bordered by the 500 mm isohyet to the south (in the east, as far south as the Emerald region of central Queensland), and to the east by the 800 mm isohyet in central Queensland and the 1200 mm isohyet on Cape York Peninsula (Fig. 1). As is the case throughout the world's seasonal tropics, the dominant vegetation is tropical savanna, characterised by a relatively sparse canopy of trees (primarily eucalypts) occurring over a more-or-less continuous grass-layer (Mott *et. al.* 1985).

Australia's monsoonal tropics encompasses four major biogeographical regions: north Queensland; the Gulf country of far northwestern Queensland and northeastern Northern Territory; the Top End of the Northern Territory, and the Kimberley region of far northern Western Australia (Fig. 1). To the south it borders the northern arid zone, and this is the source of many monsoonal ant taxa. To the east in sub-coastal north Queensland lie extensive tracts of humid tropical rainforest, which support an entirely different ant fauna, with predominantly Indo-Malayan affinities (Taylor 1972). Many of the genera are rainforest specialists, and occur nowhere else in Australia. Throughout the monsoonal zone, rainforest occurs as numerous, small patches, normally restricted to areas of permanent moisture or to topographic positions affording shelter from fire (McKenzie 1991; Russell-Smith 1991). Some of the Queensland rainforest taxa also occur in monsoon rainforests of northwestern Australia, particularly in the higher rainfall zone of the Top End (Reichel & Andersen 1996), and are therefore covered by this guide. However, there are many taxa whose Australian distribution is restricted to humid rainforests of the north-eastern seaboard, and these lie outside the scope of this book.

USING THE KEYS

This guide covers all ant genera and the major species known to occur in the monsoonal zone. All large genera have also been divided into species-groups that, unless otherwise indicated, have not been formally published, and are my opinions of natural groupings. In many cases these groupings are preliminary only, and are likely to be modified once more material has been collected, and species are subject to detailed taxonomic analysis. Unless otherwise stated, taxonomic nomenclature throughout the guide follows Shattuck (1999). A major exception is that *Bothroponera*, *Brachyponera*, *Ectomomyrmex* and *Trachymesopus* are treated as separate genera, rather than considered together under *Pachycondyla*. The synonymy of genera within the *Pachycondyla* genus-group has not been formally published, and therefore is not recognised here.

The keys cover worker ants only, and are designed to be as simple as possible. Readers are referred to the Glossary for explanations of technical terms, as well as an illustration showing major morphological characters (Fig. 39). It needs to be noted that the 'total length' of an ant refers to measurements taken of specimens in typical mounted posture, i.e. head with mandibles facing downward, and gaster somewhat pendulous. This can be very substantially shorter than the distance between tip of mandibles and tip of gaster in extended specimens. Shattuck (1999) provides advice on collecting and curating ant specimens.

I have employed definitive characters in the keys as much as possible, in order to maximise their generality. The keys will therefore also work for many taxa from outside the monsoonal region, particularly from the arid zone. However, in some cases the characters are diagnostic only for the monsoonal fauna, and obviously there are numerous taxa exclusive to other regions that are not covered. Considerable caution must therefore be exercised when attempting to use this guide to identify specimens from outside the monsoonal region, especially in areas of higher rainfall. Finally, the monsoonal fauna is still very incompletely known, and it very likely includes species-groups and even genera not currently known to occur in the region.

OVERVIEW OF THE MONSOONAL FAUNA

I estimate that somewhat more than 1500 ant species occur in the monsoonal zone, from 66 genera (Table 1). There is a bimodal distribution of ant species across genera (Fig. 2). On one hand, eight genera are likely to have 100 or more monsoonal species: *Melophorus* (estimated 225 species), *Pheidole* (200), *Meranoplus* (150), *Monomorium* (140), *Camponotus* (130), *Polyrhachis* (125), *Rhytidoponera* (110) and *Iridomyrmex* (100). Together these eight (12%) genera contribute almost 75% of all monsoonal species. This conforms to a global pattern, where the 24 (8%) genera with 100 or more described species contribute about 60% of all the world's described species (Bolton 1995*b*). On the other hand, 26 (39%) genera are each known in the monsoonal region from a single species, collectively contributing <2% total species.

Nearly half (44%) of the monsoonal species have Torresian affinities: that is, they belong to species-groups occurring primarily in the tropics. About 50 of these species represent taxa occurring exclusively or primarily in rainforest and other closed canopy vegetation (Table 2). They are fragments of the far richer rainforest fauna of Queensland's humid tropics, which in turn is a relatively depauperate extension of the extremely rich rainforest fauna of the Indo-Malayan region. The number of specialist rainforest species declines as one moves westward from north Queensland, through the Top End to the Kimberley, and southward from the coast inland (Andersen 1992*a*; Reichel & Andersen 1996). Most Torresian species belong to taxa that in Australia have diversified primarily in savanna rather than rainforest (Table 3). These taxa include several entire genera, such as *Anochetus, Bothroponera, Odontomachus, Calomyrmex* and *Opisthopsis*, all of which extend through central Australia to the southern arid zone (Greenslade 1979).

A slightly lower proportion (40%) of the monsoonal fauna has Eyrean affinities, belonging to species-groups that occur primarily in the arid zone. This applies to all species of *Melophorus*, most of *Iridomyrmex*, and many of *Camponotus*. It is typical for these three genera collectively to contribute half or more of the total species

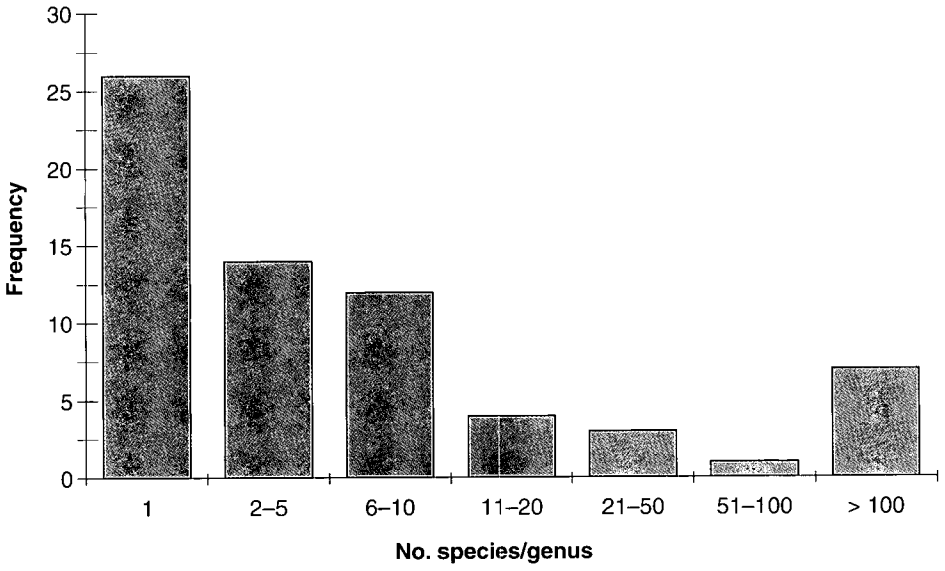


Fig. 2 ***Distribution of ant species across genera in monsoonal Australia. Numbers of species are estimates only (see Table 1)***

occurring in local ant communities throughout the arid zone (Greenslade 1979; Andersen 1993). Not surprisingly, these Eyrean taxa are concentrated in the southern, lower rainfall areas of the monsoonal zone, and many are absent altogether from higher rainfall areas. A few (<2%) monsoonal species have Bassian affinities (belonging to the predominantly cool-temperate genera *Myrmecia* and *Stigmacros*), with the remainder (13%) belonging to widespread species-groups

A range of distributional patterns is evident at the species level. First, a suite of species occurs throughout the monsoonal region, from the western Kimberley region to northeastern Queensland. Some of these, such as the northern meat ant *Iridomyrmex sanguineus*, its congeners *Iridomyrmex* sp. (*anceps* group) and *I. pallidus*, and *Crematogaster queenslandica*, *Monomorium disetigerum*, *M. fieldi*, *Tetramorium* sp. (*striolatum* group), *Camponotus* sp. (*novaehollandiae* group, 'yellow' species), *C. dromas*, *Opisthopsis haddoni*, *Polyrhachis inconspicua* and *P. senilis*, are virtually ubiquitous. Others occur throughout either the wetter (northern) or drier (southern) parts of the region. Examples of the former are *Meranoplus ajax*, *Iridomyrmex reburrus*, *Camponotus* sp. (*novaehollandiae* group, 'black' species; Plate 16), *Oecophylla smaragdina*, *Paratrechina* sp. (*vaga* group), *Polyrhachis pseudothrinax* and *P. schenkii*, and the latter *Rhytidoponera* sp. nr. *rufithorax*, *Camponotus fieldeae*, *Melophorus bagoti* and *Polyrhachis prometheus*. Still others occur patchily throughout the region, associated with particular habitats. This especially applies to the specialist rainforest taxa mentioned previously (Table 2), but also to savanna species associated with, for example, rocky habitats (e.g. *Iridomyrmex*

sp. (*gracilis* group), *Polyrhachis gab*) or riparian zones (e.g. *Iridomyrmex* sp. (*suchieri* group), *Paratrechina* sp. (*obscura* group), *Polyrhachis ?obtusa*). Many of these cosmopolitan species are numerically dominant ants in local faunas, conforming to a general pattern in biological communities whereby locally abundant species tend to have wide geographical distributions (Gaston 1994). However, some cosmopolitan species in monsoonal Australia, such as *Leptogenys adlerzi* and *Cerapachys* sp. (*singularis* group) are never numerically dominant, and therefore do not conform to this pattern.

Another suite of species is widely distributed within a major sub-region, but restricted to it. The Kimberley, Top End and north Queensland, for example, all support species that are widely distributed within, but endemic to, them. For example, *Odontomachus ruficeps* (in the strict sense), *Rhytidoponera dubia*, *R. trachypyx*, and *Meranoplus minimus* are all widely distributed in the Top End, but apparently occur nowhere else. There is often a 'replacement' series of species within particular species-groups across the major biogeographical regions. For example, within the *taurus* group of *Rhytidoponera*, *R. taurus* itself is restricted to the southern fringe of the monsoonal region (extending into the central arid zone), and is replaced by *R. cerastes* in the Kimberley, an undescribed species in the Top End, and *R. cornutus* in north Queensland, all of which are widespread within their particular regions.

Most species, however, have restricted distributions. For example, in addition to the widespread species mentioned above, the *taurus* group of *Rhytidoponera* includes several species with limited distributions in the Top End and Kimberley. Large numbers of monsoonal species are known from only a single locality, although this undoubtedly reflects inadequate collecting as much as localised distribution. Many, and perhaps most, species with restricted distributions are also uncommon, such that previously unknown species can be collected virtually anywhere in the monsoonal zone.

Table 1 Synopsis of the ant fauna of monsoonal Australia, following the sub-family classification presented by Bolton (1994), and adopted by Shattuck (1999). Estimated numbers of species refer only to those in the monsoonal region.

	Biogeographical affinity	*Estimated number of species*
sub-family MYRMECIINAE		
Myrmecia	Bassian	4
sub-family PSEUDOMYRMECINAE		
Tetraponera	Torresian	4
sub-family PONERINAE		
Amblyopone	widespread	1
Anochetus	Torresian	15
Bothroponera	Torresian	25
Brachyponera	Torresian	1
Diacamma	Torresian	2
Discothyrea	widespread	1
Ectomomyrmex	Torresian	1
Hypoponera	widespread	5
Leptogenys	Torresian	25
Mystrium	Torresian	1
Odontomachus	Torresian	15
Platythyrea	various	6
parallela group	Torresian	5
turneri group	Bassian	1
Ponera	Torresian	1
Prionopelta	Torresian	1
Proceratium	Torresian	1
Rhytidoponera	various	110
araneoides group	Torresian	3
aurata group	Torresian	12
convexa group	Eyrean	15
foreli	Torresian	1
mayri group	Eyrean	5
metallica group	widespread	5
reflexa group	Torresian	2
reticulata group	Torresian	15
taurus group	Torresian	20
tenuis group	Torresian	12
turneri group	Torresian	5
tyloxys group	Eyrean	8
Group A	Eyrean	5
Trachymesopus	Torresian	1
sub-family CERAPACHYINAE		
Cerapachys	various	50

Table 1 Continued

	Biogeographical affinity	*Estimated number of species*
brevis group	Torresian	10
clarki group	Eyrean	10
fervidus group	Eyrean	5
longitarsus group	Torresian	3
singularis group	Eyrean	15
turneri group	Torresian	1
typhlus group	Torresian	3
Sphinctomyrmex	Torresian	8
sub-family AENICTINAE		
Aenictus	Torresian	8
sub-family LEPTANILLINAE		
Leptanilla	widespread	2
sub-family MYRMICINAE		
Aphaenogaster	widespread	5
Cardiocondyla	Torresian	5
Colobostruma	Bassian	1
Crematogaster	various	30
cornigera group	Torresian	5
laeviceps group	widespread	12
queenslandica group	widespread	8
Group A	Torresian	2
Group B	Eyrean	1
Group C	Torresian	1
Machomyrma	Torresian	1
Mayriella	Torresian	1
Meranoplus	various	150
dimidiatus group	Eyrean	1
diversus group	Eyrean	30
fenestratus group	Eyrean	10
hirsutus group	Torresian	3
mjobergi group	Torresian	10
testudineus group	Torresian	5
Group A	Torresian	1
Group B	Torresian	1
Group C	Torresian	10
Group D	Eyrean	20
Group E	Torresian	20
Group F	Torresian	10
Miscellaneous groups	Eyrean	30
Mesostruma	Bassian	1
Monomorium	various	140

	Biogeographical affinity	*Estimated number of species*
bifurdum group	Torresian	5
carinatum group	Torresian	20
eremophilum group	Eyrean	8
laeve group	Eyrean	25
nigrius group	Torresian	20
rothsteini group	Eyrean	25
sordidum group	Eyrean	5
talpa	Torresian	1
Group A	Torresian	25
Introduced species	Torresian	3
Oligomyrmex	Torresian	6
Pheidole	various	200
impressiceps group	Torresian	1
hartmeyeri group	Eyrean	3
longiceps group	Torresian	15
megacephala (introduced)	Torresian	1
Group A	widespread	40
Group B	Eyrean	5
Group C	widespread	12
Group D	Eyrean	10
Group E	Torresian	40
Group F	Torresian	20
Group G	Torresian	30
Group H	Torresian	2
Group I	Torresian	1
Group J	Torresian	3
Group K	Torresian	25
Pheidologeton	Torresian	1
Podomyrma	Torresian	10
Pyramica	Torresian	5
Rhopalomastix	Torresian	1
Solenopsis	widespread	6
Strumigenys	Torresian	8
Tetramorium	various	50
impressum group	Eyrean	12
ornatum group	Torresian	5
spininode group	Eyrean	8
striolatum group	Eyrean	15
lanuginosum group	Torresian	1
Group A	Torresian	6
Introduced species	Torresian	2
Willowsiella	Torresian	1

Table 1 Continued

	Biogeographical affinity	*Estimated number of species*
sub-family DOLICHODERINAE		
Bothriomyrmex	widespread	5
Doleromyrma	Bassian	1
Dolichoderus	Bassian	1
Froggattella	widespread	1
Iridomyrmex	various	100
agilis group	Eyrean	1
anceps group	Torresian	15
bicknelli group	Eyrean	5
cyaneus group	Eyrean	5
discors group	Eyrean	1
gracilis group	Eyrean	12
mattiroloi group	widespread	12
pallidus group	Eyrean	20
purpureus group	Eyrean	6
rufoinclinus group	Eyrean	4
rufoniger group	Eyrean	10
suchieri group	Eyrean	10
Leptomyrmex	Torresian	1
Ochetellus	various	6
flavipes group	Eyrean	1
glaber group	widespread	5
Papyrius	widespread	5
Tapinoma	widespread	8
Technomyrmex	Torresian	1
Turneria	Torresian	1
sub-family FORMICINAE		
Acropyga	widespread	6
Anoplolepis (introduced)	Torresian	1
Calomyrmex	Torresian	10
Camponotus	various	130
claripes group	widespread	15
confusus group	Torresian	1
denticulatus group	Eyrean	5
discors group	widespread	15
ephippium group	Eyrean	5
janeti group	Torresian	5
macrocephalus group	Torresian	2
nigroaeneus group	Eyrean	5
novaehollandiae group	Torresian	20

	Biogeographical affinity	*Estimated number of species*
pellax group	Eyrean	20
reticulatus group	Torresian	2
rubiginosus group	widespread	20
subnitidus group	Eyrean	8
vitreus group	Torresian	1
Group A	Eyrean	5
Group B	Torresian	1
Melophorus	Eyrean	225
anderseni group	Eyrean	5
aeneovirens group	Eyrean	10
bagoti group	Eyrean	2
bruneus group	Eyrean	10
fieldi group	Eyrean	30
froggatti group	Eyrean	20
mjobergi group	Eyrean	50
pillipes group	Eyrean	15
perthensis group	Eyrean	2
potteri group	Eyrean	3
wheeleri group	Eyrean	15
Group A	Eyrean	25
Group B	Eyrean	6
Group C	Eyrean	10
Group D	Eyrean	2
Group E	Eyrean	8
Group F	Eyrean	15
Group G	Eyrean	3
Group H	Eyrean	1
Notoncus	Bassian	4
Oecophylla	Torresian	1
Opisthopsis	Torresian	12
Paratrechina	various	25
longicornis (introduced)	Torresian	1
minutula group	widespread	12
obscura group	widespread	1
vaga group	Torresian	10
Plagiolepis	widespread	5
Polyrhachis	various	120
Sub-genus *Campomyrma*	various	35
creusa group	Torresian	1
gravis group	Torresian	5
inconspicua group	Torresian	10

Table 1 Continued

	Biogeographical affinity	*Estimated number of species*
micans group	Torresian	6
schwiedlandi group	Eyrean	12
Group A	Torresian	1
Sub-genus *Chariomyrma*	Torresian	50
Sub-genus *Cyrtomyrma*	Torresian	1
Sub-genus *Hagiomyrma*	Torresian	15
Sub-genus *Hedomyrma*	Torresian	15
Sub-genus *Myrma*	Torresian	1
Sub-genus *Myrmhopla*	Torresian	5
Sub-genus *Myrmothrinax*	Torresian	1
Pseudolasius	Torresian	1
Stigmacros	Bassian	15

Table 2 Monsoonal taxa occurring almost exclusively in tropical rainforests and other denser vegetation types. They virtually all have Torresian affinities, and total about 50 species.

Ponerinae
Amblyopone
Ectomomyrmex
Mystrium
Prionopelta
Proceratium
Rhytidoponera foreli

Myrmicinae
Crematogaster Groups A and C
Pheidologeton
Strumigenys chyzeri
Meranoplus Group F
Tetramorium ornatum group

Dolichoderinae
Turneria

Formicinae
Camponotus macrocephalus, janeti, reticulatus and *vitreus* groups, *Polyrhachis* sub-genera *Cyrtomyrma, Hedomyrma, Myrma, Myrmhopla* and *Myrmothrinax, Pseudolasius*

Table 3 Major Torresian taxa occurring primarily in savanna rather than rainforest habitats.

Ponerinae
Anochetus
Bothroponera
Diacamma
Odontomachus
Rhytidoponera aurata, reflexa, reticulata, taurus, tenuis and *turneri* groups

Cerapachyinae
Cerapachys brevis and *longitarsus* groups

Myrmicinae
Crematogaster cornigera group
Meranoplus mjobergi group and Groups A–F
Monomorium Group A and *nigrius, bifurdum* and *carinatum* groups
Tetramorium Group A

Formicinae
Calomyrmex
Camponotus novaehollandiae group
Opisthopsis
Polyrhachis creusa, gravis, inconspicua and *micans* groups, and sub-genera *Chariomyrma* and *Hagiomyrma*

GUIDE TO SUB-FAMILIES

All ants belong to a single taxonomic family, the Formicidae, currently arranged within 16 living sub-families (Bolton 1994), ten of which occur in Australia. All but one of these is found in the monsoonal region. The sole exception is the sub-family Nothomyrmeciinae, which is represented by the single species *Nothomyrmecia macrops* and known only from semi-arid southern Australia. One sub-family occurring in monsoonal Australia, Leptanillinae, consists of minute, subterranean species that are extremely rarely recorded; it is included in the following key, but not considered further.

Key to sub-families

1. Waist consisting of a single segment, the petiole **2**

   Waist 2-segmented, including a post-petiole that is distinctly smaller than the first gastric segment **5**

2. Sting present (but often retracted and not visible); except for the distinctive *Odontomachus* (Plate 4) and *Anochetus* (Fig. 4), gaster with a prominent constriction between first and second segments **3**

   Sting absent; gaster without a prominent constriction between first and second segments **4**

3. Pygidium flattened and with small, blunt teeth or spines; trunk often with a flattened dorsal face that is separated from lateral faces by carinae ..... **Cerapachyinae (p. 33)**

   Pygidium not as above; trunk never with dorso-lateral carinae ..... **Ponerinae (p. 19)**

4. Small cone (acidopore) present at apex of gaster, with the circular opening usually surrounded by a circlet of hairs (such hairs absent in *Camponotus* and *Polyrhachis*); gaster with five segments visible from above ..... **Formicinae (p. 68)**

   Acidopore absent; gaster often with only four segments visible from above ..... **Dolichoderinae (p. 59)**

5. Very large species (total length ≥7 mm); mandibles long and elongate, with saw-like inner margins (*Myrmecia*; Fig. 3) ..... **Myrmeciinae (p. 16)**

Not as above 6

6. Antennal attachments partly obscured by frontal lobes, which extend into conspicuous frontal carinae (includes all species with conspicuous eyes) 7

Frontal lobes and frontal carinae absent 8

7. Uniformly black, arboreal species; head long, parallel-sided and with extremely large eyes; propodeum without teeth or spines (*Tetraponera*; Plate 1) ..... **Pseudomyrmecinae (p. 18)**

Not as above ..... **Myrmicinae (p. 37)**

8. Antennae with 10 segments; gaster in dorsal view with a neck-like narrowing where it joins the post-petiole (*Aenictus*; Fig. 11) ..... **Aenictinae (p. 36)**

Antennae with 12 segments; gaster not as above ..... **Leptanillinae**

SUB-FAMILY MYRMECIINAE

Myrmecia (*Fig. 3*)

The sub-family Myrmeciinae comprises a single genus, *Myrmecia*, whose species are popularly referred to as bull or bulldog ants. Their large size (up to 25 mm or more), fearsome appearance, and willingness to use their powerful sting make them among Australia's most notoriously familiar insects. All of the 100-plus species are confined to Australia, except for one in New Caledonia (Clark 1951; Ogata & Taylor 1991). Two common forms are easily recognised: the very large 'inch ants' of the *gulosa* and related groups, and the smaller 'jumper ants' of the *pilosula* group. Most species occur in southern woodlands and open forests, with only a handful known from monsoonal Australia. All are widespread arid-zone 'species', with limited occurrences in the north.

One of the monsoonal 'species' is *M.* '*desertorum*' (Fig. 3), a member of the *vindex* group (considered to be part of the *gulosa* group by Ogata & Taylor 1991). It has two forms in the monsoonal region, both differing from typical *M. desertorum* of the southern arid zone by having mandibles that are broadened basally, and a gaster completely covered with pubescence. One form occurs in the Kimberley region and, like specimens from the central and northern arid zones, has extremely hairy legs and

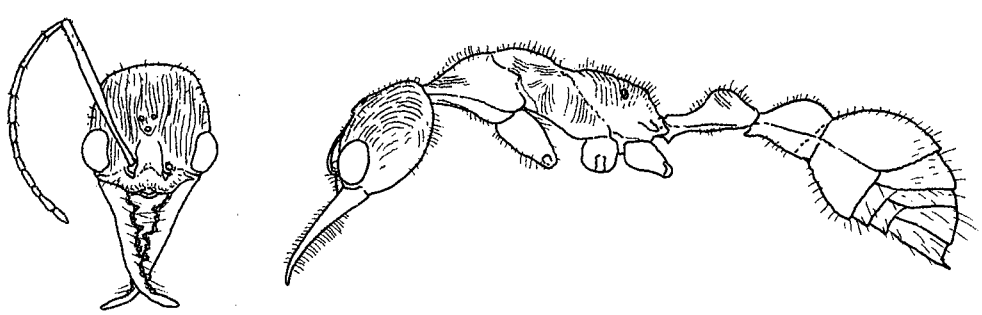


Fig. 3 ***Myrmecia desertorum***

slightly hairy antennal scapes. The other form has completely glabrous scapes and less hairy legs, and is known only from the Marrawal Plateau of Kakadu National Park in the Top End. Detailed taxonomic analysis would likely reveal that the monsoonal forms represent an undescribed species, or possibly even two species.

Another monsoonal 'species' is *M. 'varians'*, a member of the *pilosula* group. It is relatively common in central Queensland, with extensions into Cape York peninsula. Two forms of *'varians'* can be recognised, one (*varians* in the strict sense) with dark mandibles and bicoloured red and black trunk, and the other with yellow mandibles and entirely red trunk. The two forms (possibly separate species) are sympatric in central Queensland. The entirely reddish form is superficially similar to *M. callima*, a widespread member of the *cephalotes* group that is locally common in central Queensland. Species of the *cephalotes* group are substantially larger than *M. 'varians'* (about 10 *cf.* 7 mm), have stouter mandibles (with outer margins straight or feebly convex, rather than concave), and both hind tibial spurs are simple (one is pectinate in *M. 'varians'*).

SUB-FAMILY PSEUDOMYRMECINAE

Tetraponera (Plate 1)

This genus is centred on the African and Asian tropics, with the only other pseudomyrmecine genus (*Pseudomyrmex*) occurring in the neotropics. Both genera nest in hollow twigs and branches. All species of *Tetraponera* have a very distinctive appearance, with elongate body, stout legs, parallel-sided heads, and very large eyes. Australian species are uniformly black, and at least three occur in the monsoonal region. Two of these, *T. nitida* and an undescribed species (sp. A in key below), are restricted to closed forests. *Tetraponera punctulata* (Plate 1), on the other hand, is an extremely widespread savanna species, and, as formally recognised, extends through the central arid zone into South Australia (Greenslade 1979). However, the taxon probably includes more than one species, with narrow-headed forms occurring in the Pilbara region of Western Australia and in the southern arid zone. In the Top End, a large-sized form occurs together with typical *T. punctulata*, but otherwise seems indistinguishable morphologically.

Key to species

1. Ventral surface of petiole markedly swollen, giving it a convex profile; total length >3.5 mm **2**

   Petiole not swollen ventrally, ventral surface with a posterior pair of small teeth; total length 3–3.5 mm ..... ***nitida***

2. Head covered with microscopic punctures; propodeum rather flat, with dorsal and posterior faces at 90°; petiolar node longer than high in profile; total length 4.5–7 mm (savanna species; Plate 1) ..... ***punctulata***

   Head with sparse microscopic punctures; propodeum prominently raised; petiolar node as high as long in profile; total length about 4.5 mm (rainforest species) ..... **sp. A**

SUB-FAMILY PONERINAE

The Ponerinae is a predominantly tropical sub-family, with many genera occurring primarily or exclusively in rainforest. Two broad ecological types of ponerines can be recognised throughout the world: small, cryptic species inhabiting soil, litter and rotting logs; and large, active predators of the soil surface. The former species have reduced (often absent) eyes, and a tubular body that helps them 'worm' their way through soil and litter. The latter species usually have large eyes and powerful stings. Both these ecological types are well-represented in tropical Australia. In Australia, however, the most diverse and abundant ponerines belong to a third ecological type: unspecialised omnivores occurring predominantly in open habitats. These are species of *Rhytidoponera*, one of Australia's major ant genera, with very many species occurring in drier regions. The reproductive biology of many ponerines is very unusual, with a distinct queen caste often being absent, and reproduction occurring through mated workers (Peeters 1993).

The genera *Amblyopone*, *Discothyrea*, *Mystrium*, *Ponera*, *Prionopelta*, *Proceratium* and *Trachymesopus* are covered by the following key, but are not considered further. Each is represented by a single cryptic species that occurs primarily in rainforest, and is rarely collected. The only exception is *Trachymesopus darwinii*, which occurs in savanna throughout most of subcoastal northern Australia. Alate queens are often collected at lights, but workers are rarely seen.

Key to genera

1. Eyes inconspicuous, either dot-like (comprising <10 facets) or absent 2

   Eyes conspicuous (comprising >10 facets); total length >2.5 mm 9

2. Apex of gaster strongly reflexed, curving down and back towards head 3

   Gaster not as above 4

3. Antennae with ≤10 segments, with the last segment greatly enlarged, about half total length of funiculus ..... ***Discothyrea***

Antennae with 12 segments, with last segment not so large ..... ***Proceratium***

4. Petiolar node broadly attached to gaster, without a distinct posterior face (tribe Amblyoponini 5

Petiolar node clearly separate from the gaster, with a distinct posterior face 7

5. Head and trunk covered with spatulate hairs; apex of mandible broadly rounded ..... ***Mystrium***

Head and trunk with normal hairs; apex of mandible produced into a pointed tooth 6

6. Mandible with three teeth, the central one being the smallest ..... ***Prionopelta***

Mandible with more than three teeth ..... ***Amblyopone***

7. Clypeus projecting above mandibles, with a conspicuous carina that is produced into a sharp tooth ..... ***Trachymesopus***

Clypeus not projecting above mandibles, and without a sharp tooth 8

8. Eyes absent; sub-petiolar process with a small, transluscent 'window', and a ventral pair of tiny teeth ..... ***Ponera***

Eyes usually present; sub-petiolar process without such a 'window' or teeth (Fig. 7) ..... ***Hypoponera*** **(p. 24)**

9. Head conspicuously furrowed; mandibles inserted close to each other, directly below the frontal carinae; each mandible long and parallel-sided, with three large teeth at apex 10

Not as above 11

10. Larger species (5–12 mm); dorsum of petiole projecting as a sharp spine (Plate 4) ..... ***Odontomachus*** **(p. 26)**

Smaller species (3–5 mm); dorsum of petiole broadly rounded (Fig. 4) ..... ***Anochetus*** **(p. 21)**

11. Frontal carinae widely separated, with their minimum distance apart equal to about two maximum diameters of antennal scapes 12

Minimum distance between frontal carinae equal to about one maximum diameter of antennal scapes 13

12. Lower angle of pronotum produced into a tooth; hind tibia with at most one spur having a comb-like series of teeth (Fig. 9; Plate 5) ..... ***Rhytidoponera*** **(p. 28)**

Lower angle of pronotum broadly rounded; hind tibia with two spurs having a comb-like series of teeth ..... ***Platythyrea*** **(p. 27)**

13. Petiolar node with a dorsal pair of spines (Fig. 6) ..... ***Diacamma*** **(p. 23)**

Petiolar node without spines 14

14. Tarsal claws of hind legs comb-like, with a series of teeth on their inner margins (Plate 3) ..... ***Leptogenys*** **(p. 24)**

Tarsal claws of hind leg simple, without a comb-like series of teeth 15

15. Trunk in profile with a conspicuous metanotal notch (Fig. 5) ..... ***Brachyponera*** **(p. 23)**

Trunk in profile not conspicuously notched 16

16. Total length 4–5 mm; maximum diameter of eyes smaller than maximum diameter of antennal scapes ..... ***Ectomomyrmex*** **(p. 24)**

Total length >5 mm; maximum diameter of eyes greater than maximum diameter of antennal scapes (Plate 2) ..... ***Bothroponera*** **(p. 22)**

Anochetus (*Fig. 4*)

This and the related *Odontomachus* are highly distinctive genera distributed throughout the tropical world. They are easily recognised by their peculiarly furrowed heads, and long, linear mandibles that are attached medially rather than laterally. Workers characteristically forage with mandibles opened at 180°, exposing sensory hairs that, when touched, cause the mandibles to snap shut. If the mandibles snap against an immovable object, the ant can be propelled backwards, with an audible click, for up to several centimetres.

Only five species of *Anochetus* have been described from Australia (Brown 1978), but probably at least four times that many occur, with all but two or three from the southern arid zone occurring in the monsoonal region. One monsoonal species is from the Indo-Malayan *graeffei* group, and occurs in denser forests from north Queensland to the Kimberley. Its eyes are relatively small (maximum diameter approximately equal to maximum scape diameter), and it is the only known Australian species that has a petiolar node with a convex dorsum. It also differs from most other Australian species in that its trunk is heavily sculptured throughout. The only other Australian species of *Anochetus* with heavily sculptured trunks are members of Group A, comprising a handful of species from north Queensland and the eastern Top End.

All other Australian *Anochetus* belong to one of three closely related species-groups. The most distinctive of these is the *paripungens* group, characterised by a pair of erect propodeal teeth. It includes only two known species, with *A. paripungens* (Fig. 4) being restricted to denser forests of the Top End, and the other (undescribed) species occurring in the Gulf region of both Queensland and the Northern Territory. The *rectangularis* and *armstrongi* groups are characteristic of drier regions with more open vegetation. The former (pronotum striate laterally) is restricted to the monsoonal

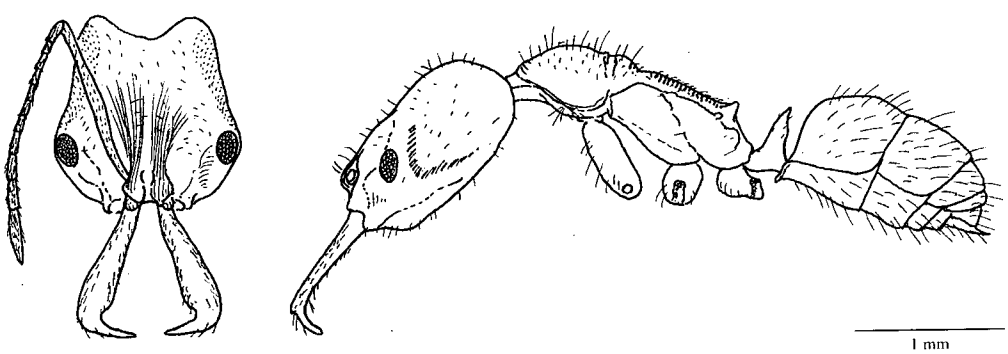


Fig. 4 ***Anochetus paripungens***

region, whereas the latter (pronotum entirely smooth) extends into the southern arid zone. *Anochetus armstrongi* itself occurs throughout semi-arid eastern Australia, from northern central Queensland to South Australia, and is the only representative of the genus throughout most of this range.

Key to species-groups

1. Dorsum of petiolar node strongly convex; trunk conspicuously sculptured throughout, without shiny patches ..... ***graeffei* group**

   Dorsum of petiolar node flat or concave (sometimes markedly so); much of trunk often smooth and shiny **2**

2. Dorsum of pronotum conspicuously sculptured ..... **Group A**

   Dorsum of pronotum smooth and shiny **3**

3. Sides of pronotum with feeble or conspicuous striations ..... ***rectangularis* group**

   Sides of pronotum smooth and shiny **4**

4. Propodeum with a pair of upward-projecting teeth; dorsum of petiolar node deeply concave, with a lateral pair of projections ..... ***paripungens* group**

   Propodeum without upward-projecting teeth; dorsum of petiolar node not so deeply concave ..... ***armstrongi* group**

Bothroponera (Plate 2)

This is Australia's richest genus within the *Pachycondyla* genus-group, and occurs throughout the monsoonal region, extending into the central and even southern arid zones. All species are large (>5 mm), stoutly built and black, with the gaster covered with silver or golden pubescence. They live in exceptionally small, queenless colonies, sometimes with fewer than a dozen workers (Peeters 1991). As in many other members of the *Pachycondyla* genus-group, species of *Bothroponera* appear to feed primarily on termites, and possess a powerful sting.

Two species complexes can be recognised in Australia: one with conspicuous striations on the gaster and dorsal face of the petiolar node (*porcata*, *denticulata* and *excavata* groups), and the other without (*sublaevis* group). The *sublaevis* and *porcata* groups are restricted to the tropics, whereas the *denticulata* and *excavata* groups are characteristic of the arid zone. The latter groups are closely related, with both having a serially dentate dorso-posterior border of the petiolar node. In the *excavata* group this border is markedly concave, with projecting corners. Within the monsoonal region, both groups appear to be restricted to central Queensland. Most *Bothroponera* species in the monsoonal region belong to the *sublaevis* group, which has up to 20 or more species. One member of this group is the very large (14 mm) *B. hera* (Plate 2), which is endemic to rainforest in the northern Top End.

Key to species groups

1. First gastric segment with coarse longitudinal striations 2

   Gaster without such striations ..... ***sublaevis* group**

2. Posterior dorsal edge of petiolar node extremely concave, with conspicuous lateral projections ..... ***excavata* group**

   Posterior dorsal edge of petiolar node at most feebly concave, never with conspicuous lateral projections 3

3. Posterior dorsal edge of petiolar node conspicuously dentate ..... ***denticulata* group**

   Posterior dorsal edge of petiolar node entire ..... ***porcata* group**

Brachyponera (Fig. 5)

This genus occurs throughout the Old World tropics, and its species are among the smallest (typically 3–5 mm) of the *Pachycondyla* genus-group. Most species are black and characteristic of tropical rainforest, where they forage on the ground and low vegetation. One such species, *B. croceicornis*, occurs in north Queensland. Australia's only other described species, *B. lutea* (Fig. 5), on the other hand, is restricted to sub-humid habitats and is primarily subterranean. It is one of Australia's most widespread ants, occurring throughout the mainland outside higher rainfall areas of the eastern seaboard, except for the central arid zone. Its colour ranges from yellowish to dark-brown.

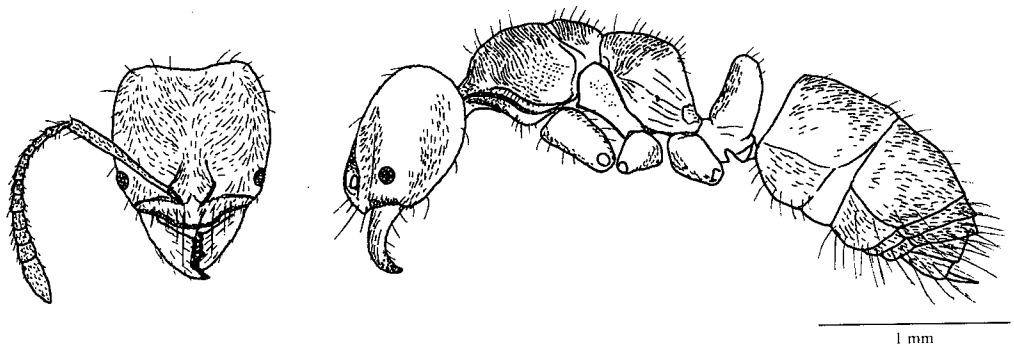


Fig. 5 ***Brachyponera lutea***

Diacamma (Fig. 6)

This genus is centred on the Indo-Malayan region, and is easily recognised by its pair of petiolar spines. All species are large (>6 mm), coarsely sculptured and black, sometimes with reddish legs. They are long-legged, swift-moving ants that appear to be ecological opportunists much like larger species of *Rhytidoponera*. Colonies are

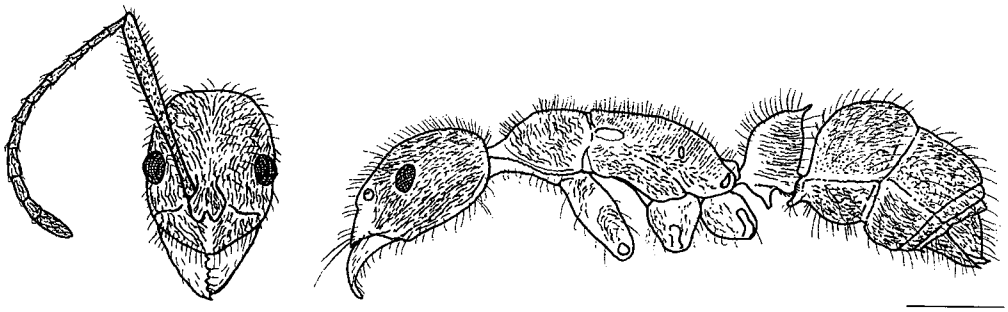


Fig. 6 ***Diacamma levis***

queenless, and worker reproduction is regulated by peculiar, bladder-like glands located on each side of the trunk (Peeters *et al.* 1992). Two Australian forms are known: *D. australe* from north Queensland, and its 'subspecies' *levis* from the Darwin region of the Top End. The latter is less coarsely sculptured, with shorter petiolar spines, and is likely to be a separate species. In north Queensland, specimens of *D. australe* from the Townsville/Cairns region are morphologically uniform, and differ from apparently disjunct populations elsewhere in north Queensland that are less heavily sculptured. The taxonomic significance of this is unclear. Another form of uncertain status has recently been collected from the Wessel Islands off northeastern Arnhem Land (Woinarski *et al.* 1998).

Ectomomyrmex

This member of the *Pachycondyla* genus-group occurs throughout the south-east Asian region, and is represented by a single Australian species, *E. ruficornis*. It is most similar to species of *Bothroponera*, from which it can be distinguished by its smaller size and relatively small eyes. It is restricted to rainforests of north Queensland and the Top End.

Hypoponera (Fig. 7)

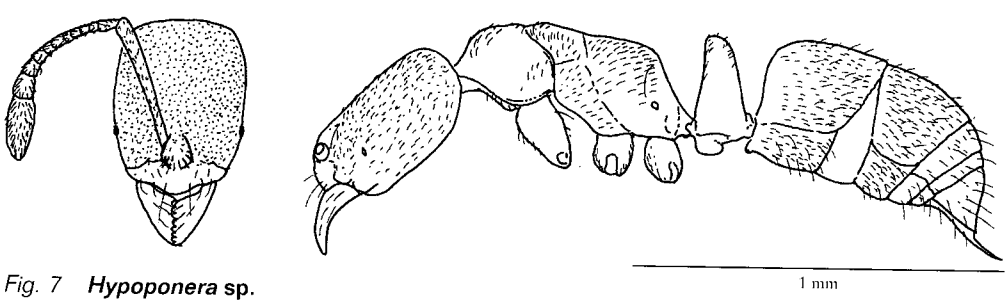


Fig. 7 ***Hypoponera* sp.**

Species of *Hypoponera* are small (typically 1.5–2 mm), litter-dwelling ants that often nest inside or under rotting logs. They occur throughout Australia outside the central arid zone, most characteristically in wetter forests. Most species within the monsoonal region are restricted to areas of higher rainfall.

Leptogenys *(Plate 3)*

This is a highly diverse group of specialist predators, occurring throughout the world's tropics, particularly in rainforest. They are highly variable morphologically, but can be distinguished from most other Australian ponerines (species of *Rhytidoponera* being notable exceptions) by their toothed or, more commonly pectinate (comb-like), tarsal claws. The majority of species are relatively large (>4 mm), black, long-legged and swift moving.

Australia has several species-groups characteristic of rainforest, with virtually none of these occurring in the monsoonal region. Several other species-groups, on the other hand, are well-represented in Australian savannas. The most common of these is the *conigera* group, whose species are shiny black with a distinctive petiolar node that is asymmetrically longer than high, with the anterior face less than half as high as the posterior face. *Leptogenys conigera* itself is a large (8 mm) Queensland species, and a very similar (but hairier) species occurs in the Top End. The most common representative is the smaller (about 6 mm) *L. adlerzi*, which occurs throughout most of northern Australia. It appears to be synonymous with *L. centralis*, which is widespread in the central and southern arid zones. There are several other undescribed species similar to *L. adlerzi* in the monsoonal region. *Leptogenys exigua* (Plate 3), a common Top End and Kimberley species, could probably also be considered part of this group, despite having a considerably shorter petiolar node.

Species of the *diminuta* group have a distinctively saddle-shaped trunk, and are widespread in south-east Asia. One common Indonesian species also occurs in north Queensland. Its head is covered with striate sculpturing, whereas the head of the form (probably separate species) occurring in rainforest and riverine habitats of the Top End is smooth and shiny. The *fallax* group comprises at least three yellowish or reddish savanna species, which apparently forage primarily under the soil surface. They have relatively small eyes and short legs compared with surface-active species of *Leptogenys*. *Leptogenys fallax* is a reddish species widely distributed in north Queensland and the Top End. The other two are smaller (about 3 mm) and yellowish, with one (*L. tricosa*) occurring in Queensland, and the other (undescribed) in the northern Kimberley.
The final group occurring in the monsoonal region is the *clarki* group. It consists of heavily sculptured species with narrow, scythe-like mandibles, and teeth-like projections on the clypeus. There are at least six species in the monsoonal region, none of which appear to be named.

Key to species and species-groups

1. Colour uniformly yellowish or reddish brown; eyes small (less than maximum diameter of antennal scapes) ..... ***fallax* group**

   Colour black, legs sometimes reddish; eyes large (greater than maximum diameter of antennal scapes) **2**

2. Trunk saddle-shaped, with pro-mesonotum higher than propodeum in profile; petiolar node about twice as high as long ..... ***diminuta* group**

   Profile of trunk straight; petiolar node about as long as high or longer **3**

3. Head, trunk and petiole heavily sculptured; anterior clypeal margin with at least a central pair of teeth-like projections ..... ***clarki* group**

   Body smooth and shiny throughout; clypeus without teeth-like projections **4**

4. Petiolar node about as high as long ..... ***exigua***

   Petiolar node conspicuously longer than high (Plate 3) ..... ***conigera* group**

Odontomachus (Plate 4)

Species of *Odontomachus* are among the most conspicuous and familiar ants in many habitats of northern Australia, due to their large size (up to 15 mm), long mandibles and formidable sting. In these respects they are reminiscent of species of *Myrmecia* in southern Australia, and indeed are often mistakenly called bull ants. *Odontomachus* is closely related to *Anochetus*, with both genera having peculiar mandibles that are triggered by sensory hairs (see p. 21).

Up to 20 species occur in Australia, but only a few are named. The most common and widespread species in higher rainfall regions of the monsoonal region are members of the *turneri* group (Plate 4), which can be among the most conspicuous ants in rainforest and other shady habitats, including suburban gardens. They are polymorphic, with minor workers being far smaller (down to 6 mm) than species from other groups. They have a cluster of hairs on the pronotum, relatively short mandibles, and the petiolar spine is characteristically crooked and curved backwards. Despite their specialised mandibles and sensory hairs, they are ecological opportunists, occurring in a wide range of habitats, foraging throughout the day and night, and having an omnivorous diet. The group includes two very common species. *Odontomachus turneri* itself (Plate 4) occurs throughout north Queensland, with an apparently disjunct population in and around the Arnhem escarpment in the Kakadu region of the Top End. The dorsal surface of its first gastric segment is finely but conspicuously striate throughout, compared with smooth and shiny (at least for the anterior half) in the other (undescribed) species, which occurs throughout the rest of the Top End (including central and eastern Arnhem Land) and the Kimberley. A third

species, rarely recorded in rainforest patches in the Darwin region, apparently also belongs to this group. Its head is pear-shaped (i.e. narrowed posteriorly), and the queens are considerably smaller than typical *O. turneri*, and entirely black.

Odontomachus cephalotes is a rainforest species with a conspicuously sculptured gaster that occurs throughout north Queensland and eastern Top End. All remaining species can be assigned to the *ruficeps* group, with several occurring in the monsoonal region, and others in the arid zone. In most species the head is reddish, and distinctly lighter than the trunk. One exception is uniformly pinkish or reddish brown, with a strikingly lustrous gaster. It is characteristic of rocky gorges and scree slopes, often associated with monsoon rainforest, and occurs in the Kimberley and Top End. Others are uniformly blackish, including one that occurs throughout eastern and southern semi-arid Australia, from central Queensland to southern Western Australia, and another that appears to be restricted to cracking clays of the semi-arid tropics.

Platythyrea (Fig. 8)

This genus is distributed throughout the world's tropics, with two distinct radiations occurring in Australia. One of these (*turneri* group) has a southern distribution, with one species (*P. septentrionalis*) extending into eastern central Queensland. The other (*parallela* group) occurs throughout most of the tropical north, as well as elsewhere in the Indo-Malayan region (Brown 1975). Although all Australian species of the latter group have been formally synonymised with *parallela*, there are in fact several species. One of these (*P. parva*; Fig. 8) is relatively common in sub-coastal savannas of the Top End, with a very similar species occurring in the Victoria River District and southeastern Kimberley. Another species occurs in rainforest in the Darwin region.

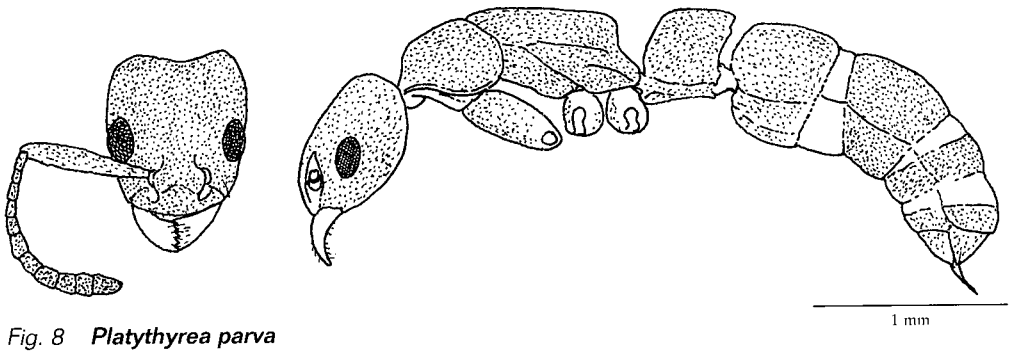


Fig. 8 ***Platythyrea parva***

Rhytidoponera (Fig. 9, Plate 5)

This is one of Australia's richest and most conspicuous ant genera, with probably 200 or more species, fewer than half of which have been described (Clark 1936; Brown 1958). Species of *Rhytidoponera* are large (generally ≥4 mm), usually heavily sculptured ants, with a characteristic tooth on the inferior pronotal angle, just above the front coxa. As mentioned previously, *Rhytidoponera* is most unlike other ponerine genera given its extremely high diversity and predominance in open habitats, and its unspecialised foraging ecology.

Tropical, arid-adapted and widespread species-groups are all well-represented in the monsoonal region. The most conspicuous are species of the related *aurata* (Plate 5) and *taurus* groups, which are easily recognised by their large size (up to 10 mm) and sharply angled occipital corners which, in the latter group, form prominent, horn-like projections (Fig. 9*h*). They have a characteristic, asymmetrical petiolar node, with an erect anterior face, and broadly curving dorsal and posterior faces. Some species, including *R. aurata* (Plate 5) in the Top End and *R. cerastes* (Fig. 9*h*) in the Kimberley, have mantid mimics (*Nesoxypilus albomaculatus* and *N. pseudomyrmex* respectively) that possibly benefit from this association through reduced predation (Milledge 1990). The *aurata* group occurs primarily in the Top End and the Kimberley, with one species extending eastward to the Gulf region of Queensland. The *taurus* group, on the other hand, is distributed throughout the monsoonal region, with *R. taurus* itself occurring in the central and northern arid zones. A closely related species is widespread in the southern and central Top End, often associated with stony country, and another appears to be restricted to the northern Victoria River District of southwestern Top End. *Rhytidoponera cerastes* and *R. cornuta* are members of the *taurus* group with particularly prominent 'horns'. The former occurs in the north Kimberley, with a similar species known from the western Top End (especially Litchfield National Park, south of Darwin), whereas the latter occurs in the Gulf region and far north Queensland, with a similar species occurring elsewhere in northwestern Queensland. Members of the related *mayri* group are also very large ants with a prominent occipital crest, but with bluntly angled or rounded occipital corners. The group is represented in central and north Queensland, and elsewhere in the drier fringes of the monsoonal region, but occurs primarily in the arid zone.

The *reticulata*, *reflexa*, *araneoides*, *turneri* and *tenuis* groups are other monsoonal taxa with tropical distributions. The *turneri* group (Fig. 9*f*) is the most distinctive of these, having a concave posterior face of the propodeum, and a thin, often bilobed petiolar node. There are at least five species in the group, including *R. turneri* and *R. lamellinodis* from north Queensland, an undescribed black species close to *R. turneri* from the Top End, and *R. haeckeli* from north Queensland through to the Top End. In the last species the propodeum is only feebly concave and the petiole only

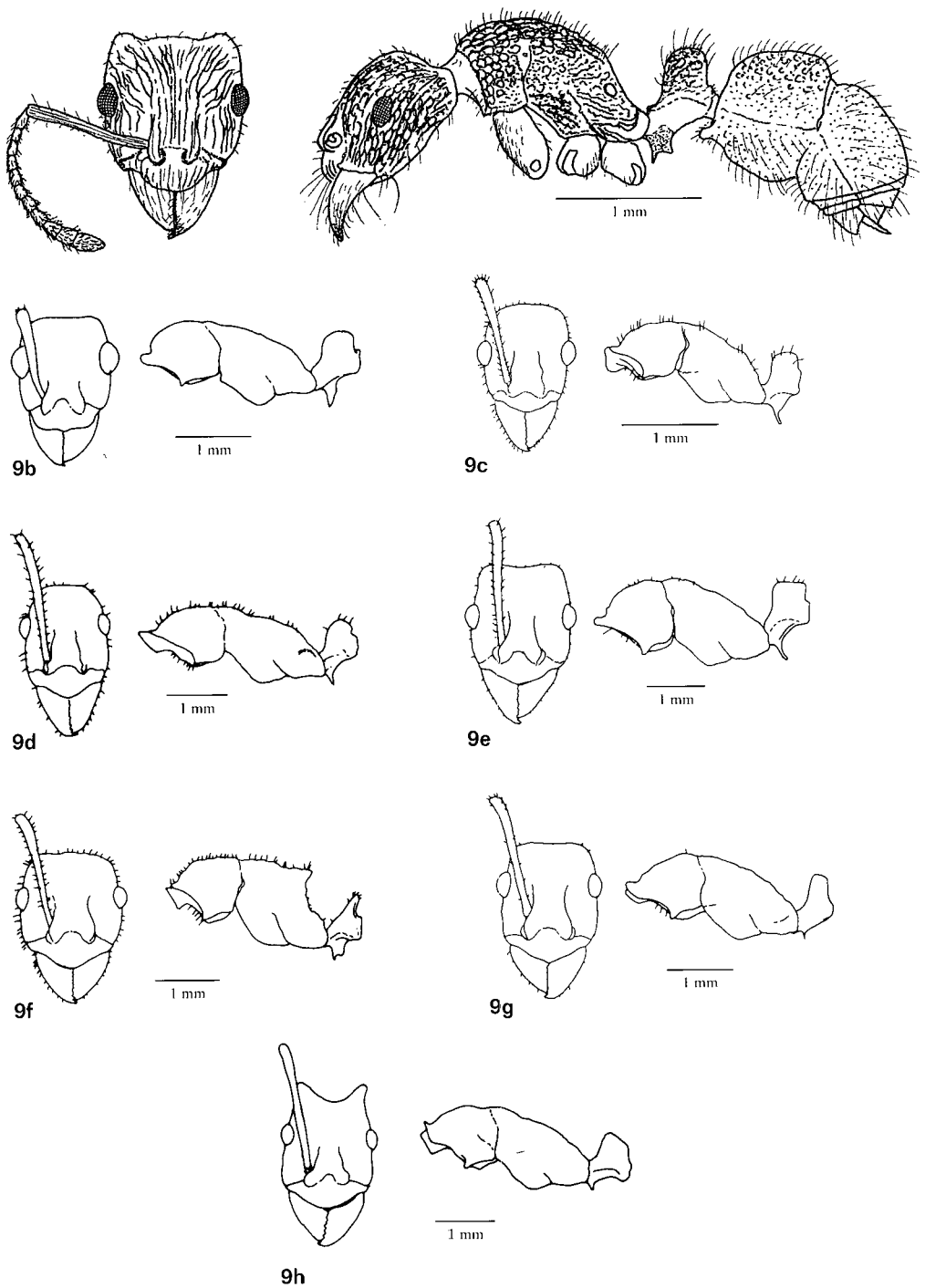


Fig. 9 ***Rhytidoponera*** **spp.** (a) ***borealis*** (b) ***tyloxys*** **group** (c) ***tenuis*** **group** (d) ***foreli*** (e) ***reticulata*** (f) ***turneri*** **group** (g) ***convexa*** **group** (h) ***taurus*** **group**

dorsally concave rather than bilobed. The group appears to be absent from the Kimberley region.

In contrast, the *reticulata* group occurs primarily in the western monsoonal region, where it is very diverse. *Rhytidoponera reticulata* itself (Fig. *9e*) occurs throughout the Top End and northern Kimberley, and a closely related species occurs from the Victoria River District to central Queensland. All other species in the monsoonal region have restricted distributions in the Top End or Kimberley. The *reflexa* group is possibly allied to the *reticulata* group, and is restricted to the Darwin region of the Top End, including the Tiwi Islands off the Darwin coast. It consists of *R. reflexa* and an undescribed species that are characterised by a dome-shaped head and petiolar node that projects backwards as a blunt spine. *Rhytidoponera reflexa* has a heavily sculptured node, and appears to be restricted to the Tiwi Islands. The other species is smaller, with petiole predominantly smooth and shiny, and occurs in seasonally flooded habitats and 'dry' rainforest.

The *tenuis* group (Fig. *9c*) consists of relatively small (3–4 mm), elongate species, occurring throughout the monsoonal region. They appear very similar morphologically to a group of species (*kurandensis* and allies) restricted to rainforest of far north Queensland, but the latter (as do most other species of *Rhytidoponera*) have well-developed tibial spurs equipped with comb-like teeth. Most species of the *tenuis* group occur in savanna habitats, although one is restricted to Kimberley rainforests. Another rainforest specialist is the long-legged and gracile *R. foreli* (Fig. *9d*), which is restricted to the Top End. Despite superficially resembling species of the *tenuis* group, it is probably unrelated.

Australian species of the *araneoides* group are restricted to subcoastal north Queensland, often in rainforest, except for one species on Melville Island. Unlike all other groups previously discussed, its centre of distribution is in New Guinea rather than Australia. It appears to be related to the *spoliata* group, which also occurs in north Queensland, but outside the monsoonal region.

Three Eyrean groups are well-represented in the monsoonal region, particularly in areas of lower rainfall. The most abundant of these is the very rich and taxonomically difficult *convexa* group. It includes *R. rufithorax* and close allies (Fig. *9g*), in which the occipital border is somewhat crested, and the trunk and gaster are mostly glabrous. *Rhytidoponera rufithorax* itself has a reddish-brown head and trunk with contrasting black gaster, whereas a more common species is uniformly black. Both are widespread in the semi-arid tropics. Other species in the group include *R. convexa* itself (colour uniformly black, head feebly crested, trunk and gaster with scattered hairs) and *R. rufescens* (colour uniformly reddish, head and trunk glabrous), both from central Queensland, and *R. hilli* (virtually entirely glabrous, gaster often reddish brown) from the Northern Territory. A uniformly black, very hairy species is common

in Mitchell grasslands of the Northern Territory. Some Western Australian species (*R.* '*violacea*') have blue, green, pink or golden iridescence.

The highly distinctive *tyloxys* group (Fig. 9*b*) is another with a predominantly arid-zone distribution. The species are all reddish brown, with long heads, rather massive mandibles, extremely large eyes, and distinctive sculpturing (finely punctate with scattered pits) on the head and trunk. In some of the species, including *R. tyloxys* itself, the petiole is produced into a backward-projecting spine. The species without such a spine have low, rounded petiolar nodes. The only described one of these is *R. dubia* from the Top End, where it is most commonly observed foraging on low vegetation. Species of the *tyloxys* group are possibly specialist predators, rather than ecological opportunists like other species of *Rhytidoponera*.

The third Eyrean group ('Group A') appears to have no described representatives, and seems to be restricted to the southwest of the monsoonal region and elsewhere in the northwestern arid zone. The species are morphologically similar to members of the *reticulata* group, but their relationships are unclear.

The final species of *Rhytidoponera* in the monsoonal region belong to the widespread *metallica* group. Species of this group are characteristically iridescent green or pink, and occur primarily in southern Australia. At least one such species (?*R. metallica* itself) occurs in central Queensland as far north as the Townsville region. In northwestern Australia the group is represented by two smallish, entirely reddish-brown species, *R. borealis* (Fig. 9*a*) and *R. trachypyx* (gaster more coarsely sculptured than in *R. borealis*). The latter is restricted to higher rainfall regions of the Top End, whereas *R. borealis* occurs from the Top End to the Kimberley. A closely related, undescribed species with dorsal blue-green iridescence occurs in savannas of far north Queensland.

Key to species and species-groups

1. Hind tibia with a spur that is as long as maximum width of tibia or longer; if marginal (some species of the *mayri* group), then total length >6 mm **4**

   Tibial spurs of hind legs reduced (about half or less maximum width of tibia) or absent; total length always <6 mm **2**

2. Head and trunk covered with coarse reticulate-rugose sculpturing **3**

   Head and trunk with scattered foveae, over finely punctate background sculpture (Fig. 9*b*) ..... ***tyloxys* group**

3. Sides of head only slightly converging above the eyes, almost square with occipital margin; antennal scapes surpassing occipital border by less than a quarter of their total lengths (Fig. 9*c*) ..... ***tenuis* group**

   Sides of head strongly convergent above the eyes; antennal scapes surpassing occipital border by nearly half their total length (Fig. 9*d*) ..... ***foreli***

4. Occipital corners sharply angled (sometimes forming horn-like projections) or occipital border deeply concave and prominently crested; includes all species with total length >7 mm 5

   Occipital corners broadly rounded, with border at most rather weakly concave 8

5. Occipital corners sharply angled, with a conspicuous carina (clearly differentiated from surrounding sculpture) running between the points of each corner to form the occipital border 6

   Occipital corners bluntly angled or rounded, without a clearly differentiated carina forming the occipital border 7

6. Occipital border conspicuously concave, with corners forming horn-like projections; larger species (total length ≥8 mm; Fig. 9*h*) ..... ***taurus* group**

   Occipital border straight or feebly concave; smaller species (6–8 mm) (Plate 5) ..... ***aurata* group**

7. Larger species (total length >7 mm); occipital corners rather angular; posterior part of head often with very coarse, transverse striae ..... ***mayri* group**

   Generally smaller species; occipital corners broadly rounded; head with reticulate-rugose sculpturing, without very coarse, transverse striae ..... **Group A**

8. Propodeum with a distinct posterior face that is feebly to markedly concave in profile, with the dorsum often forming an angular, backward-pointing projection; dorsum of petiolar node also concave, often conspicuously bilobed (Fig. 9*f*) ..... ***turneri* group**

   Not as above 9

9. Smaller species (total length ≤5 mm); in profile, occipital corner produced into a broad, backward-projecting lobe (Fig. 9*a*) ..... ***metallica* group**

   Larger species (>5 mm) 10

10. Occipital border markedly convex, almost dome-shaped, without any suggestion of a crest; dorsum of petiolar node produced into a backward-pointing, spine-like process (Top End only) ..... ***reflexa* group**

    Occipital border straight or medially concave, and often feebly crested; petiolar node sometimes slightly reflexed, but never forming a spine-like projection 11

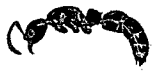
11. Ventral surface of petiole with a prominent, stalactite-like process that is as long or longer than the first funicular segment; petiolar node approximately square in profile (Fig. 9*e*) ..... ***reticulata* group**

    Sub-petiolar process shorter than the first funicular segment; petiolar node often markedly higher than long in profile 12

12. Posterior part of head ('above' the eyes) extremely coarsely and rather uniformly reticulate, without a conspicuous series of coarse striations arising from the frontal area; restricted to wetter, sub-coastal regions ..... ***araneoides* group**

    Posterior part of head less coarsely and uniformly sculptured, always with a conspicuous series of coarse, longitudinally divergent striations arising from the frontal area (Fig. 9*g*) ..... ***convexa* group**

SUB-FAMILY CERAPACHYINAE



This is a predominantly Old World tropical group that has traditionally been placed in or near the Ponerinae, but is now considered to represent a separate lineage allied to army ants (Baroni Urbani *et al.* 1992). There are only two Australian genera, *Cerapachys* and *Sphinctomyrmex*, with the latter being distinguished by marked constrictions between each gastric tergite, rather than just between the first and second. Species of both genera appear to be specialist brood raiders of other ants (Brown 1975).

Cerapachys (Plate 6)

Despite having a tropical distribution globally, *Cerapachys* occurs throughout mainland Australia, and includes a diverse radiation in the arid zone. A small number of Australian species belong to Indo-Malayan groups that were previously recognised as separate genera. One of these is *C. longitarsus*, the only representative of what was previously referred to as *Lioponera* that is formally recognised in Australia. It occurs widely in subcoastal northeastern Australia, from central New South Wales to the Top End. A closely allied, apparently undescribed species is known from the Darwin region of the Top End. Another species with Indo-Malayan affinities is *C. edentatus*, the only species from the *typhlus* group (formerly the genus *Syscia*) described from Australia. Its broad distribution is very similar to that of *C. longitarsus*, except it usually occurs in more densely forested habitats. Another species from the *typhlus* group, possibly undescribed but very close to *C. biroi* from south-east Asia, occurs in Kimberley rainforests. Species of the *typhlus* group are cryptic ants of soil and litter, whereas all other Australian species of *Cerapachys* have large eyes and forage actively on the soil surface.

All other Australian *Cerapachys* belong to Australian species-groups, mostly belonging to the former genus *Phyracaces*. The treatment of species-groups presented

here is rather different from that previously suggested (Brown 1975), although there is substantial overlap and I have used the same names where possible. There appears to be two major radiations of '*Phyracaces*'. The first consists of small, black or bicoloured species occurring primarily in tropical forests (*turneri* group) and savannas (*brevis* group). *Cerapachys turneri* itself occurs from north Queensland to the Kimberley, and appears to be the only representative of its group in the monsoonal region outside Queensland. Species of the *brevis* group, on the other hand, occur throughout the monsoonal region. Species-level variation in this group is unresolved, with *C. brevis* itself apparently occurring from central Queensland to the Kimberley. There are localised variants of uncertain taxonomic status, such as a relatively small form with yellow petiole from the northern Victoria River District.

The second radiation of '*Phyracaces*' (all other species-groups) consists of generally larger, often uniformly reddish species that are extremely diverse in the arid zone, but with many species extending into the monsoonal region. The *singularis* group is easily recognised by the carinate posterior corners of the head (Plate 6). Larger species are uniformly reddish, whereas smaller species are often black or bicoloured. One relatively large species occurs throughout the monsoonal region. In the *clarki* group, lateral carinae are absent from the middle third of the trunk, and in some species (including *C. clarki* itself) the dorsal surface of the petiole is conspicuously punctate. Most species from this group occur in eastern Australia, with many from central Queensland. At least two of these, including *C. princeps* (which is one of several '*Phyracaces*' species in which workers have ocelli), extend to the Top End. I have provisionally assigned all remaining species to the *fervidus* group, although further work might result in the recognition of other groups. *Cerapachys fervidus* itself occurs throughout subcoastal northern Australia, from Queensland to the Kimberley.

Key to species-groups

1. Eyes prominent; antennae with 12 segments; petiolar node with lateral carinae separating dorsal from lateral faces **2**

   Eyes absent; antennae with 9 segments; petiole without lateral carinae ..... ***typhlus* group**

2. Trunk with lateral carinae separating dorsal from lateral faces; total length 2–8 mm **3**

   Trunk without lateral carinae; total length 2 mm ..... ***longitarsus* group**

3. Posterior corners of head each with a distinct carina running toward the eye (Plate 6) ..... ***singularis* group**

   Not as above **4**

4. Lateral carinae absent from middle third of trunk; colour always uniformly reddish ..... ***clarki* group**

   Lateral carinae running along virtually the entire length of the trunk; includes all bicoloured or blackish species **5**

5. Uniformly reddish species; posterior corners of petiolar node projecting backwards as sharp teeth ..... ***fervidus* group**

   Black or bicoloured species; posterior corners of petiolar node generally square, less commonly projecting backwards as rounded teeth..... **6**

6. Body entirely black; posterior corners of petiolar node usually projecting backwards as small, blunt teeth; restricted to rainforest and other dense vegetation ..... ***turneri* group**

   Body bicoloured reddish and blackish; posterior corners of petiolar node square or rounded; often in open habitats ..... ***brevis* group**

Sphinctomyrmex (Fig. 10)

Its long, tubular gaster with prominent constrictions between segments makes *Sphinctomyrmex* highly distinctive. It is far less diverse than is *Cerapachys*, consisting of primarily subterranean species occurring mostly in wet forests. Their cryptic habits make them poorly recorded even by Australian standards, so that it is difficult to comment on species diversity and distributions. However, there appear to be at least six species occurring in the Top End, all with 12-segmented antennae. Species with 11-segmented antennae occur in higher rainfall areas of eastern and southern Australia.

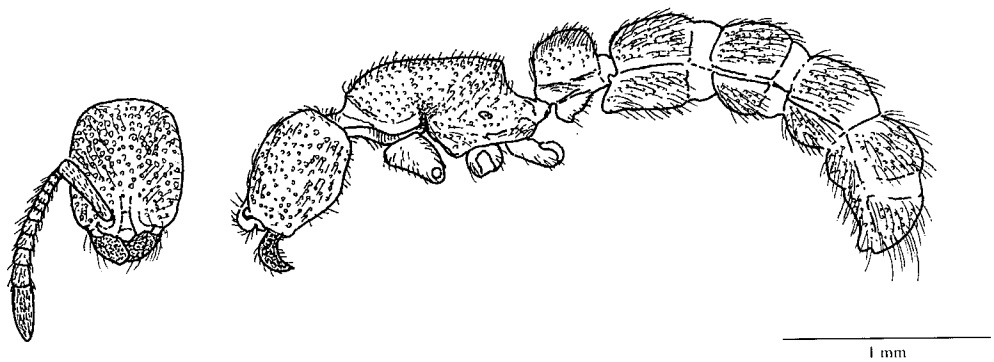


Fig. 10 ***Sphinctomyrmex* sp.**

SUB-FAMILY AENICTINAE

Aenictus (Fig. 11)

This monogeneric sub-family is distributed throughout the Old World tropics, and its species are the only 'true army ants' (Gotwald 1995) occurring in Australia. However, species of *Aenictus* have relatively small colonies and are the least conspicuous of all army ants: they do not display the spectacular polymorphism and nomadic life-style of their famous cousins (Ecitonini) in the neotropics (Gotwald 1995). All Australian species appear to be specialist predators of the brood of other ants. Most are small (total length about 2 mm), yellowish members of the *ceylonicus* group (Fig. 11), which occur in rainforest and thickly-wooded savanna throughout sub-coastal northern Australia. A larger (2.5 mm), black species (*A. aratus*) is known from rainforest in the Top End as well as from Queensland (Reichel & Andersen 1996).

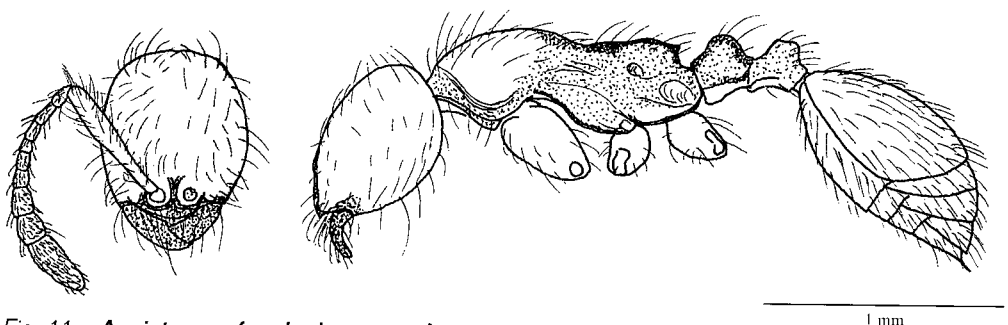


Fig. 11 ***Aenictus* sp. (*ceylonicus* group)**

SUB-FAMILY MYRMICINAE

Globally, the Myrmicinae is easily the most diverse of all ant sub-families, both in terms of the numbers of genera (about 150; Bolton 1994) and species. They are diverse in all climatic zones, but particularly in the tropics. Myrmicine habits are equally diverse, with the sub-family including specialist predators such as members of the tribe Dacetonini, and specialist granivores (Andersen 1991*b*) such as several species-groups within each of *Monomorium*, *Pheidole* and *Meranoplus*.

Several myrmicine genera are known from the monsoonal region as single, rare species. These are: *Colobostruma* sp. from eastern central Queensland; *Machomyrma dispar*, known from both north Queensland and the Top End; *Mayriella* sp. nr. *spinosior*, a tiny (1 mm), apparently undescribed species known only from western Cape York Peninsula; *Mesostruma turneri* from eastern central Queensland; *Rhopalomastix rothneyi*, a south-east Asian species known in Australia from north Queensland and from a single record from Darwin; and *Willowsiella anderseni*, a species endemic to the northern Kimberley (Taylor 1990). The genera are covered in the following key, but are not considered further.

Key to genera

1. Antennae with 4–6 segments (tribe Dacetonini) 2

   Antennae with ≥9 segments 5

2. Mandibles narrow and linear, meeting only at their apices, and inner margins without teeth ..... ***Strumigenys*** **(p. 56)**

   Mandibles broadly triangular, meeting (or almost so) along their entire inner margins, which are toothed 3

3. Tiny (about 1.5 mm); post-petiole surrounded by spongy material (Fig. 23) ..... ***Pyramica*** **(p. 55)**

   Larger (2–2.5 mm); post-petiole without spongy material, but with prominent lateral flanges 4

4. Petiole (as well as post-petiole) with prominent lateral flanges; pronotal shoulders always acutely angled, produced into small teeth ..... ***Colobostruma***

   Petiole not flanged; pronotal shoulders often rounded, not produced into teeth ..... ***Mesostruma***

5. Post-petiole attached to the dorsal surface of the gaster, which has a pointed apex (Fig. 14, Plate 7) ..... ***Crematogaster*** **(p. 40)**

   Not as above **6**

6. Antenna with a 2-segmented club **7**

   Antenna without a clearly differentiated club, or club with more than two segments **11**

7. Eyes conspicuous, either strongly elliptical or tear-shaped **8**

   Eyes inconspicuous and dot-like (at most feebly elliptical), or absent **9**

8. Eyes tear-shaped; propodeum with a pair of teeth ..... ***Mayriella***

   Eyes elliptical; propodeum without teeth ..... ***Rhopalomastix***

9. Clypeus with a pair of small teeth; propodeum never with teeth or spines; monomorphic (except for the introduced *S. geminata* from the Darwin region, which is polymorphic) ..... ***Solenopsis*** **(p. 55)**

   Not as above **10**

10. Propodeum with small teeth, or (rarely) teeth absent; dimorphic species, heads of major workers with toothed occipital corners (Fig. 19) ..... ***Oligomyrmex*** **(p. 49)**

    Propodeum with long teeth or spines; polymorphic species, heads of major workers without teeth (Fig. 21) ..... ***Pheidologeton*** **(p. 53)**

11. Dorsum of trunk conspicuously flattened, such that it is distinct from lateral faces, and usually with lateral projections that form a shield-like plate; sides of head with deep grooves to receive the 9-segmented antennae (Fig. 15, Plate 8) ..... ***Meranoplus*** **(p. 42)**

    Not as above **12**

12. Petiole without a prominent erect node (sometimes with a broad, erect tooth); head rectangular and coarsely striate; femora markedly swollen; antennae 11-segmented; arboreal species (Fig. 22) ..... ***Podomyrma*** **(p. 54)**

    Not as above **13**

13. Clypeus with a medial, unpaired seta; in larger (>2 mm) species clypeal margin medially concave, and often with conspicuous teeth; propodeum without a pair of teeth or spines (except for *talpa*, and one species from the *bifurdum* group) (Figs 16–18, Plate 9) ..... ***Monomorium*** **(p. 45)**

    Not as above **14**

14. Pro-mesonotum prominently rounded, and markedly higher than propodeum in profile... **15**

    Profile of trunk relatively straight and simple, with at most a small metanotal notch **16**

15. Monomorphic; antenna with 4-segmented club; total length about 5 mm (Fig. 12) ..... ***Aphaenogaster*** **(p. 39)**

    Dimorphic (occasionally polymorphic); antenna with 3-segmented club; total length of minor workers <4 mm (Fig. 20; Plates 10, 11) ..... ***Pheidole*** **(p. 50)**

16. Head coarsely striate; antennae inserted in deep, circular pits (Plate 12) ..... ***Tetramorium*** **(p. 56)**

    Not as above **17**

17. Petiole almost as wide as post-petiole when viewed from above, both more than twice as wide as long ..... ***Willowsiella***

    Petiole only about half as wide as post-petiole when viewed from above, and not more than twice as wide as long **18**

18. Eyes prominent and elliptical, as long as the space between the eye and mandibular insertion; post-petiole swollen when viewed from above, and broadly attached to gaster; monomorphic (Fig. 13) ..... ***Cardiocondyla*** **(p. 40)**

    Eyes small and approximately circular, much shorter than space between the eye and mandibular insertion; polymorphic ..... ***Machomyrma***

Aphaenogaster (Fig. 12)

Aphaenogaster is widely distributed throughout the world, and is closely related to the cosmopolitan *Pheidole*. All species of *Aphaenogaster* are monomorphic (compared with dimorphic or, less commonly, polymorphic in *Pheidole*), and all Australian species of *Aphaenogaster* are substantially larger (>4 mm) than any of *Pheidole*. *Aphaenogaster* is widespread in Australia, with one radiation (*longiceps* group) occurring in eastern and northern subcoastal regions, and the other (*barbigula* group) occurring in the southern semi-arid zone. Species of *Aphaenogaster* are usually associated with sandy soils (Nicholls & McKenzie 1994), and build conspicuous nests with large, multiple entrances, each surrounded by a crater of soil up to 15 cm in diameter. This has given rise to their common name of 'funnel ants'. In some areas, *Aphaenogaster* nests are a locally dominant feature of the soil surface (Saunders 1967; Humphreys 1981). Even when this occurs, foraging workers are seldom seen in large numbers, leading to the (as yet unsubstantiated) suggestion that nest craters act as pitfall traps, thus reducing the need for active foraging for prey.

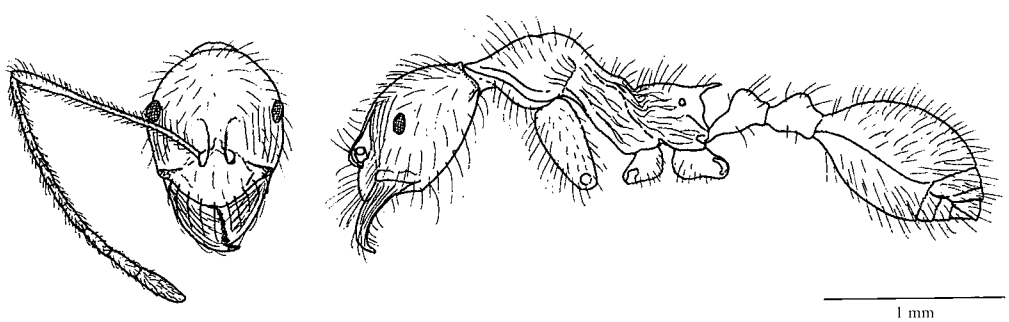


Fig. 12 ***Aphaenogaster*** **sp. nr.** ***longiceps***

Four species of *Aphaenogaster* are currently known from the monsoonal region. Three of these are very close to *A. longiceps*, one occurring in central Queensland north to the Townsville region, another in monsoon rainforest associated with the Arnhem escarpment in the Top End (and also in rainforest of north Queensland), and the other in monsoon rainforest of the northern Kimberley. The fourth species is *A. pythia*, a north Queensland species that is also known from a single rainforest patch in Arnhem Land (Reichel & Andersen 1996).

Cardiocondyla (Fig. 13)

Cardiocondyla is primarily a tropical genus, but one radiation (*nuda* group; Fig. 13) is extremely widespread in Australia. It is represented by *C. ?wroughtoni*, a yellow species occurring in rainforest litter throughout northern Australia, and the problematic *C. 'nuda'*. The latter is either a single, variable species (ranging in colour from reddish brown to black), or, more likely, a complex of sibling species, patchily distributed throughout much of mainland Australia. They are opportunistic ants characteristic of open sites of low ant diversity. Another radiation (*thoracica* group), featuring prominent projections on the pronotal shoulders, also occurs in tropical Australia. *Cardiocondyla thoracica* itself is a bicoloured (yellow trunk, contrasting with black head and gaster) Indonesian species that is also known from Arnhem Land (Reichel & Andersen 1996). Another species from the group has been recorded from the nearby Kakadu region.

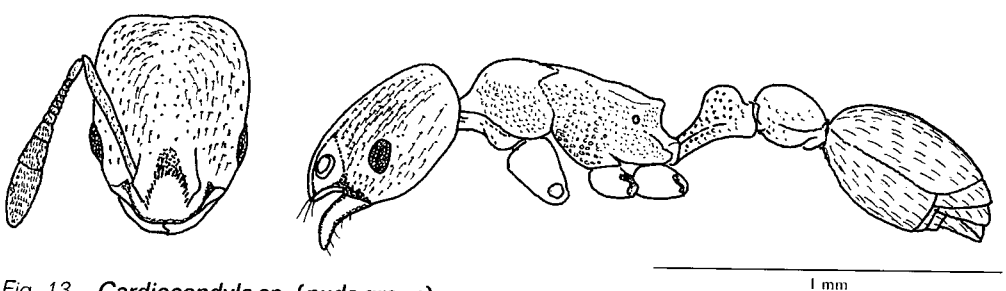


Fig. 13 ***Cardiocondyla* sp. (*nuda* group)**

Crematogaster (Fig. 14, Plate 7)

This genus is ubiquitous in Australia, as it is throughout much of the rest of the world, and is easily recognised by its heart-shaped gaster that is attached dorsally to the post-petiole. Many species are arboreal, nesting either in hollow twigs and branches, or in cracks and other cavities in tree trunks. The most common and diverse Australian representatives are members of the *laeviceps* group (Plate 7), which generally have reddish foreparts with contrasting black gaster. The species in southern Australia are

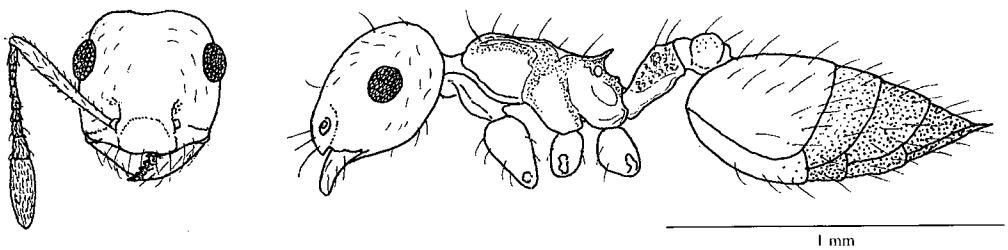


Fig. 14 ***Crematogaster queenslandica***

monomorphic, as is typical for *Crematogaster*, but most species in the monsoonal region (described as subspecies of C. '*australis*') are polymorphic, and this makes them very difficult taxonomically. For example, the minor workers of a very common and unspecialised savanna species are virtually indistinguishable from a highly specialised monomorphic species that is restricted to mangroves (Nielsen 1997), where it tends coccids inside its nests in hollow twigs.

Species of the *queenslandica* group (Fig. 14) are also distributed widely in Australia, and are common throughout the monsoonal region. They are all relatively small (total length about 2 mm), yellow or brownish species, which, unlike most other groups of *Crematogaster*, nest in soil. Most have a distinctive array of evenly spaced, erect setae on the pro-mesonotal dorsum, with two or three near each lateral margin, and sometimes another two near the anterior margin. However, the pro-mesonotum has numerous setae in some species (one of these occurs in the Kimberley), and at least one species (not known from the monsoonal region) is glabrous. In both the latter sub-groups the head is conspicuously sculptured, whereas more typically the head is mostly or entirely smooth and shiny. In many species of *Crematogaster*, the post-petiole is conspicuously bilobed dorsally, and this is generally a reliable character at the species-group level, occurring, for example, in all species of the *laeviceps* group. However, in the *queenslandica* group it occurs in some species but not others, including C. *queenslandica* itself (Fig. 14), which is a yellow species occurring throughout the higher rainfall zone of the monsoonal region, from north Queensland to the Kimberley.

All other species-groups in the region have restricted distributions. Two of these, Group B and the *cornigera* group, share many features in common and may be closely allied. In both cases the trunk is punctate throughout, and somewhat 'two-stepped' in profile, with a flat pro-mesonotum, and mesonotum with a vertical posterior face. Species of the *cornigera* group have long propodeal spines, but these are extremely reduced or absent in Group B. The latter occurs throughout arid Australia, extending into the southern fringes of the monsoonal region, and appears to consist of a single, variable species. The *cornigera* group consists of several species patchily distributed throughout the higher rainfall areas of the region.

Groups A and C contain arboreal species that are restricted to rainforests and other closed vegetation types. The former consists of small, yellow-brown species with contrasting black gaster, which resemble those of the terrestrial *queenslandica* group. Two are known from the monsoonal region: a common, hairy species that occurs from north Queensland to the Kimberley, and an uncommon, glabrous species from the Top End and the northern Kimberley. Group C has Indo-Malayan affinities, and apparently includes just one Australian species. Its prominently rounded pro-mesonotum, and long, curved propodeal spines make it Australia's most distinctive species of *Crematogaster*. In Australia it is known only from the Darwin region, including Melville Island.

Key to species groups

1. Profile of trunk forming a more-or-less continuous curve, with propodeum only feebly, if at all, differentiated from remainder of trunk; yellow or brownish ground-nesting species (Fig. 14) ..... ***queenslandica* group**

   Propodeum distinct from pro-mesonotum, with metanotal groove forming a conspicuous notch in profile; includes all reddish species with contrasting black gaster, and all arboreal species **2**

2. Trunk pale yellow-brown; arboreal rainforest species ..... **Group A**

   Trunk reddish or dark brown **3**

3. Trunk without erect hairs **4**

   Trunk with numerous erect hairs **5**

4. Propodeal spines reduced to small teeth, or absent (driest regions only) ..... **Group B**

   Propodeal spines long and prominent (wetter regions only) ..... ***cornigera* group**

5. Pro-mesonotum prominently rounded in profile, with metanotal groove deep and broadly rounded; propodeal spines longer than length of propodeum, and projecting upwards; monomorphic ..... **Group C**

   Pro-mesonotum flatter in profile, with metanotal groove notch-like; propodeal spines shorter than length of propodeum, and not projecting upwards; often polymorphic (Plate 7) ..... ***laeviceps* group**

Meranoplus (Fig. 15, Plate 8)

Meranoplus occurs in tropical Africa and throughout the Indo-Malayan region (Schodl 1998), but its centre of diversity is in the Australian arid zone. It is one of Australia's richest genera, with hundreds of species, only about 30 of which are named. The genus is easily recognised by its box-like trunk, with the dorsal surface typically expanded to form a shield-like plate. The head has deep grooves to receive the antennae. When

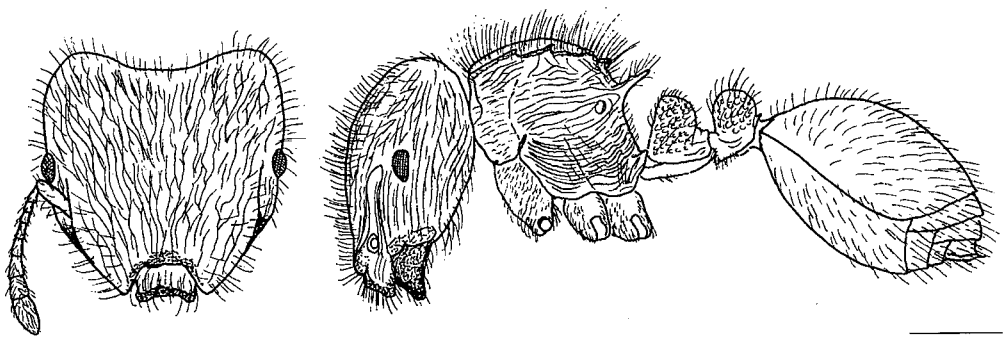


Fig. 15 ***Meranoplus unicolor***

disturbed, the ants characteristically retract their antennae, tuck their legs under the dorsal shield, and lie motionless in a 'foetal' position for several seconds.

The largest, and most conspicuous species in the monsoonal region are members of the *diversus* group (Fig. 15), which are specialist granivores (Andrew 1986; Andersen 1991*b*) whose middens of discarded seed husks are a feature of Australia's tropical savanna landscape (Andersen & Lonsdale 1990; Andersen *et al.* 2000). Their dorsal shields are reduced to irregular projections, and the ants do not display the 'playing dead' behaviour of species from other groups. The group is exceptionally diverse, with species most readily separated by clypeal morphology.

Two sub-groups can be recognised in the monsoonal region. The first comprises typically larger (4–6 mm) species in which the posterior corners of the dorsal shield are only feebly projecting, and the gaster is often striate. It includes *M. ajax*, an extremely widespread species with a single, pointed clypeal projection, and *M. unicolor* (Fig. 13), a species from the Top End and Kimberley with a relatively simple, concave clypeal margin, that feeds on the seeds of annual *Sorghum* (Andrew 1986). This sub-group occurs primarily in higher rainfall areas of the monsoonal region, whereas the other is more characteristic of drier regions, with extensive radiations in the central and northern arid zones.

In several monsoonal groups of *Meranoplus* the dorsal shield is strongly developed laterally to enclose translucent 'windows'. The most common of these are the apparently related *mjobergi* and *fenestratus* groups. Species of the *fenestratus* group occur throughout arid Australia and are granivorous, whereas those of the *mjobergi* group (Plate 8) occur primarily in the monsoonal region, and apparently do not eat seeds. One of the largest (up to 3.5 mm) species of the *fenestratus* group is *M. pubescens*, which occurs from central New South Wales to north Queensland. Its post-petiole is broadly flattened and prominently reflexed dorsally. A very similar species (occiput less coarsely sculptured) occurs in central Northern Territory and the Kimberley. One of the smallest (about 2 mm) of the group is *M. minimus*, which appears to be restricted to the Top End.

The dorsal shield has remarkably prominent flanges in the spectacular 'turtle ants' of the *testudineus* group. *Meranoplus testudineus* itself appears to be restricted to the Kimberley region, but a related species occurs sporadically throughout much of the northern arid zone. Another distinctive group with prominent flanges is the *hirsutus* group. It has Indo-Malayan affinities, and most Australian species are restricted to Queensland rainforests. However, a widespread savanna species occurs in the mid-rainfall zone from northern central Queensland to the southern Kimberley. Another savanna species is known from the northern Kimberley. A fifth group with particularly prominent flanges (Group C) appears to be restricted to the western monsoonal region, and a sixth group (Group B) is known from a single species, apparently endemic to sandstone country of western Arnhem Land in the northern Top End.

In contrast to the above, translucent flanges are entirely lacking in species of the *dimidiatus* group. *Meranoplus dimidiatus* itself has a box-shaped trunk without dorsal projections, and occurs from the southern Kimberley to the Victoria River District southwest of the Top End. Related species occur elsewhere in Western Australia, with one distributed across the entire southern semi-arid zone.

Like Group B, another distinctive monsoonal group (Group A) is also known from a single species that is apparently endemic to sandstone country of western Arnhem Land. It is a highly polished species with a short but very broad shield, and a massive, cuboid petiolar node. It is apparently unrelated to any other Australian *Meranoplus*.

All other species in the region appear to belong to a single radiation that occurs throughout Australia. Within this radiation I have distinguished two groups in the key below that are centred on the monsoonal region. One (Group E) has a characteristic fur-like 'pelt' of silky hairs, with different species known from Queensland, the Top End, and the Kimberley. The other (Group F) is the only group characteristically found in monsoon rainforest. I have also distinguished a group of large-eyed species (Group D) that is extremely diverse in the arid zone, with many monsoonal representatives.

Key to species-groups

1. Dorsal shield about twice as wide as long; posterior face of trunk without teeth or spines (black, shiny species from Arnhem Land) ..... **Group A**

   Dorsal shield about as long as wide, or longer; posterior face of trunk with teeth or spines 2

2. Dorsal shield very extensively flanged, with projections completely filled-in by thin, translucent material, giving the flanges a window-like appearance 3

   Lateral margins of dorsal shield with angular projections that project well beyond any translucent flanging 8

3. Shoulders of gaster with translucent flanges 4

   Gaster without translucent flanges 5

4. Post-petiole in profile higher than broad, with angular apex; gaster with finely punctate sculpture, sometimes also with coarser striae ..... ***testudineus* group**

   Post-petiole in profile as broad as high, and not at all angular apically; gaster coarsely pitted ..... **Group B**

5. Body densely clothed with long (≥ height of petiolar node), fine hairs ..... ***hirsutus* group**

   Hairs relatively short and stout **6**

6. Post-petiole strongly reflexed, with posterior face markedly concave; usually tan in colour ..... ***fenestratus* group**

   Not as above **7**

7. Shield smooth, not conspicuously sculptured; usually dark-chocolate in colour ..... ***mjobergi* group**

   Not as above ..... **Group C**

8. Larger species (total length ≥3 mm); occipital border concave; clypeal margin elaborate, usually deeply concave, and often with a central tooth or blunt projection; granivorous (Fig. 15) ..... ***diversus* group**

   Not as above **9**

9. Dorsal surface of trunk without projections on lateral or posterior margins, or, if present, projections without translucent flanges ..... ***dimidiatus* group**

   Projections on dorsal shield with conspicuous translucent flanges **10**

10. Eyes very large, occupying half total length of head or more ..... **Group D**

    Eyes not so large **11**

11. Body densely clothed with a silky fur-like 'pelt' of white, semi-adpressed hairs ..... **Group E**

    Not as above **12**

12. Petiolar node with a distinct dorsal face; dorsal shield always with conspicuous angular projections; restricted to denser forests ..... **Group F**

    Not as above ..... **miscellaneous groups**

Monomorium *(Figs 16–18, Plate 9)*

Monomorium is a cosmopolitan genus that is exceptionally diverse in Australia, where the several hundred species are distributed across virtually all habitats. Australian species have recently been revised by Heterick (in press). There are two major radiations. The first consists of small (total length ≤2 mm), blackish or yellowish species with 11-segmented antennae. The most common of these in the monsoonal region are predominantly smooth and shiny species that are either blackish (*nigrius* group; Plate 9) or yellowish (*laeve* group), and these are often among the most abundant ants. *Monomorium nigrius* itself is the smallest (total length about 1 mm) member of its group, and appears to be distributed throughout sub-coastal northern

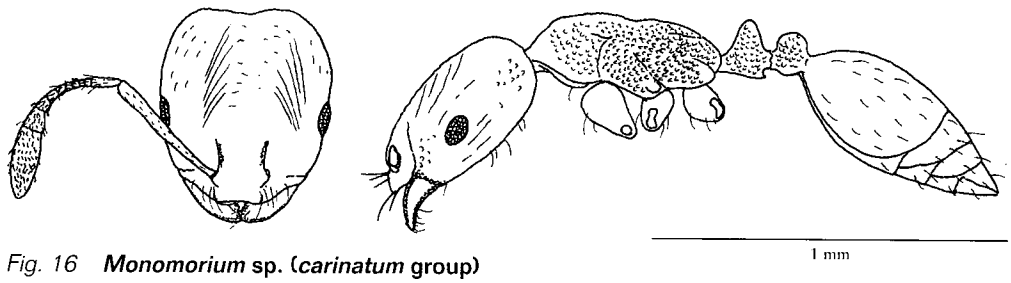


Fig. 16 ***Monomorium* sp. (*carinatum* group)**

Australia, from north Queensland to the Kimberley. It has a rather truncated propodeum, and a low petiolar node that is triangular in profile. One of the largest (nearly 2 mm) members of the *nigrius* group is *M. donisthorpei*, which appears to be restricted to the northern Top End. It has a relatively broad head, and high, narrow petiolar node. Its integument often has a milky, bluish grey translucence, particularly on the dorsal surfaces. *Monomorium fieldi* is a particularly hairy species of the *nigrius* group, with a relatively low and broad petiolar node, and occurs throughout the monsoonal zone.

Species of the *laeve* group are primarily nocturnal, and often have very large eyes. One exception is a relatively small-eyed species that is virtually ubiquitous in the monsoonal region, occurring in a wide range of habitats. *Monomorium disetigerum*, with moderately large eyes and glabrous except for a pair of long setae on the pronotum, is similarly widespread. A hairy species with exceptionally large eyes (longer than a third of total head length) is common from central Queensland to the Victoria River District.

Species from the *eremophilum* and *carinatum* groups also have 11-segmented antennae. The first consists of arid-adapted granivores that are characterised by large, tear-shaped eyes, and often clypeal teeth. The second is a monsoonal group, with the species illustrated in Fig. 16 occurring in the higher rainfall zone throughout the monsoonal region. In some other, larger, species (including *M. carinatum*) the predominantly smooth and shiny dorsal surface of the trunk is rather flattened and dorsally carinate.

All other species of *Monomorium* from the monsoonal zone have 12-segmented antennae. They include the rather aberrant *M. talpa*, a small (1.5 mm), yellowish species with reduced eyes and small propodeal teeth (very feebly produced, and even absent, in some specimens). *Monomorium talpa* is widespread in the Melanesian region (Wilson & Taylor 1967), but in Australia is known only from Top End rainforests (Reichel & Andersen 1996). It appears to be unrelated to any other Australian species of the genus.

Monomorium destructor, *M. floricola* and *M. pharaonis* are three small species with 12-segmented antennae that are pantropical 'tramp' ants that have been

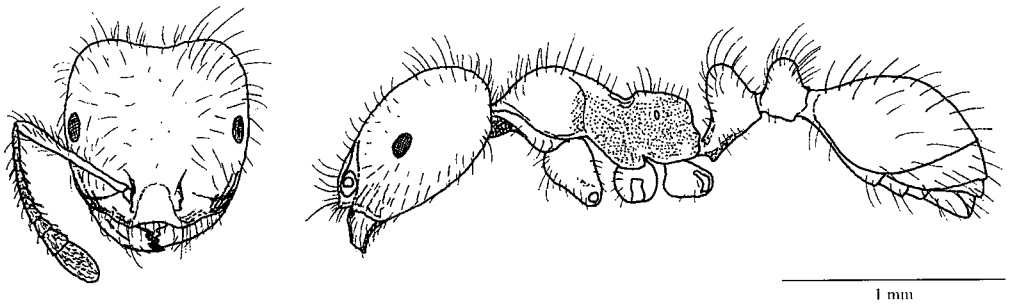


Fig. 17 ***Monomorium* sp. (*rothsteini* group)**

introduced into Australia. They are widespread in the monsoonal region in association with human settlement, and are among the most common ant pests in the home. *Monomorium destructor* (probably originally from Africa) is a particular nuisance, as it often nests in electrical equipment. *Monomorium floricola* and *M. pharaonis* are both probably native to tropical Asia.

The remaining species of *Monomorium* with 12-segmented antennae were previously referred to *Chelaner* (Ettershank 1966) and represent the second major radiation of Australian *Monomorium*. Species of the *rothsteini* group (Fig. 17) are the most abundant representatives of '*Chelaner*' throughout the drier regions of Australia, and are primarily granivorous, although their diets are supplemented by substantial amounts of insect material (Davison 1982). They are the most important harvester ants in the monsoonal region (Andersen & Braithwaite 1996). Colony size can be very large, and, despite their relatively small body size (1.5–2.5 mm), workers can form foraging trails up to 50 m from their nests, which are often surrounded by conspicuous middens of discarded seed husks (Andersen *et al.* in press). The group is morphologically uniform, but includes very many species. In most cases the clypeal margin is sinuate, but in one widespread species it is deeply concave and acutely angled laterally. In at least two reddish species, some colonies harbour uniformly black forms that are morphologically distinct from normal workers. These forms possibly represent parasitic species.

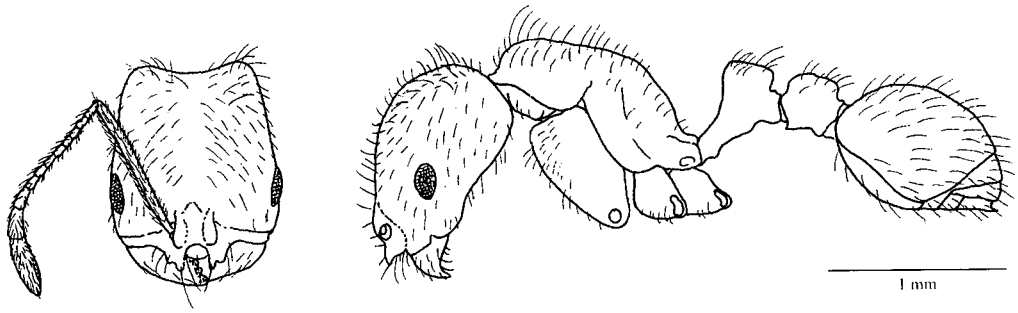


Fig. 18 ***Monomorium* sp. (Group A)**

The *sordidum* group appears to be closely related to the *rothsteini* group, and also occurs primarily in the arid zone. However, the species are not granivorous, and have a simple clypeal margin. They bear a striking resemblance to species of the *nigrius* group, and appear to play a similar ecological role as generalist scavengers. One monsoonal species occurs from the Gulf region to the Kimberley.

The *bifurdum* group comprises relatively large (3–4 mm), robust, heavily sculptured species with massive clypeal teeth, presumably associated with a granivorous diet. In all species the head is conspicuously striate, and the mandibles are prominently ridged. The group appears to be restricted to northwestern Australia. One undescribed representative from the southwestern Top End is one of the most spectacular of all Australian ants. Its massive head extends well above its point of attachment to the trunk, and the posterior face of this extension is extremely concave, rather like a deep 'thumb-print'. The propodeum is armed with a pair of small, triangular projections.

The final group of '*Chelaner*' in the monsoonal region (Group A in the key below) is endemic to the region, and is particularly diverse in Western Australia. It is referred to as *M. insolescens* by Heterick (in press), but I am not convinced that this species actually belongs to the group. Although there are at least 20 species in the group, none appear to be described. All species have a projecting clypeus that is concave medially, and larger species (such as that in Fig. 18) have massive fang-like projections, which are presumably associated with a granivorous diet. Colony size appears to be small, and nest middens are not conspicuous, if they are maintained at all.

Key to species-groups

1. Antennae with 11 segments **2**

   Antennae with 12 segments **5**

2. Eyes elongate and somewhat tear-shaped, extending close to mandibular insertions; clypeus sometimes with conspicuous teeth ..... ***eremophilum* group**

   Eyes symmetrically elliptical; clypeus sometimes concave medially, but never with conspicuous teeth **3**

3. Propodeum densely punctate; trunk rather straight in profile, with a somewhat flattened pro-mesonotum (Fig. 16); clypeal margin almost always concave medially, often with acute lateral corners ..... ***carinatum* group**

   Not as above **4**

4. Colour blackish (Plate 9) ..... ***nigrius* group**

   Colour yellowish ..... ***laeve* group**

5. Eyes tiny, diameter less than minimum diameter of antennal scapes; propodeum often with small teeth; colour yellowish ..... ***talpa***

   Not as above **6**

6. Clypeal margin concave medially; includes all species with total length >2 mm 7

   Not as above 9

7. Head completely covered with coarse striations; clypeus with a pair of massive teeth; mandibles prominently ridged ..... ***bifurdum* group**

   Not as above 8

8. Trunk saddle-shaped, with prominently rounded pro-mesonotum, and conspicuously sculptured propodeum (Fig. 17); clypeal margin sinuate (occasionally deeply concave) ..... ***rothsteini* group**

   Trunk either smooth or finely sculptured throughout, and rather uniformly curved in profile, with propodeum poorly differentiated (Fig. 18); clypeus strongly projecting medially, often as a pair of large, tooth-like processes ..... **Group A**

9. Head and trunk densely punctate (introduced) ..... ***pharaonis***

   Head and trunk mostly smooth and shiny 10

10. Bicoloured, with dark head and gaster contrasting with yellowish trunk (introduced) ..... ***floricola***

    Colour uniform 11

11. Polymorphic; petiolar node low, no higher than broad in profile (introduced) ..... ***destructor***

    Monomorphic; petiolar node markedly higher than broad in profile ..... ***sordidum* group**

Oligomyrmex (Fig. 19)

This is a morphologically conservative but species-rich genus occurring throughout the tropical world. The species are dimorphic, with major workers possessing a pair of distinctive horn-like teeth on their head. The tiny (1–1.5 mm), blind, minor workers

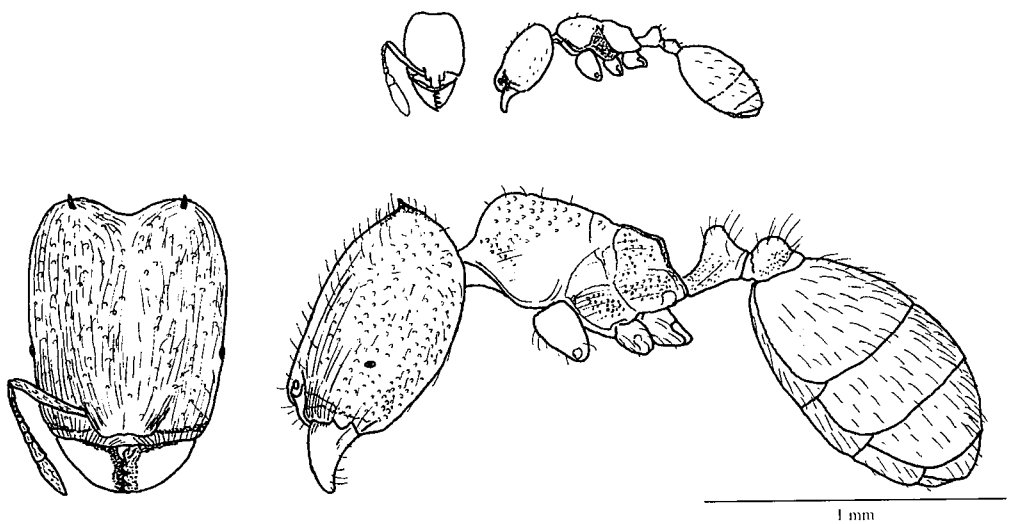


Fig. 19 ***Oligomyrmex* sp.**

are among the smallest of all ants. The ants are cryptic foragers within soil and leaf litter, and therefore occur primarily in rainforest and denser open forest. Five species are known from the monsoonal region, occurring in both wet and dry rainforest, and in denser savanna.

Pheidole *(Fig. 20; Plates 10, 11)*

Pheidole is one of the world's richest ant genera, with many hundreds, if not thousands, of species. Worldwide, it is particularly diverse in tropical rainforest, but is also a major component of local faunas in many other warm habitats. In Australia, species of *Pheidole* are often numerically dominant ants on the ground in tropical rainforest, but species richness is highest in open environments, with several species occurring in most open habitats outside (and often including) the cool-temperate zone. Despite the great number of species, most are morphologically similar, with a prominently rounded pro-mesonotum, a pair of petiolar teeth or spines, and a low and typically angular petiolar node. Only a few (mostly tropical) groups diverge markedly from this theme. Most species are dimorphic (a few are polymorphic), with major workers having particularly large heads (Plate 11), and many are granivorous.

The species-level taxonomy of Australian *Pheidole* is extremely poorly known even by Australian standards, such that even though clear natural groupings can be recognised, very few names can be put to them. The groups can be conveniently divided into those containing relatively gracile (often larger) species with long antennal scapes on one hand, and stockier (typically smaller) species with short scapes on the other. The former can have the appearance of miniature *Aphaenogaster*, and are primarily tropical. Most species from these gracile groups are apparently not granivorous. Species from two of these groups have prominent pronotal spines, but are apparently unrelated to each other. One of these (Group I) is known in the monsoonal region only by a yellowish, predominantly shiny species from rainforest in eastern

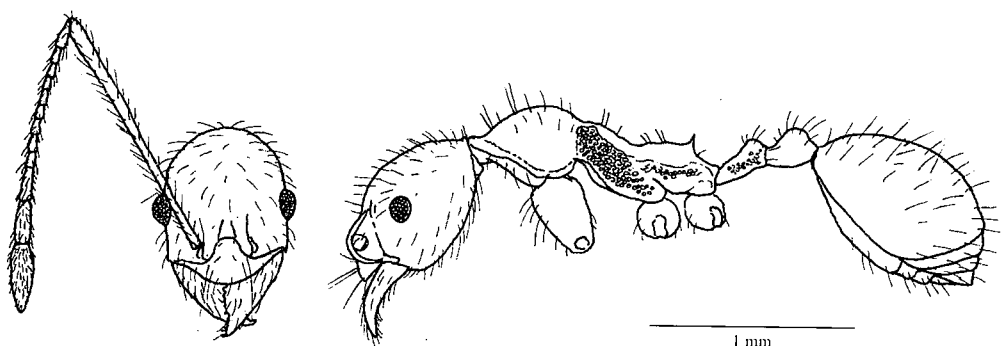


Fig. 20 ***Pheidole impressiceps***

Arnhem Land. The other 'spiny' group (Group H) contains heavily sculptured species occurring primarily in Queensland rainforests, although one species is known from the Top End.

Group G is the most diverse and widely distributed radiation of Australian tropical 'elongate' species, being represented in forested habitats throughout northern and eastern Australia. The species have small, erect propodeal teeth, rather than prominent, backward-projecting spines. Two yellowish, predominantly smooth and shiny species occur throughout the wetter half of the monsoonal region. One is a small species (total length 1.5 mm) with relatively short antennal scapes (exceeding occipital border by slightly more than maximum scape diameter), and the other is larger (2 mm) with relatively longer scapes. Group K appears to be closely related to Group G, but the propodeal teeth are longer (sometimes developed into spines) and project at least partly backwards. All species appear to be restricted to the tropics.

Other tropical, elongate species include the extremely widespread *P. impressiceps* (Fig. 20), which occurs in relatively moist habitats of low ant diversity throughout the monsoonal region. It is one of Australia's largest species of *Pheidole*, with minor workers approximately 2.5 mm in length. It belongs to a rich Indo-Malayan radiation of extremely long-legged species whose heads are narrowed posteriorly to form distinct 'necks'. Another tropical species is the African *P. megacephala*, which has been accidentally introduced throughout the tropics, where it can be a major pest (Hoffmann 1998). It is a particular problem on species-poor oceanic islands of the south Pacific, where it has extinguished many native invertebrate species. It is common throughout coastal Queensland, as well as in the Darwin region of the Top End, where it can also have severe impacts on native invertebrate faunas (Majer 1985; Heterick 1997; Hoffmann *et al.* 1999).

Species from Group D and the *hartmeyeri* group are arid-zone granivores that also have relatively long antennal scapes, but are probably not closely related to the tropical groups discussed above. The *hartmeyeri* group comprises large (minor workers approximately 2.5 mm), black, specialist granivores from the central and southern arid zones, with at least one species occurring in central Queensland. The species are particularly abundant in arid grasslands and chenopod shrublands on well-drained soils. In species from Group D, the scapes only exceed the occipital border by between one and two times their maximum diameter. Most species are yellowish brown in colour, and in several the posterior ('top') half of the head is conspicuously infuscated. One such species is abundant on clay soils in the Northern Territory, and is unusual for *Pheidole* in that it is continuously polymorphic.

Species groupings among the smaller, 'stocky' species with short antennal scapes are not so distinctive. One exception is the tropical *longiceps* group, which occurs primarily in rainforest and other shady habitats. Its species characteristically have a 'two-stepped' trunk in profile, with long, rather erect propodeal spines. The pronotum

usually has a dorsolateral pair of tubercles, which are produced into spines in at least one Queensland rainforest species. The possibly related Group A is exceptionally diverse, and occurs in all climatic zones. Several sub-groups can be recognised, including one with large, tear-shaped eyes that appears to be restricted to the monsoonal region. The species are known to eat seeds, but appear to have a broadly omnivorous diet. Species from the *mjobergi* group and Group B appear to be more granivorous, and are restricted to drier regions. They are uniformly dark brown, with trunk entirely punctate except for parts of the pronotum.

Species from Groups C, E and F, on the other hand, possibly do not eat seeds at all. Group C occurs throughout Australia outside the central arid zone. All species are yellowish, with the head of minor workers having several longitudinal striations, and usually also patches of feeble background sculpture. The dorsal surface of the pronotum is often conspicuously sculptured. In Groups E and F, virtually the entire head and pronotum is smooth and shiny. Group F consists of many, tiny (minor workers about 1 mm), litter-dwelling species restricted to the tropics. The major workers often have highly modified heads, including horn-like projections, or occipital teeth similar to those of major workers in *Oligomyrmex*. Group E comprises very many yellow or brown species, occurring primarily in wetter areas.

Finally, Group J is a rare, tropical group of unclear affinities, with highly unusual behaviour. It consists of a small number of savanna species that appear to be associated with the nests of other ants. One in the Darwin region builds its nests in the nest mounds of *Odontomachus ruficeps*. The reason for this association is yet to be determined, but one possibility is that the species are specialist brood predators of other ants.

Key to species-groups (minor workers, unless otherwise stated)

1. Scapes barely reaching, or only very slightly exceeding, occipital border **2**

   Scapes exceeding occipital border by a distance greater than their maximum diameter ... **8**

2. Head entirely sculptured **3**

   Head with at least some patches of frontal area smooth and shiny **4**

3. Frontal area finely and densely punctate, sometimes with feeble striations, giving it a dull appearance; pronotal shoulders without teeth or spines; propodeal spines projecting backwards ..... **Group A**

   Frontal area conspicuously striate and, despite background punctation, having a somewhat shiny appearance; pronotal shoulders often with tubercles or spines; propodeal spines long and directed upwards ..... ***longiceps* group**

4. Head almost entirely covered with fine punctures, except for a shiny patch on the frontal area; sides of pronotum entirely punctate; colour uniformly dark brown ..... ***mjobergi* group**

   Not as above **5**

5. Posterior ('top') half of head and pronotum entirely smooth and shiny **6**

Posterior half of head and/or pronotum partially sculptured 7

6. Tiny (about 1 mm) yellow species; heads of major workers usually with modified occipital margins, either angular or with teeth or horn-like projections ..... **Group F**

Not as above ..... **Group E**

7. Colour yellowish ..... **Group C**

Colour dark brown ..... **Group B**

8. Pronotum with a pair of spines 9

Pronotum without spines 10

9. Head conspicuously sculptured ..... **Group H**

Head smooth and shiny ..... **Group I**

10. Trunk entirely punctate; minor workers very large (about 2.5 mm) and uniformly dark brown or black; arid-zone granivores ..... ***hartmeyeri* group**

Not as above 11

11. Large (2.5 mm), very elongate species; occipital border dome-shaped, with head narrowing into a 'neck'; antennal scapes exceeding occipital border by half their length (Fig. 20) ..... ***impressiceps* group**

Not as above 12

13. Head, pro-mesonotum and gaster densely clothed with curved, silky hairs; diameter of eyes less than maximum diameter of antennal scapes ..... **Group J**

Not as above 14

14. Post-petiole conspicuously swollen, with a rather flat dorsal face that is approximately parallel with the ventral face (introduced) ..... ***megacephala***

Not as above 15

15. Propodeum with small erect teeth or short erect spines ..... **Group G**

Propodeum with spines angled at 45° or further backward-projecting 16

16. Scapes exceeding occipital border by a distance only slightly greater than their maximum diameter; occurring in southern, drier regions only; granivorous ..... **Group D**

Scapes exceeding occipital border by a distance greater than twice their maximum diameter; occurring in wetter, northern regions only ..... **Group K**

Pheidologeton *(Fig. 21)*

This genus occurs throughout the Old World tropics, with one species (*P. affinis*) known from Australia. Minor workers are morphologically similar to those of *Pheidole*, but have tiny, dot-like eyes and a two- (rather than three-) segmented antennal club. Species of *Pheidologeton* exhibit swarm-raiding behaviour similar to that of army ants. Raiding swarms of tens of thousands of polymorphic workers can break off from established foraging trails to overwhelm formidable prey items such as

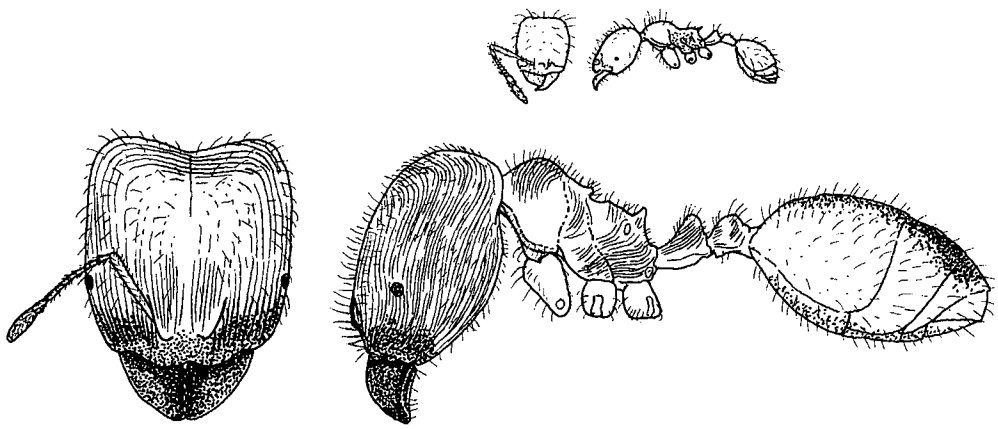


Fig. 21 ***Pheidologeton affinis***

small vertebrates (Hölldobler & Wilson 1990). *Pheidologeton affinis* is widely distributed in south-east Asia, and occurs in rainforest (and in some suburban gardens) throughout higher rainfall areas of northern Australia.

Podomyrma (Fig. 22)

Podomyrma is endemic to the Australasian region, and is one of Australia's few genera whose species are strictly arboreal, nesting in hollow twigs and branches. They are elongate, heavily sculptured ants with conspicuously swollen femora, and the petiole lacks a prominent node. The approximately 50 described Australian species occur predominantly along the eastern seaboard, primarily in rainforest. Most of the species in the monsoonal region also occur in the humid tropics of Queensland. One of these is the large (about 8 mm) and spectacular *P. tricolor* (Fig. 23), which has a black body with contrasting red head and golden gaster. There are isolated records of it from the Top End and the Kimberley. Two other Top End species, *P. basalis* and *P. femorata*, are shared with Indonesia.

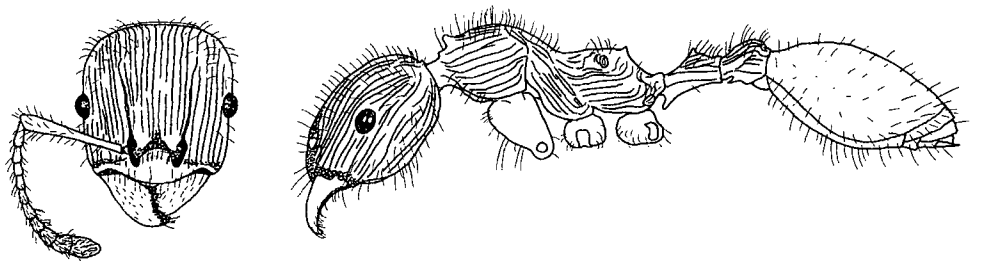


Fig. 22 Podomyrma tricolor

Pyramica (Fig. 23)

This genus can be distinguished from other dacetonines from monsoonal Australia by a combination of triangular mandibles and presence of foamy material on the waist. All species from the monsoonal region were previously known as *Glamyromyrmex* (Bolton 1999), and are rarely collected. Three species are known from savanna habitats in the Top End. Extremely little is known of their biology, but related species are specialist predators of springtails.

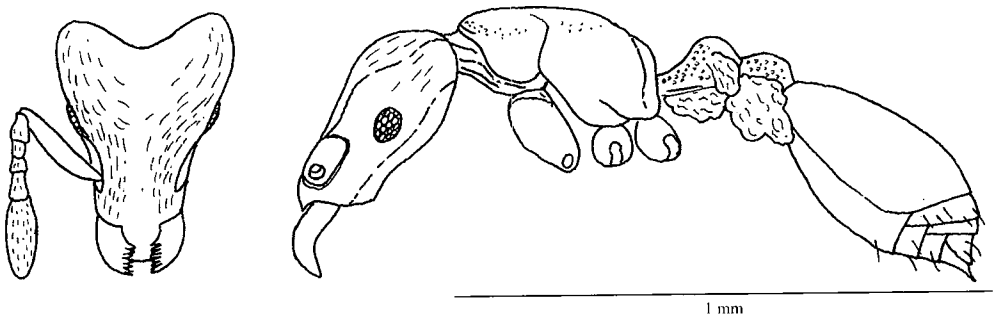


Fig. 23 ***Pyramica* sp.**

Solenopsis

All native Australian species of *Solenopsis* belong to the sub-genus *Diplorhoptrum*, and superficially resemble small, yellow species of *Monomorium* from the *laeve* group. They can be distinguished from such species by their smaller eyes, 10- rather than 11-segmented antenna with a two- rather than three-segmented club, and a toothed clypeus. Species of *Diplorhoptrum* are cryptic ants of the soil and litter, but have much wider habitat distributions than most other cryptic taxa. Two of the monsoonal species are common ants in a variety of rainforest and savanna habitats from north Queensland to the Kimberley. One is extremely small (just over 1 mm), and has a narrow, parallel-sided head, whereas the other is variable in size, with a broader head. Another, relatively large (about 2 mm) monsoonal species also ranges from north Queensland to the Kimberley, but primarily in savanna.

An introduced species of *Solenopsis* from the neotropical 'fire ant' group (subgenus *Solenopsis*) also occurs in the monsoonal region. *Solenopsis geminata* is native to Central and southern North America, but now occurs throughout the tropics. It can be distinguished from sub-genus *Diplorhoptrum* by its polymorphism, larger size (2–4 mm) and longer antennae (all segments substantially longer than wide), and bears a striking resemblance (except for colour — it is entirely yellowish brown) to species of the *rothsteini* group of *Monomorium* (Fig. 17). It is common in and around Darwin, where it is locally referred to as the 'ginger ant', and its powerful sting and

preference for lawns and other open places make it a particular pest of recreation areas. Ironically, in its native habitat *S. geminata* is being displaced by another fire ant, *S. invicta*, that has been introduced from South America (Williams 1994).

Strumigenys

Strumigenys is an extremely rich dacetonine genus, with its hundreds of species occurring primarily in litter of tropical rainforest (Bolton 1999). They have the general appearance of *Pyramica* (Fig. 23), but with linear rather than triangular mandibles. Two radiations occur in monsoonal Australia. One of these (*Strumigenys* in the strict sense) appears to be represented by a single species, the New Guinean *S. chyzeri*. It occurs in rainforest patches of the Top End. Species from the other radiation (previously referred to as the genus *Quadristruma*) have flat, scale-like hairs on the head and trunk.

Tetramorium (Plate 12)

Tetramorium occurs widely throughout the world (except for South America), and is particularly diverse in the African and Indo-Australian regions (Bolton 1976). The major radiation occurring in Australia's monsoonal region, and indeed everywhere else in Australia outside the humid tropics, consists of species with 11-segmented antennae previously referred to as *Xiphomyrmex*. Bolton (1977) considered them as a single species-group (the *striolatum* group) in his revision of the fauna of the south-east Asian region, but I have divided them into a number of groups.

I reserve the *striolatum* group for smaller species with well-defined frontal carinae and shallow antennal scrobes, which are ubiquitous in mainland Australia outside wet forests. *Tetramorium striolatum* itself occurs throughout the southern semi-arid zone, but a similar species (Plate 12) has a comparable distribution in the monsoonal region. Species of the *spininode* group also have antennal scrobes, but are easily distinguished by the peculiar morphology of their waist and gaster (see key below). There are six known species, occurring from the Gulf region through to Western Australia.

Bolton (1977) describes *T. spininode* as the most spectacular of all *Tetramorium*, but this title possibly belongs to members of Group A, which were unknown at the time of Bolton's revision, and indeed none is yet described. The five known species (four from northern Western Australia and one from the western Gulf region) are spectacularly sculptured ants, with rounded trunks in profile, long propodeal spines, and massive petiolar nodes on long peduncles. Although they have 11-segmented antennae, they clearly do not belong to '*Xiphomyrmex*', and are possibly allied to the *tortuosum* group of south-east Asia.

The remaining '*Xiphomyrmex*' in the monsoonal region (all provisionally referred here to the *impressum* group) belong to an exceptionally diverse radiation centred on the Australian arid zone, and includes several distinctive sub-groups. One of these comprises *T. sjostedti* and allies, the largest (about 4 mm) of Australian *Tetramorium*. The species are either uniformly tan in colour, or dark brown with tan gaster, and in each case the anterior half of the first gastric segment is conspicuously striate. A bicoloured form occurs from the Gulf region to the Kimberley, whereas a uniformly brown but otherwise indistinguishable form occurs from central and northern Western Australia to central Queensland. Other species of the *impressum* group can be divided into two sub-groups based on the lengths of their funicular segments. One of these sub-groups (third funicular segment longer than wide) appears to be restricted to the central and southern arid zones, with no known monsoonal representatives. The other sub-group (third funicular segment wider than long) has several species occurring in the southern fringe of the monsoonal region.

The *laticephalum* group is morphologically similar to the *impressum* group, and consists of large, granivorous species, with broad heads, deeply notched clypeal margins, and smooth mandibles. They appear to be restricted to the southern arid zone, with none known from the monsoonal region, but are included in the key below for the sake of completeness.

All other Australian species of *Tetramorium* belong to tropical radiations centred outside Australia. The most distinctive is the former genus *Triglyphothrix* (Bolton 1976). It includes *T. lanuginosum*, which occurs throughout the south-east Asian region, and is one of the commonest ants in Australian monsoon rainforests (Andersen & Majer 1991; Reichel & Andersen 1996). Although it has been considered a tramp species, it is almost certainly native to Australia. The *ornatum* group has several Australian species, all characteristic of rainforest, with *T. ornatum* itself occurring in north Queensland and the Top End, as well as in New Guinea. The *pacificum* group includes several native species from Queensland rainforest, but in the monsoonal region is represented only by the introduced *T. bicarinatum*. Another introduced species, the African *T. simillimum*, is also widespread in the monsoonal region. Both introduced species are restricted to disturbed areas associated with human settlement.

Key to species and species-groups

1. Antennae with 11 segments **2**

   Antennae with 12 segments **5**

2. Profile of trunk markedly convex, with long propodeal spines, often arising from about halfway down the posterior face; petiolar peduncle about as long as length of the rather massive node; clypeus projecting over base of mandibles (NW Australia only)..... **Group A**

   Not as above **3**

3. Smaller species (1.5–2.5 mm); frontal carinae conspicuous, running almost parallel beyond the eyes, and bordered by very shallow depressions that receive the antennae (these depressions are finely punctate, interrupting the striate sculpturing of the remainder of the head); third funicular segment wider than long; clypeal margin entire, not notched medially ..... ***striolatum* group**

   Not as above **4**

4. Nodes of petiole and post-petiole strongly projecting backwards; first gastric segment flanged basally, and conspicuously striate ..... ***spininode* group**

   Not as above ..... ***impressum* group**

5. Entire body clothed with long, silky hairs, some of which are bifid or trifid; antennal scrobes conspicuous ..... ***lanuginosum***

   Not as above **6**

6. Small species (≤2 mm); propodeum with teeth rather than long spines (introduced) ..... ***simillimum***

   Not as above **7**

7. Frontal carinae extending beyond eyes, and bordered by shallow scrobes; profile of trunk at most feebly convex ..... ***pacificum* group**

   Frontal carinae inconspicuous, obscured by background sculpture, and not bordered by conspicuous scrobes; profile of trunk usually markedly convex ..... ***ornatum* group**

SUB-FAMILY DOLICHODERINAE

This is a relatively small and morphologically conservative sub-family, with 22 genera worldwide (Shattuck 1992*a*). It is poorly represented in Africa and throughout the entire northern temperate zone, but in Australia (and also in the neotropics) it includes some of the most important ant genera. Australia has a particularly rich dolichoderine fauna, and dolichoderines (especially species of *Iridomyrmex* and, in wetter areas, *Anonychomyrma*) are dominant members of most Australian ant communities. Many dolichoderines can easily be recognised in the field by their pungent 'crushed ants' odour, which is peculiar to the sub-family.

A single species (*L. ?rothneyi*) of the exceptionally elongate 'spider ants' of the genus *Leptomyrmex* occurs in the Emerald region of central Queensland. The genus is characteristic of wetter forests of eastern Australia. The southern genus *Dolichoderus* also extends into central Queensland, where it is represented by a single species (*D. scrobiculatus*) from the *reflexus* group (Andersen 1991*a*). Finally, the Queensland rainforest species *Turneria bidentata* has occasionally been recorded from rainforest in the Darwin region. These three genera are included in the following key, but are not considered further.

Key to genera

1. Petiole without a distinct, erect node **2**

   Petiole with a distinct, erect node **3**

2. Propodeum poorly differentiated, with profile of trunk interrupted by a small notch, if at all; trunk glabrous; total length about 1.5 mm (Fig. 28) ..... ***Tapinoma*** **(p. 67)**

   Propodeum strongly differentiated from pro-mesonotum; trunk with scattered erect hairs; total length 2–2.5 mm (Fig. 29) ..... ***Technomyrmex*** **(p. 67)**

3. Large (about 8 mm) and exceptionally elongate, with scapes exceeding occipital border by nearly three-quarters their length; head narrowing markedly above eyes ..... ***Leptomyrmex***

   Not as above **4**

4. Entire integument coarsely sculptured; propodeum prominently rounded and with a concave posterior face ..... ***Dolichoderus***

   Head at most finely sculptured **5**

5. Propodeum with a horizontal dorsal face (often with backward-pointing projections), that is distinct from the concave posterior face **6**

   Propodeum broadly rounded, without dorsal projections, and without clearly distinct dorsal and posterior faces **8**

6. Aboreal; eyes very large (>1/3 total head length) and markedly asymmetrical ..... ***Turneria***

   Ground-nesting; eyes of normal size and approximately symmetrical **7**

7. Propodeum with a pair of long, finger-shaped projections; trunk with numerous erect hairs (Fig. 25) ..... ***Froggattella*** **(p. 61)**

   Dorsal face of propodeum sometimes projecting backwards, but not as a pair of projections; trunk glabrous or nearly so (Fig. 27) ..... ***Ochetellus*** **(p. 66)**

8. Centre of eyes at or above centre of head (Fig. 26, Plate 13) ..... ***Iridomyrmex*** **(p. 61)**

   Centre of eyes distinctly below centre of head **9**

9. Larger (>2 mm), dark reddish brown species; occipital border very deeply concave; propodeum separated from pro-mesonotum by a deep and broad trough (Plate 14) ..... ***Papyrius*** **(p. 66)**

   Smaller (total length ≤2 mm), often yellowish species; occipital border only feebly concave, if not flat or convex; propodeum separated from pro-mesonotum by only a shallow notch **10**

10. Eyes very small (diameter less than maximum diameter of antennal scapes; Fig. 24) ..... ***Bothriomyrmex*** **(p. 60)**

    Eyes larger ..... ***Doleromyrma*** **(p. 61)**

Bothriomyrmex (Fig. 24)

This genus is widespread in the Mediterranean and southern Asian regions, with only a handful of species described from Australia, occurring primarily in the south. Indeed, no described species is known from northern Australia outside coastal Queensland

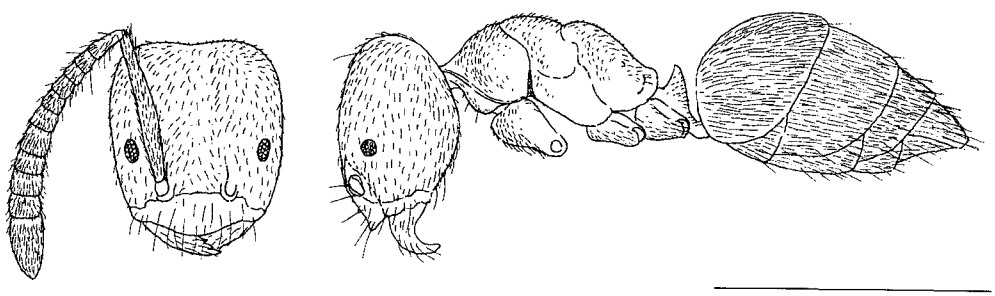


Fig. 24 ***Bothriomyrmex* sp.**

(Shattuck 1992*a*). However, there are at least three species occurring in the monsoonal region, with two known from the Top End, and a third from the Kimberley. They are all rarely collected, cryptic ants.

Doleromyrma

This is a small genus that was previously known as the *darwinianum* group of *Iridomyrmex* (Shattuck 1992*a*). It has the general appearance of *Tapinoma* (Fig. 28), but has a distinct petiolar node. Only one species (*D. darwinianum*) is formally recognised, but there are up to ten or more. The genus occurs primarily in southern Australia, but one semi-arid species extends into central Queensland and across to the Victoria River District, where it is locally common at sites of low ant diversity.

Froggattella (Fig. 25)

Froggattella is a highly distinctive genus endemic to Australia, being easily recognised by its blunt, finger-shaped propodeal projections. The genus consists of just two known species (Shattuck 1996*a*), both of which are uniformly reddish except for a contrasting black gaster. One species (*F. kirbii*) is one of Australia's most widely distributed ant species, occurring patchily around much of the mainland coast. Its distribution is also patchy locally: it is not frequently recorded, but is often extremely abundant (usually seen foraging on low vegetation) where it occurs.

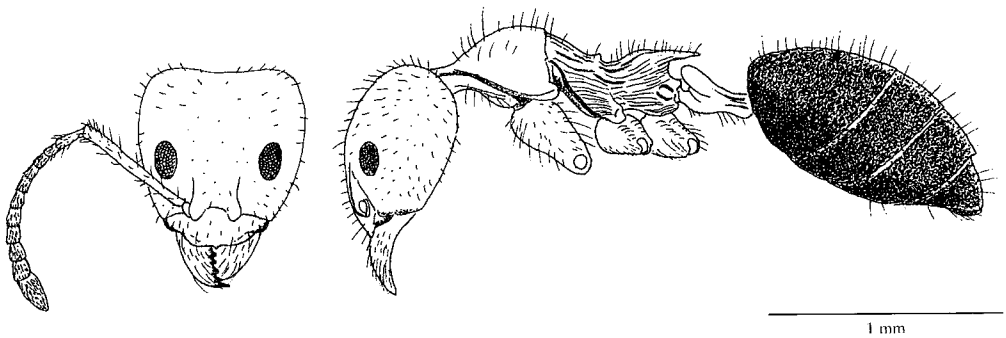


Fig. 25 ***Froggattella kirbii***

Iridomyrmex (Fig. 26, Plate 13)

Iridomyrmex is by far Australia's most ecologically important ant genus. Species of *Iridomyrmex* are highly abundant and aggressive ants occurring in open habitats throughout the continent, where they exert a strong influence on other ants (Andersen 1992*b*; Andersen & Patel 1994). *Iridomyrmex* can be considered the *Eucalyptus* of Australian ant communities: just as eucalypts dominate virtually all Australian

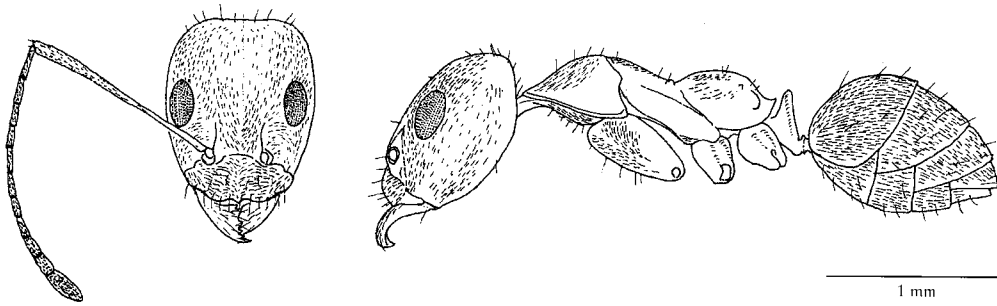


Fig. 26 ***Iridomyrmex* sp. (*anceps* group)**

woodlands and forests outside the wettest areas, *Iridomyrmex* dominates virtually all Australian ant communities outside the shadiest of habitats (Andersen 1995). Such continental dominance by a single ant genus is unique to Australia (Andersen 1997*b*).

Morphological diversity in *Iridomyrmex* is far lower than in other large Australian genera such as *Camponotus*, *Polyrhachis*, *Rhytidoponera* and *Monomorium*. This is especially true since several taxa previously considered as species-groups of *Iridomyrmex* are now recognised as separate genera (Shattuck 1992*b*; see *Doleromyrma*, *Ochetellus* and *Papyrius*). All species are morphologically conservative, having a simplified trunk entirely devoid of protuberances, heavy sculpture, or any other elaboration. This makes *Iridomyrmex* extremely difficult taxonomically at the species, and often even species-group, level.

Iridomyrmex is most diverse and abundant in the arid zone, and the majority of monsoonal species are northern representatives of Eyrean groups. Several such species are relatively large (≥4 mm), usually with reddish head and trunk contrasting with black gaster. These include the famous meat ants of the *purpureus* group, which are such a prominent feature of inland Australia (Greenslade 1976; Greenslade & Halliday 1982). The group includes about a dozen species (Shattuck 1993), with six occurring in the monsoonal region. Two of these, *I. sanguineus* (Plate 13) and *I. reburrus* occur throughout the region. The former is more common, and I consider it to have the highest biomass of any Australian ant species, and probably the highest biomass of any native Australian animal species, vertebrate or invertebrate. *Iridomyrmex reburrus* is more patchily distributed (characteristically in slightly moister habitats), and does not extend as far south. *Iridomyrmex reburrus* can usually be distinguished from *I. sanguineus* in the field by its darker colouration (dark purplish compared with brick-red), but this often fades in preserved specimens. The blackish Centralian meat ant, *I. viridiaeneus*, reaches the southern fringe of the monsoonal zone, occurring, for example, on the Barkly Tableland. It is the only meat ant in the region with greenish iridescence. The southern meat ant *I. purpureus* has its

northern limit in the Emerald region of central Queensland. It has a purplish trunk, with paler head. Another meat ant, *I. spadius*, also occurs in central Queensland, known only from disjunct populations in the Emerald and Ravenshoe regions. It has a blackish trunk with contrasting orange head.

The final member of the *purpureus* group in the monsoonal region is *I. bigi*. It is uncommon but widely distributed in the northern arid zone, extending to the Gulf region. As its name suggests, it has extremely large eyes.

Iridomyrmex discors is extremely widespread in southern and central Australia (Shattuck 1996*b*), and has a disjunct population in the western Gulf region. It is closely related to meat ants, and indeed should probably be considered part of the group.

The *rufoinclinus* group consists of four known species from the central and northern arid zones. They are closely related to species from the *viridigaster* group of the southern arid zone. These two groups, along with the *calvus* group of mesic southern Australia, represent a distinct radiation within *Iridomyrmex* in which the frontal carinae are uniformly curved rather than sinuate (Shattuck 1993). The most common member of the *rufoinclinus* group is *I. rufoinclinus* itself, which is entirely reddish (except for the black gaster) and occurs from central and southwestern Queensland through the Gulf region to the Top End. It nests in the soil, but is most commonly seen foraging on low vegetation. *Iridomyrmex cephaloinclinus* has a black head, and occurs sporadically throughout the southern fringe of the monsoonal region. A third species from the group, *I. anteroinclinus*, with black head and pronotum, is known only from three independently collected specimens in the northern Kimberley.

Aside from *I. agilis*, which is a large, elongate and long-legged arid-zone species that extends to the Mt Isa region in northern central Queensland, all other monsoonal species of *Iridomyrmex* are relatively small (2–4 mm), and usually uniformly yellowish or brownish. They are extremely difficult taxonomically. Crepuscular or nocturnal yellowish species with large eyes occur throughout arid, semi-arid and seasonally arid Australia, and, although I have grouped them together (*pallidus* group), it is possible that they represent two or more independent lineages. *Iridomyrmex pallidus* itself (actually described as a sub-species of the unrelated *I. rufoniger*) appears to be distributed throughout the monsoonal region, where it is often among the most common ant species. It is highly variable (often within a single nest), with larger specimens having very broad, cordate (occipital margin strongly concave) heads. Another widely distributed and variable (2.5–4 mm) species in the group is *I. hartmeyeri*, which occurs throughout the lower rainfall zone of the region. Its trunk is glabrous except for a pair of short pronotal hairs, and it has a prominently rounded propodeum. A very similar species occurs throughout the southern arid zone. A smaller (2.5–3 mm), entirely glabrous species with not such a rounded propodeum is common from the Top End to the northern Kimberley.

The remaining, mostly brownish species of *Iridomymex* in the monsoonal region include three groups of long-legged, gracile species. The most distinctive is the *bicknelli* group, whose species have a characteristically dome-shaped head, and often have feeble, bluish iridescence. One variably sized (2.5–4 mm) species ranges from north Queensland to the northern Kimberley. It is behaviourally quite unlike typical *Iridomyrmex* species, occurring in small colonies, and exhibiting submissive rather than aggressive behaviour. A smaller (about 2 mm) species with large, protuberant eyes, is known from Groote Eylandt off the eastern Arnhem Land coast. The *bicknelli* group is possibly related to the *agilis* group.

The other two gracile groups are extremely close morphologically. The *anceps* group occurs primarily in the tropics, and extends into the Indo-Malayan region, whereas the *gracilis* group is centred on the arid zone. Most (?all) species of the *gracilis* group appear to be polydomic, with nest entrances joined by trunk trails, whereas species of the *anceps* appear to have single nests. One species (Fig. 26) of the *anceps* group is common in non-rocky habitats throughout most of the monsoonal region, and is replaced by species of the *gracilis* group in rocky habitats. Species of the *gracilis* group tend to be hairier than those of the anceps groups, and often have hairy hind femora and antennal scapes. *Iridomyrmex* '*eteocles*' (described as an infra-subspecific variety of *I. mayri*, and therefore the name is not taxonomically valid; Taylor 1986) is a distinctive large (3.5–4 mm), reddish, arid-zone member of the *gracilis* group that extends across the southern fringe of the monsoonal zone.

Four groups of relatively small, non-gracile species of *Iridomyrmex* with short antennal scapes can be recognised in the monsoonal region. The most distinctive of these is the *rufoniger* group. This occurs primarily in the central and southern arid zones, where the species can be exceptionally abundant, forming broad foraging trails up to 50 m or more from their nests, often leading to shrubs and trees with honeydew-producing Homoptera. One reddish brown species is known from Mitchell grasslands on the southern fringe of the monsoonal region, and another species (*I. septentrionalis*) is common throughout inland New South Wales and central Queensland.

Species of the *cyaneus* group have large eyes and bluish iridescence, and are often associated with habitats of low ant diversity, such as riparian zones and seasonally waterlogged sites. The *mattiroloi* group consists of small (about 2 mm), robust species, with a short propodeum, that occur throughout Australia. One is locally abundant throughout the monsoonal region, extending through central Queensland to northern New South Wales. Its trunk is glabrous except for 2–4 short hairs on the pronotum. A very similar, if not the same, species occurs in Indonesia. Finally, the *suchieri* group has numerous species occurring primarily in the central and northern arid zones. They range from being entirely glabrous to densely hairy. A moderately hairy species occurs throughout much of the monsoonal zone, and is characteristic of poorly drained sites such as fringes of billabongs and riparian areas.

Key to species-groups

1. Colour yellow or yellow-brown; crepuscular/nocturnal species ..... ***pallidus* group**

   Colour red, brown or black; diurnal species 2

2. Antennal scape exceeding occipital margin by distinctly more than twice its maximum diameter 3

   Antennal scape shorter, exceeding occipital margin by at most twice its maximum diameter 6

3. Occipital border feebly or markedly convex 4

   Occipital border straight or feebly concave 5

4. Smaller species (<4 mm); occipital border markedly convex ..... ***bicknelli* group**

   Larger species (>4 mm); occipital border feebly convex ..... ***agilis* group**

5. Antennal scapes often exceeding occipital margin by a distance greater than one-third their total length; hind femora usually with scattered erect hairs; scapes often also with scattered erect hairs ..... ***gracilis* group**

   Antennal scapes exceeding occipital margin by a distance less than one-third their total length; hind femora rarely with scattered erect hairs; scapes always glabrous ..... ***anceps* group**

6. Larger species (total length >3.5 mm); trunk often reddish with contrasting black gaster; body covered with hairs 7

   Smaller species (total length <3.5 mm); colour usually uniformly brown or black; usually only with scattered hairs 9

7. Frontal carinae uniformly curved and concave throughout; petiolar node extremely asymmetrical, with anterior face only about a third as long as posterior face; antennal scapes extremely flattened, with erect hairs confined to a single face ..... ***rufoinclinus* group**

   Frontal carinae sinuate, convex medially; petiolar node not so asymmetrical, with anterior face about three-quarters the length of the posterior face; antennal scapes not so flattened, with erect hairs abundant on all faces 8

8. Larger species (4–6 mm); trunk covered with relatively short, stout hairs; gaster usually with strong, greenish iridescence ..... ***purpureus* group**

   Smaller species (3–4 mm); trunk covered with fine, silky hairs; gaster without iridescence ..... ***discors* group**

9. Occipital border markedly concave; trunk strongly biconvex in profile, with steep anterior face of pronotum; pronotum with >8 erect hairs ..... ***rufoniger* group**

   Occipital border flat or feebly concave; trunk not so strongly biconvex in profile; pronotum often with <6 erect hairs 10

10. Eyes relatively large, as long as distance between them and mandibular insertions; body with feeble, bluish iridescence ..... ***cyaneus* group**

    Not as above 11

11. Smaller species (total length 1.5–2 mm); profile of pro-mesonotum often markedly asymmetrical, with steeply rising anterior face; propodeum short and rounded ..... ***mattiroloi* group**

    Larger species (total length 2–3 mm); profile of pro-mesonotum never so asymmetrical; propodeum usually rather flattened ..... ***suchieri* group**

Ochetellus (Fig. 27)

This small genus occurs primarily in the Australasian region, but extends through south-east Asia to Japan. Until recently (Shattuck 1992) it was known as the *glaber* group of *Iridomyrmex*. Most species are either reddish or black, with the general appearance of Fig. 27. However, in two species the propodeum projects backwards over the petiole, and both these species occur in the monsoonal region. One of these is the spinifex ant, *O. flavipes*, of the northern arid zone, which constructs covered runways across the ground surface by mixing sand with resin from the 'spinifex' grasses of the genus *Triodia* (Morton & Christian 1994). It occurs primarily in the Northern Territory (as far north as the Katherine region), but is also known from far western Queensland and from the Pilbara region of Western Australia. The other is an undescribed species known only from northwestern Queensland and the northern Top End. The propodeum in this species has a broad dorsal face, as in most other species of *Ochetellus*, whereas the propodeum in *I. flavipes* is 'pinched' to form a ridge-like dorsum.

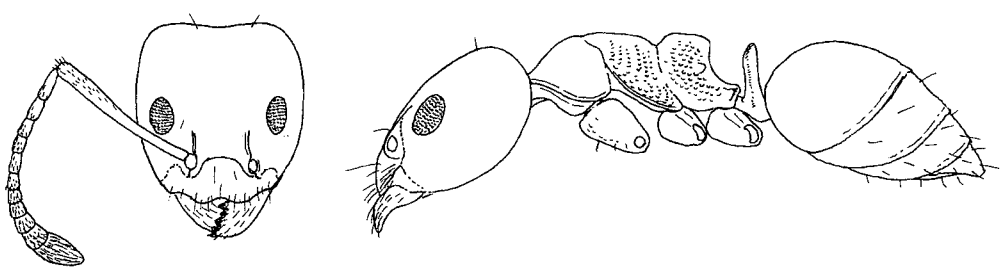


Fig. 27 ***Ochetellus* sp. (*glaber* group)**

Papyrius (Plate 14)

This genus is restricted to Australia and New Guinea, and was previously known as the *nitidus* group of *Iridomyrmex* (Shattuck 1992). It consists of about 15 species, all morphologically similar, and restricted to open habitats of higher rainfall areas. They occur in large colonies, usually in and around the bases of shrubs and trees, and form conspicuous foraging trails. The species in Plate 14 is common throughout most of the monsoonal zone.

Tapinoma (Fig. 28)

Tapinoma is a cosmopolitan genus, with all native Australian species belonging to the tiny (total length about 1.5 mm) *minutum* group. They are distributed throughout the mainland and in Tasmania, occurring in a wide range of habitats. *Tapinoma melanocephalum* is an introduced species of unknown origin that occurs throughout the monsoonal region in association with human settlement. It is morphologically very similar to native species, but can be recognised by its dark head and trunk, contrasting with pale gaster, legs and antennae.

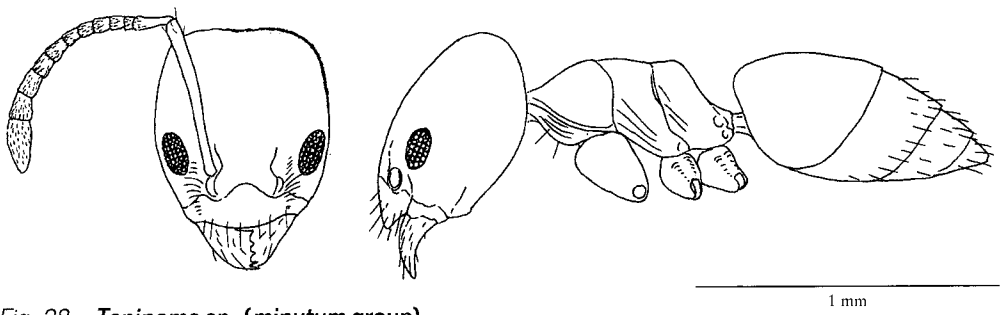


Fig. 28 **Tapinoma sp. (*minutum* group)**

Technomyrmex (Fig. 29)

This genus occurs primarily in the Old World tropics, with most of the handful of Australian species occurring in Queensland. One of these extends to the Top End, where it is restricted to rainforest and denser savanna.

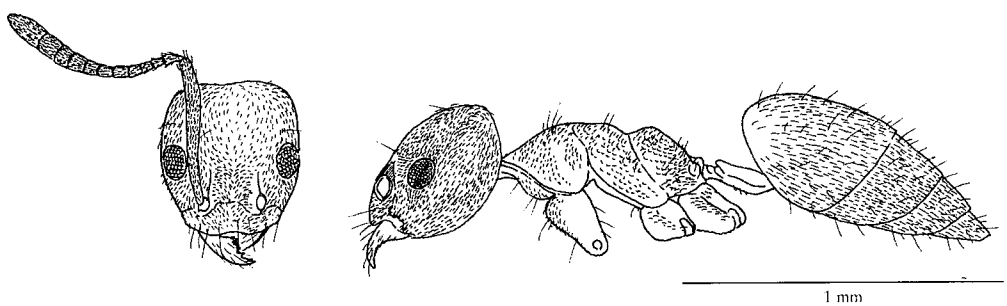


Fig. 29 **Technomyrmex sp.**

SUB-FAMILY FORMICINAE

The Formicinae is second in diversity to the Myrmicinae, with about 50 living genera. In *Camponotus*, *Melophorus* and *Polyrhachis*, it includes three of Australia's most diverse genera, each with well over 200 Australian species. One formicine genus, *Anoplolepis*, is not native to Australia, but is represented in the monsoonal region by *A. gracilipes* (formerly *A. longipes*), a widespread tropical tramp species from Africa. Its only known occurrence on the Australian mainland is from the Gove Peninsula of eastern Arnhem Land. It occurs primarily in rainforest and other riparian areas, and, like *Pheidole megacephala* (p. 51), can have a devastating impact on native invertebrates. Another genus, *Pseudolasius*, is also known in the monsoonal region from a single record in Arnhem Land rainforest. The genus is widespread in the Indo-Malayan region, and occurs in tropical rainforest of north Queensland. Both genera are included in the key below, but are not considered further.

Key to genera

1. Trunk hour glass-shaped from above, with constricted mesonotum; petiolar node very feeble, without an erect anterior face; gaster usually green; arboreal, nesting in leaves (Plate 18) ..... ***Oecophylla*** **(p. 81)**

   Not as above **2**

2. Antennae inserted well above upper clypeal margin, with antennal sockets distant by a length equalling or exceeding their diameter (tribe Camponotini) **3**

   Antennal sockets (or carinae of pits in which they arise) on or very close to upper clypeal margin **6**

3. In dorsal view, first segment of gaster occupying half or more of total gaster length; propodeum and petiole usually with teeth or spines (Figs 33–36, Plate 21) ..... ***Polyrhachis*** **(p. 85)**

   First gastric segment not so large; propodeum and petiole never with teeth or spines..... **4**

4. Eyes exceptionally large, and located on occipital corners (Plate 19)... ***Opisthopsis*** **(p. 82)**

   Not as above **5**

5. Monomorphic; trunk with a deep metanotal groove, and densely clothed with long, silvery hairs (Plate 15) ..... ***Calomyrmex*** **(p. 70)**

   Polymorphic (occasionally dimorphic); trunk not as above (Fig. 31, Plate 16) ..... ***Camponotus*** **(p. 70)**

6. Antennae with 11 segments (tribe Plagiolepidini) **7**

   Antennae with 12 segments **10**

7. Total length about 3 mm; extremely gracile species, with antennal scapes exceeding occipital margin by about two-thirds of their total length (introduced) ..... ***Anoplolepis***

   Total length ≤2 mm; antennal scapes exceeding occipital margin by at most half their total length **8**

8. Propodeum with a pair of small teeth..... ***Stigmacros*** **(p. 96)**

   Propodeum without teeth **9**

9. Eyes at most equal in diameter to maximum diameter of antennal scapes, generally tiny or absent..... ***Acropyga*** **(p. 69)**

   Eyes prominent, markedly greater in diameter than maximum diameter of antennal scapes ..... ***Plagiolepis*** **(p. 84)**

10. Polymorphic; clypeus with a 'moustache' of curved hairs; propodeal spiracle elongate ..... ***Melophorus*** **(p. 76)**

    Not as above..... **11**

11. Profile of trunk highly complex, with elaborated pronotal shoulders and a prominent metanotal projection ..... ***Notoncus*** **(p. 81)**

    Not as above..... **12**

12. Eyes relatively small (maximum diameter approximately equal to maximum diameter of antennal scapes); trunk with numerous fine, long, unpaired hair..... ***Pseudolasius***

    Eyes larger; trunk with sparse, stout, paired setae ..... ***Paratrechina*** **(p. 83)**

Acropyga (Fig. 30)

This is a genus of small, cryptic ants occurring in soil and litter throughout the world's tropics. In the monsoonal region the genus is restricted to denser forests. *Acropyga*

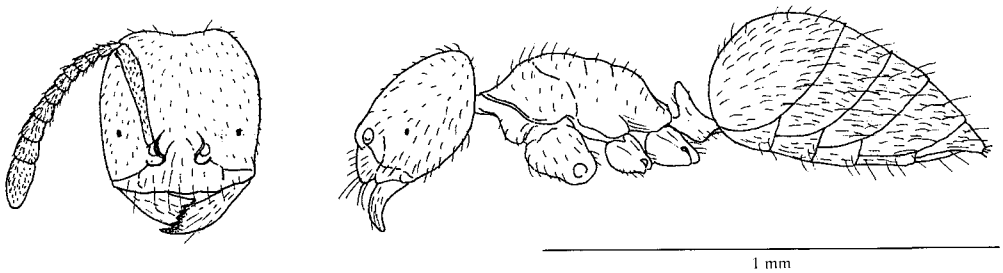


Fig. 30 ***Acropyga*** **sp.**

acutiventris is an unusually large (about 2 mm) and surface-active species with well-developed eyes. It is a rainforest species distributed widely in south-east Asia, with occurrences in north Queensland and the Top End.

Calomyrmex (Plate 15)

Calomyrmex is restricted to Australia, New Guinea and Indonesia, and all species are morphologically similar to that shown in Plate 15. When handled, they characteristically exude a milky substance from their mandibular glands, presumably as a defence against predators. Many of the monsoonal species are entirely black. The most widespread of these is *C. impavidus* (Plate 15), a species of shady habitats (especially the fringes of rainforest and riparian vegetation) of both north Queensland and the Top End, where it often forages on low vegetation. Most species from drier areas, including *C. cyaneus* and *C. splendidus*, are spectacularly iridescent, and move swiftly across the soil surface, often with a raised gaster. The genus is particularly diverse in central Queensland and the Gulf region, where five or six species can occur in a single locality. In at least two of these species the trunk and legs are reddish brown, without iridescence. Several of the species have strikingly iridescent, bauble-like gasters.

Camponotus (Fig. 31, Plate 16)

Camponotus is one of the world's richest and most widespread ant genera, having well over a thousand species, and occurring in virtually all habitats supporting ants. The genus is exceptionally diverse in Australia, with possibly 500 or more species. Greatest diversity is in the southern arid zone, where more than 30 species can occur at a single site (Andersen & Clay 1996).

Two major ecological groups can be recognised in the monsoonal region, as is the case elsewhere in Australia. The first comprises several, apparently independent, lineages of small (minor workers about 4 mm) and stout arboreal species nesting in twigs and branches. They are representatives of tropical groups whose centres of diversity are elsewhere in the Indo-Malayan and south Pacific regions. The species are often dimorphic (rather than polymorphic, as is more typical of the genus), with major workers having flattened, plug-like ('phragmotic') heads that they use to block the entrances to their nests. They occur primarily in rainforest, mangroves or other closed vegetation types. The most common species is *C. vitreus* (Fig. 31*a*), which is locally abundant in rainforest and mangroves in north Queensland and the Top End. It is uniformly black, with a trunk that is strongly biconvex in profile. It superficially resembles species of the *gasseri* group of southern Australia (Andersen 1991*a*), but I

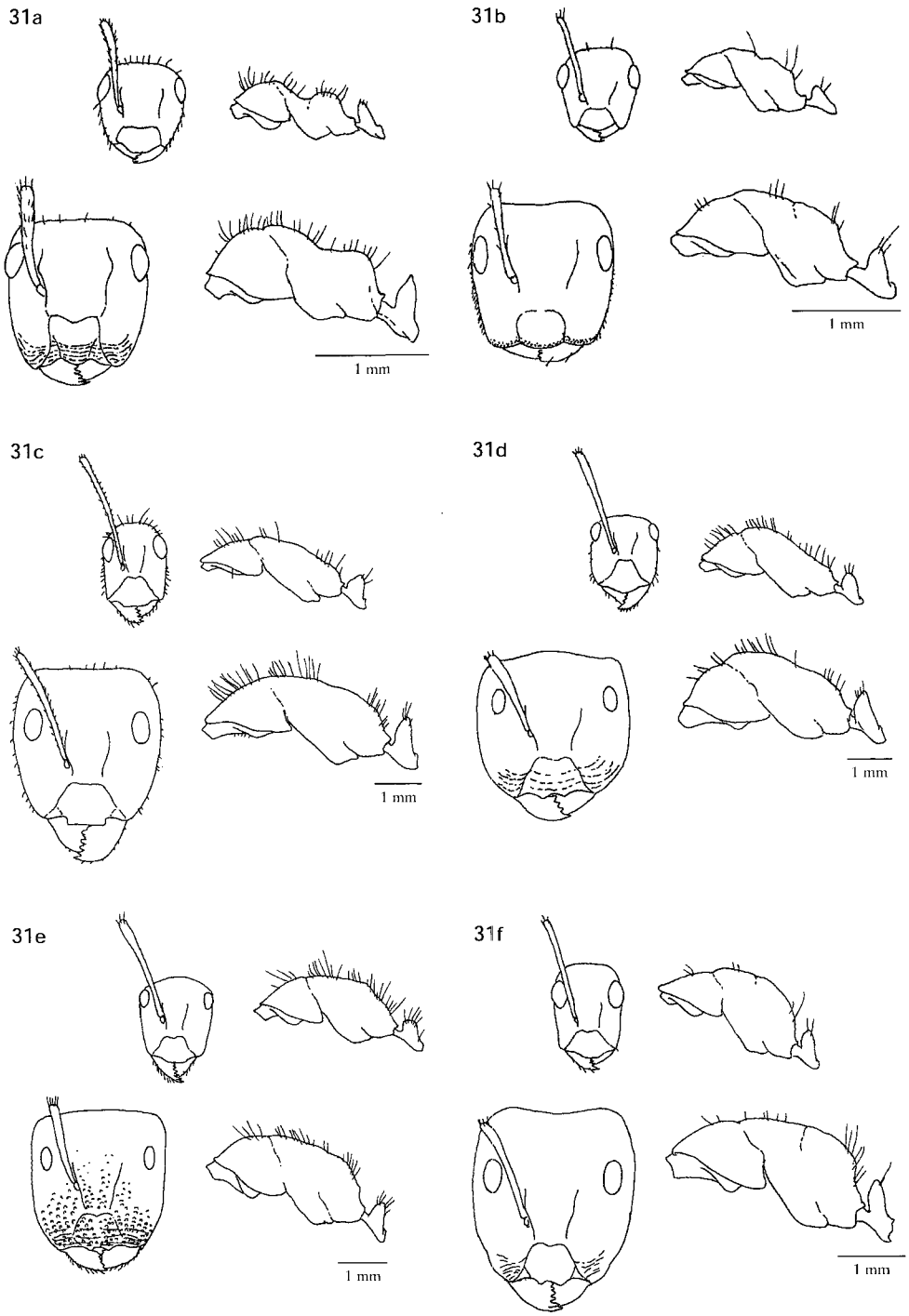


Fig. 31 ***Camponotus*** **spp.** (a) ***vitreus*** (b) ***reticulatus*** **group** (c) ***novaehollandiae*** **group** (d) ***ephippium*** **group** (e) ***pellax*** **group** (f) ***claripes*** **group** (continued overleaf)

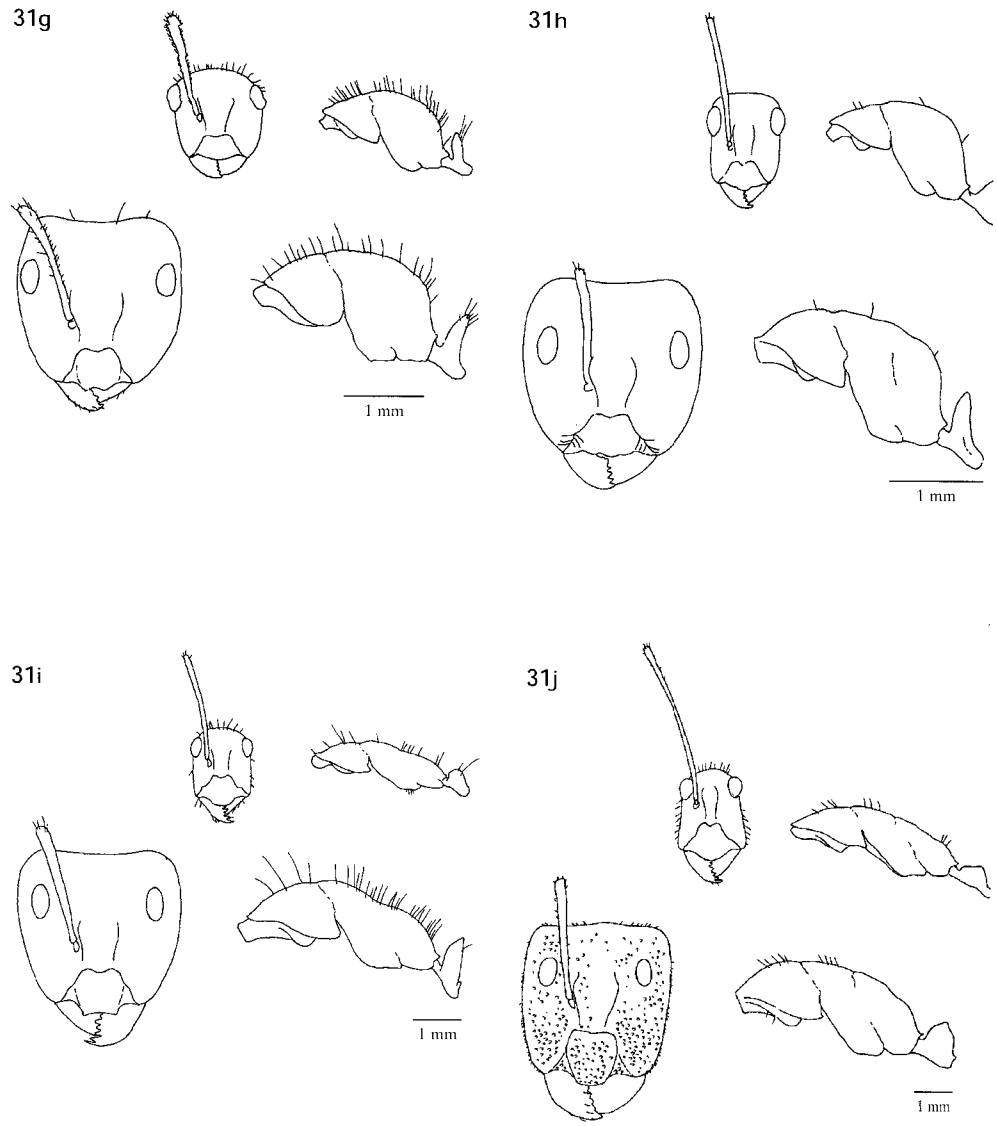


Fig. 31 cont'd ***Camponotus* spp.** (g) ***rubiginosus* group** (h) ***discors* group** (i) ***denticulatus* group** (j) ***subnitidus* group**

suspect the two groups are not closely related. Some species of the *janeti* group also have a biconvex trunk, whereas in others there is only a small metanotal groove differentiating the propodeum. One of the latter occurs in mangroves and other riparian vegetation in the Top End. A biconvex species has also been recorded from mangroves in the Darwin Harbour. Another biconvex species has a rather aberrant distribution, known only from savanna in the Katherine region of the Top End.

Species of the *reticulatus* group have a characteristically concave, and sometimes highly elaborate, propodeum, and are extremely diverse in the Old World tropics. There are only a small number of Australian species, with one (Fig. 31*b*) being relatively common in Top End rainforests, and also occurring in the Kimberley. Its colour is highly variable, ranging from orange with contrasting black gaster (the most common form), to uniformly dark brown. Species of the *macrocephalus* group have a highly simplified, rectangular trunk, with Australian representatives occurring primarily on the eastern seaboard. One species has been recorded from a rainforest patch near Darwin. Finally, a species with unclear affinities (Group B in key below) is common in mangroves of the Darwin region, apparently nesting exclusively in twigs of *Sonneratia alba*. Unlike species from other phragmotic groups of *Camponotus*, the entire clypeal region is flattened in major workers. This is used to plug the nest entrance when it is inundated during high tides.

All other groups of Australian *Camponotus*, representing the vast majority of species, nest in the ground and occur primarily in open habitats. They are often among the largest and most conspicuous ants. The most abundant is the *novaehollandiae* group (Fig. 31*c*, Plate 16), which is part of the extremely diverse *maculatus* complex that occurs throughout the Old World tropics. The *novaehollandiae* group is closely allied to the very familiar 'sugar ants' (*consobrinus* group; McArthur & Adams 1996) of southern Australia. In the former, the clypeus projects as a broad, rectangular lobe, with a straight to weakly concave anterior margin, whereas in the latter this anterior margin is deeply incised. Species of both groups are primarily nocturnal, and are often the most conspicuous ants at night. One species of the *novaehollandiae* group is the uniformly dark *C. fieldeae*, which is common throughout the south of the monsoonal region. It is finely but densely sculptured, with a rather dull appearance. Another dark (but shinier) species (that in Plate 16) is extremely abundant in north Queensland, the Top End and the Kimberley, where it often co-occurs with a larger, uniformly yellowish species. Its distribution also overlaps that of a common bicoloured species (trunk yellowish brown, contrasting with dark brown head and gaster), which extends into drier regions. The group also includes several rainforest species, which tend to be smaller (minor workers 4–5 mm) and uniformly yellowish.

Camponotus confusus is a large (minor workers 9 mm), variegated (yellowish to dark brown) species that appears related to the *novaehollandiae* group. The occipital corners of major workers project backwards as angular lobes. It is a New Guinean species, occurring in north Queensland and the northern Top End.

Several monsoonal groups belong to a major radiation of Australian *Camponotus* in which major workers have a projecting clypeus with a notched anterior margin, producing a lateral pair of angular or rounded lobes. One of these is the arid-adapted *ephippium* group (Fig. 31*d*), in which minor workers have a characteristically concave trunk in profile. The heads of major workers are somewhat flattened and coarsely

pitted anteriorly, rather like that in some of the arboreal groups described above, and are used to plug the nest entrance in the ground. The most common monsoonal species is *C. dromas*. It has a bluish-black trunk with red legs and golden gaster, and occurs from north Queensland to the northern Kimberley. The closely related *pellax* group (Fig. 31*e*) consists of numerous smaller (minor workers about 5 mm), more robust species that occur almost exclusively in the monsoonal region. The species are either reddish with black gaster (as in *C. pellax* itself) or uniformly black except for silver or golden pubescence on the gaster.

The diverse *nigroaeneus* group is apparently related to the *ephippium* group, but major workers do not have modified heads. The species occur primarily in central and to a lesser extent southern Australia, with only a few, uniformly black species known from the monsoonal region. One of these is the widespread *C. aeneopilosus*, which has a strikingly golden gaster, and occurs from northern Victoria to north Queensland. A species without gastric pubescence is common on clay soils in the Barkly and Victoria River regions of the Northern Territory.

The widespread *claripes* and *rubiginosus* groups also belong to this radiation. In the latter group, minor workers have a compressed trunk that is densely clothed with long, silvery hairs (Fig. 31*g*). They have a highly distinctive coconut odour when crushed. The minor workers of all known monsoonal species of the *claripes* group have similarly compressed trunk morphology, but without the hairs (Fig. 31*f*). This makes them virtually indistinguishable from minor workers of the *discors* group (Fig. 31*h*). However, in the latter, major workers have a simple clypeal margin, and the two groups are apparently not closely related. Species of the *discors* group are always yellowish, whereas some members of the *claripes* group are bicoloured, with black body contrasting with yellow legs. The heads of minor workers are also longer in the *claripes* group, and generally have a projecting clypeal margin.

The *subnitidus* group includes some of the largest of all Australian species of *Camponotus*, with minor workers up to 10 mm. They have exceptionally long antennae, and a peculiar head shape, with sides of the head in front view diverging anteriorly such that the head is broadest at the mandibular insertions (Fig. 31*j*). The soldiers have very large, heavily pitted heads. This group appears unrelated to any other *Camponotus* from the monsoonal region, but similar species are widely distributed elsewhere in the Old World tropics. In several monsoonal species the petiolar node is long and low, with a nipple-like dorsal projection. A uniformly dark brown species occurs in central Queensland, the Top End and the northern Kimberley. There are several other dark brown or blackish species, as well as yellowish species with contrasting dark head and gaster.

The final two monsoonal groups belong to a separate radiation of Australian *Camponotus*, comprising fast-moving, often brightly coloured diurnal species that are distributed throughout arid Australia. The radiation includes the *ceriseipes*,

aurocinctus and *terebrans* groups of the southern arid zone, and in central and northern Australia is represented primarily by the *denticulatus* group (Fig. 31*i*). This group occurs throughout the monsoonal zone, where the species are typically reddish brown with a black gaster, and in the field closely resemble the northern meat ant *Iridomyrmex sanguineus* (p. 62). Interestingly, species in the central arid zone are blackish, resembling the blackish Centralian meat ant *I. viridiaeneus*. It is therefore possible that species of the *denticulatus* group are meat ant mimics, aiming to reduce aggressive interactions with either meat ants or other ant species. The other group (Group A, apparently most closely related to the *aurocinctus* group) in this radiation consists of a small number of uncommon blackspecies with saddle-shaped trunks, all undescribed and known only from northwestern Australia.

Key to species-groups (minor workers, unless otherwise specified)

1. Arboreal species, generally occurring in rainforest, mangroves or other closed vegetation; total length 3–4 mm; in major workers, anterior portion of head flattened in plane of mandibles, in order to 'plug' nest entrances in branches and twigs **2**

   Ground-nesting species, occurring primarily in open habitats; total length usually (but not always) >4 mm **6**

2. Trunk very hairy (pronotum with >5 erect hairs) **3**

   Trunk not very hairy (pronotum with <5 erect hairs) **4**

3. Antennal scapes with numerous erect hairs (Fig. 31*a*) ..... ***vitreus* group**

   Antennal scapes glabrous ..... ***janeti* group**

4. Eyes exceptionally large, occupying nearly half total length of head; scapes barely surpassing occipital border ..... **group B**

   Not as above **5**

5. Profile of trunk rather straight and virtually uninterrupted; dorsal face of propodeum flat or feebly convex ..... ***macrocephalus* group**

   Profile of trunk not as above; dorsal face of propodeum concave (Fig. 31*b*) ..... ***reticulatus* group**

6. Gaster covered with white or yellow adpressed pubescence, giving it a silvery or golden appearance **7**

   Gaster not covered with such pubescence **11**

7. Underside of head with a cluster of several long, J-shaped setae projecting behind mandibles **8**

   Underside of head without such setae **9**

8. Trunk saddle-shaped, with propodeum markedly lower than pro-mesonotum in profile ..... **group A**

   Trunk not saddle-shaped (Fig. 31*i*) ..... ***denticulatus* group**

9. Head of major workers with clypeal region flattened and coarsely sculptured, and occipital border convex with lateral lobes **10**

   Not as above ..... ***nigroaeneus* group (part)**

10. Total length of minor worker ≥6 mm; occipital margin almost straight, forming blunt right-angles with sides of head (Fig. 31*d*) ..... ***ephippium* group**

    Total length of minor worker ≤5 mm; occipital margin strongly convex (Fig. 31*e*) ..... ***pellax* group**

11. Trunk compressed longitudinally; propodeum with high posterior face that rounds very broadly into dorsal face; body size relatively small (minors generally ≤5 mm) **12**

    Trunk elongate, with posterior face of propodeum <1/2 length of dorsal face; body size often larger (minors 5–12 mm) **14**

12. Trunk with dense (>20) long, often forward-projecting hairs (Fig. 31*g*) .. ***rubiginosus* group**

    Trunk with sparse (<10), erect hairs **13**

13. In major worker, anterior margin of clypeus projecting and deeply concave medially; trunk sometimes black, contrasting with pale yellow legs (Fig. 31*f*) ..... ***claripes* group**

    In major worker, anterior margin of clypeus straight or feebly convex throughout its length; colour entirely yellowish, sometimes with darker blotches on the trunk (Fig. 31*h*) ..... ***discors* group**

14. Head broadly triangular (widest anteriorly); scapes exceptionally long, exceeding occipital border by at least three-quarters their length (Fig. 31*j*) ..... ***subnitidus* group**

    Not as above **15**

15. Antennal scapes glabrous, exceeding occipital border by only about half their length; clypeal margin of major workers with a central notch ..... ***nigroaeneus* group (part)**

    Not as above **16**

16. Very large species (minor worker >8 mm); scapes with numerous erect hairs of length equal to maximum diameter of scape; erect hairs on propodeum numerous (>20) and covering entire dorsal surface ..... ***confusus***

    Smaller species; scapes with semi-adpressed hairs only (Plate 16, Fig. 31*c*) ..... ***novaehollandiae* group**

Melophorus (Plate 17)

Melophorus is an extremely rich genus endemic to Australia, and occurs primarily in the arid zone. All species are polymorphic and exhibit thermophilic behaviour, foraging only during hot weather. Analogous thermophilic formicine genera, such as *Cataglyphis* in northern Africa and *Myrmecocystus* in North America, are characteristic of deserts elsewhere in the world, but the heat tolerance of *Melophorus* can be exceptional even for thermophilic taxa (Christian & Morton 1992).

Most species of *Melophorus* are generalist predators and scavengers. The most prominent exceptions are the specialist granivores of the *wheeleri* group. Some other formicines include seeds in their omnivorous diets (Andersen 1991*b*), but members of the *wheeleri* group appear to be the only formicines anywhere in the world that are specialist seed harvesters. They are restricted to arid areas, and are therefore absent from higher rainfall zones of the monsoonal zone. Smaller workers look very similar to 'mainstream' species of the *fieldi* group (p. 79), but have shorter maxillary palps. Major workers are more distinctive, with very large heads that are considerably broader than long in front view, often with a straight or concave anterior clypeal margin. They bear a morphological resemblance to major workers of the granivorous myrmicine genus *Messor* of the northern hemisphere. Most species are reddish brown with few hairs, but a black, heavily sculptured and hirsute species occurs in the southern Victoria River District.

Another noteworthy exception to the typical *Melophorus* habit is seen in a radiation centred on the *fulvihirtus* group of the southern arid zone, whose species are specialist brood raiders of other ants (Clark 1941). The *fulvihirtus* group in its strict sense does not appear to occur in the monsoonal zone, but several apparently related groups do. Three of these appear to be endemic to the monsoonal zone. One is the *anderseni* group, with *M. anderseni* itself occurring in the northern Top End, where it has been observed nesting immediately adjacent to nests of *Iridomyrmex sanguineus* (p. 62), and hitching a ride on the back of returning foragers as they enter the nest (Agosti 1997)! Very similar species have been recorded in central Queensland and the Victoria River District of the Northern Territory. Another of the three groups is Group G, with one species known from central and northwestern Queensland, and a similar species from northwestern Western Australia. The third is Group H, known as a single species from the northern Top End where it appears to be associated with a similarly sized and coloured species of the *rothsteini* group of *Monomorium*.

The specialist termite-eating species of the *potteri* group (McAreavey 1947) possibly also belong to this radiation. They occur primarily in the southern arid zone, but extend into central Queensland. They are extremely stocky ants for *Melophorus*, and some of the more specialised species have extraordinarily massive mandibles, giving them the appearance of miniature bull-dozers.

The highly diverse but usually distinctive *bruneus* group has unclear relationships with other groups. Some species resemble species of the *fulvihirtus* group, sharing the fine but dense sculpturation (giving them a dull appearance) and short, stout setae. Several of these are two-toned, with paler patches on the trunk, and the head paler anteriorly. However, such species are often very common and widespread, whereas most, if not all, species of the other groups in the *fulvihirtus* radiation are uncommon and typically have localised distributions. Other species of the *bruneus* group are only

very feebly sculptured and have few if any hairs, giving them the appearance of species of the *fieldi* group (p. 79).

Another major radiation of *Melophorus* comprises very long-legged, predominantly glabrous species with dome-shaped heads and a strongly projecting clypeus. Several groups can be recognised. Species of the *aeneovirens* group are large reddish ants that occur predominantly in the northern arid zone, and in the field can easily be mistaken for *Iridomyrmex sanguineus* (p.62). Most species are very finely sculptured or smooth and shiny, and largest workers often have deeply concave heads. A rather unusual, highly sculptured and hirsute species occurs in the Arnhem escarpment region of the Top End. Group A is closely related to the *aeneovirens* group, but the species are substantially smaller. They likewise occur predominantly in the northern arid zone, with very many species occurring in the south of the monsoonal region. Another closely related group (Group B), with relatively short and broad antennal segments, appears to be restricted to the northeastern arid zone. The *froggatti* group also belongs to this radiation. It is one of the most widely distributed of all groups of *Melophorus*, occurring in open habitats throughout most of mainland Australia, including temperate areas. In one species from the Gulf region, the profile of the trunk is a uniformly rounded curve, without any differentiation between trunk segments.

The largest species of *Melophorus* belong to the *bagoti* group, with worker size ranging from 6–10 mm. They are elongate, uniformly bright tan ants, with the general morphology of species of the *aeneovirens* group. *Melophorus bagoti* itself occurs throughout the northern arid zone across the southern fringe of the monsoonal region, and extending into the eastern Kimberley and Victoria River regions. A southern Kimberley form has a black gaster, and might represent a separate species. The *bagoti* group appears to be related to the *iridescens* group of the southern arid zone, and, despite its general resemblance to species of the *aeneovirens* groups, does not have a projecting clypeus, so that it is not clear if the two groups are closely related.

The exceptionally rich *mjobergi* group includes the smallest of all *Melophorus*, with species resembling plagiolepidine ants such as *Stigmacros* (but without propodeal teeth). They occur throughout the arid zone. Some have strongly convex trunks in profile, resembling the sub-genus *Stigmacros*, whereas others have rather flat trunks, resembling the sub-genus *Campostigmacros*. Some of the latter have markedly flattened heads.

Group C consists of gracile, silvery species with short setae, which occur throughout the arid zone. Yellowish species occur throughout the eastern semi-arid zone, from South Australia to central Queensland. A smaller, darker species occurs from the Gulf region to the Victoria River District, and is replaced by a very similar species in the Top End.

Group D consists of numerous, often hairy species with a short propodeum and very narrow, plate-like petiolar node. The head is somewhat compressed dorso-ventrally, with the occiput being rather angular in profile, and the legs are often relatively short and stout. The group is possibly allied to the highly distinctive, barrel-trunked *hirsutus* group of the eastern seaboard.

Species of the *pillipes* group can be easily recognised by the long hairs on their tibiae. They occur throughout the arid zone, but appear to be particularly abundant and diverse in central Queensland. The only other species of *Melophorus* with comparably hairy tibiae belong to apparently unrelated Group E. Species in this group are unusual for *Melophorus* in that the head and trunk are conspicuously, sometimes very coarsely, sculptured. All known species are extremely hairy, and often have broad, bulbous petiolar nodes. They occur predominantly in the monsoonal region, and their relationships with other groups are unclear.

The *perthensis* group consists of a relatively small number of reddish-brown, biconvex species that occur primarily in the southern (especially southwestern) arid zone. One species is known from central Queensland to the Top End. Group F contains rather stocky, large-eyed, smooth and shiny species with relatively short antennal scapes. They are particularly rich in the southeastern monsoonal zone, from the Gulf region to central Queensland. Several species have a bulging clypeus and short maxillary palps, suggesting a relationship with the granivorous *wheeleri* group (p. 77).

Finally, the more gracile but otherwise morphologically similar (but possibly not closely related) *fieldi* group (Plate 17) is extremely rich in species, and occurs at most sites in arid Australia, where its representatives are very often the most abundant species of *Melophorus*. It is possibly a composite group. In its strictest sense, it comprises species in which minor workers are glabrous or nearly so, with no hairs whatsoever on their antennal scapes, although major workers are generally hairy. There are many yellowish species that fall into this category. In other, very similar, species the trunk of minor workers is glabrous, but antennal scapes have a series of sparse hairs on one face. In still other similar species, minor workers are hairy.

Key to major species groups (minor workers unless otherwise indicated)

1. Clypeus strongly projecting over base of mandibles, with anterior margin acutely angled in profile **2**

   Clypeus not as above, if projecting then not acutely angled in profile **7**

2. Legs extremely stout, with femora only about three times as long as their maximum widths; scapes often not reaching occipital border, exceeding it by at most their maximum width ..... ***potteri* group (part)**

   Not as above **3**

3. Head of minor workers squarish in front view, with flat occipital margin; colour uniformly yellowish brown ..... ***anderseni* group**

Head of minor workers dome-shaped, with strongly convex occipital margin; colour uniformly dark brown, or with reddish foreparts *contrasting* with black gaster **4**

4. Trunk longitudinally compressed, with a truncate propodeum that has a very short dorsal face ..... ***froggatti* group**

Trunk elongate and saddle-shaped, with propodeum of normal length **5**

5. Total length of minor worker >4 mm; head and trunk red, contrasting with black gaster ..... ***aeneovirens* group**

Total length of minor worker <4 mm; colour usually dark brown, sometimes reddish..... **6**

6. Second funicular segment greater than twice as long as wide ..... **Group A**

Second funicular segment slightly less than twice as long as wide ..... **Group B**

7. Total length of minor worker >5 mm; head and trunk uniformly bright tan..... ***bagoti* group**

Not as above **8**

8. Gaster and usually also trunk with adpressed pubescence, giving it a silvery appearance; trunk with sparse, short setae; scapes exceeding occipital border by greater than half their length; propodeum often only feebly differentiated from rest of trunk..... **Group C**

Not as above **9**

9. Very small species, total length 1.5 (minor workers)–3 (major workers) mm; trunk of minor workers usually glabrous ..... ***mjobergi* group**

Not as above **10**

10. Maxillary palps relatively short, less than head length; anterior clypeal margin in largest major workers at most feebly convex, usually straight or concave; major workers with very broad heads; granivorous species ..... ***wheeleri* group**

Not as above **11**

11. Tibiae clothed with fine, erect hairs that are longer than maximum tibial diameter..... **12**

Not as above **13**

12. Head and trunk conspicuously sculptured and dull throughout ..... **Group E**

Head and trunk smooth and shiny ..... ***pillipes* group**

13. Petiolar node flat and plate-like, even in minor workers; propodeum short and often angular, with dorsal face markedly shorter than posterior face ..... **Group D**

Not as above **14**

14. Profile of trunk strongly biconvex, with short (less than a third the length of pro-mesonotum) and low, prominently rounded, propodeum; petiolar node broad, nearly half as long as high in profile ..... ***perthensis* group**

Not as above **15**

15. Propodeum and mesonotum finely but densely sculptured, giving them a dull appearance; hairs, when present, often short and stout **16**

    Propodeum and mesonotum predominantly smooth and shiny; hairs, when present, usually fine and long **19**

16. Head smooth and shiny; scapes often failing to reach occipital border, exceeding it by at most their maximum width; femora only about three times as long as maximum width; ant entirely glabrous ..... ***potteri* group (part)**

    Not as above **17**

17. Scapes relatively short, exceeding occipital border by a third or less of their length; clypeus prominently bulging, with a distinct anterior face at right-angles to the plane of the mandibles **18**

    Scapes longer, exceeding occipital border by about half their length; clypeus usually not prominently bulging ..... ***bruneus* group**

18. Body glabrous (minor workers only); colour uniformly yellow-brown ..... **Group G**

    Body covered with stout, relatively short hairs; head and trunk red, contrasting with black gaster ..... **Group H**

19. Scapes relatively short, in minor workers exceeding occipital border by about one-third their length, and just reaching the occipital border in major workers; eyes large, usually occupying more than one-third the length of the head ..... **Group F**

    Scapes long, in minor workers almost always exceeding occipital border by half their length, and exceeding it by at least their width in major workers; eyes usually not so large ..... ***fieldi* group**

Notoncus

This highly distinctive genus is endemic to Australia except for a single species in New Guinea. Most species occur in southern Australia (Andersen 1991*a*), but representatives of three groups extend into the sub-humid fringe of eastern central Queensland. All three groups have complex trunk morphology, with prominent metanotal projections that are rounded in two groups (*enormis* and *giberti* groups) and Y-shaped in the other (*ectatommoides* group). Species of the *gilberti* group are predominantly smooth and shiny, whereas those of the *enormis* group are heavily sculptured and dull. The metanotal projection is only feebly produced in one central Queensland species from the *enormis* group.

Oecophylla (Plate 18)

This genus consists of just two species, *O. longinoda* from Africa and *O. smaragdina* from eastern and southern Asia. They are called weaver ants due to the 'sewing' (more accurately, gluing) of leaves together with larval silk to form their arboreal nests.

Oecophylla smaragdina extends into northern Australia, occurring throughout the higher rainfall zone of the monsoonal region (Lokkers 1986), where it is one of the most familiar of all insects. It is known locally as the green tree ant due to its arboreal habit and uniquely green gaster (and often also head). Such green coloration is confined to Australian populations, and throughout Asia it is uniformly yellowish to reddish brown. Its leafy nests are a conspicuous feature of rainforest, mangroves, riparian vegetation and other denser vegetation types, including orchards and suburban gardens. It is a very aggressive ant: workers stream out of their nest at the slightest provocation to bite *en masse* any would-be intruder, adding a painful dimension to tropical gardening! Chinese horticulturalists have traditionally exploited *O. smaragdina* to control insect pests, and there is currently research into their potential use as bio-control agents in northern Australian horticulture (Peng *et al.* 1995).

A single colony occupies several to very many nests, distributed over one to several trees. Interestingly, colonies are always founded by several (up to 20 or more) queens (Peeters & Andersen 1989), and, although more than one queen may be present (Peng *et al.* 1998), mature colonies appear to be usually controlled by a single queen. It is unclear how the queen that ultimately prevails eliminates her rivals.

Opisthopsis *(Plate 19)*

This is an extremely distinctive and morphologically uniform genus centred on northern Australia, with additional occurrences elsewhere in the New Guinea region (Wheeler 1918). All species have a rather flat, grasshopper-like 'face', with enormous eyes. The ants are very timid, with a distinctively 'jerky' motion, leading to a range of common names such as 'electric', 'robot' and 'strobe' ant. All monsoonal species occur in savanna, whereas at least two species in northeastern Queensland are restricted to rainforest. With one exception, the morphology of all monsoonal species is extremely similar to *O. haddoni* shown in Plate 19. The exception is *O. major*, which has a more sloping trunk in profile and a cluster of about 10 hairs on its pronotum. It occurs in denser savanna in higher rainfall areas across the whole monsoonal zone.

The remaining species are distinguished primarily by colour. Species of the *haddoni* group have a uniformly orange head. The group includes two extremely common and widely distributed species: *O. rufoniger*, with a uniformly black gaster, occurring in the central arid zone; and *O. haddoni* itself, with the first gastric segment mostly orange, occurring throughout the monsoonal region. In the Top End and the northern Kimberley, *O. haddoni* frequently co-occurs with a species with a uniformly black gaster. It is not clear if this is *O. rufoniger* or an undescribed species. In sandstone country of the Top End's Arnhem escarpment, *O. haddoni* is replaced by an undescribed species with a uniformly orange gaster. Another undescribed species (sp. A in key below) with similar coloration to *O. haddoni* is known only from far northern

Top End, including Melville Island. It is the largest (total length 6 mm) Australian species of *Opisthopsis*, with an extremely broad head, and a propodeum with a peculiarly crenulate dorsal face.

All other Australian species of *Opisthopsis* appear to be restricted to Queensland, except for *O. rufithorax*, which extends southward to range throughout the southern arid zone. One of the most distinctive of these Queensland species is *O. pictus*, which has a uniformly black head and bicolored trunk. Finally, the *diadematus* group includes up to ten species with a bicoloured head, that are distributed throughout central and north Queensland.

Key to species and species-groups

1. Head entirely orange 2
   Head with black occiput, or entirely black 4
2. Pronotum with a cluster of about 10 long hairs ..... ***major***
   Pronotum glabrous 3
3. Large (5–6 mm), broad-headed species; sides of head in front view markedly convex; dorsal profile of propodeum crenulate ..... **sp. A**
   Not as above ..... ***haddoni* group**
4. Head entirely black 5
   Head bicoloured, with black occiput only ..... ***diadematus* group**
5. Trunk entirely orange ..... ***rufithorax***
   Trunk bicoloured black and orange ..... ***pictus***

Paratrechina (Fig. 32, Plate 20)

This is a cosmopolitan genus with distinctive, paired setae on the trunk. Three Australian species-groups can be recognised, as well as the introduced *P. longicornis*, all of which occur in the monsoonal zone. The most widespread is the *obscura* group, which comprises larger, blackish species in which the trunk has numerous smaller setae

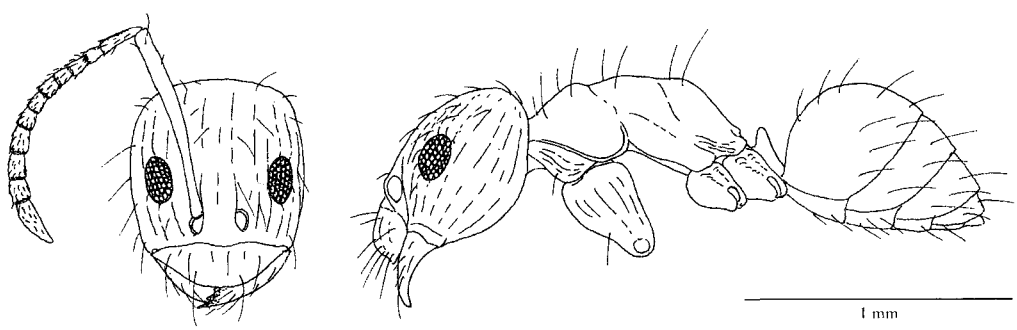


Fig. 32 ***Paratrechina* sp. (*minutula* group)**

interspersed with the longer paired setae. The group is common at sites of low ant diversity, including riparian zones, seasonally waterlogged areas, and anthropogenic habitats, throughout Australia. There appears to be a single monsoonal species, occurring throughout the region. It is commonly associated with billabongs and other waterways, sometimes nesting and foraging on aquatic vegetation.

The *vaga* group (Plate 20) is primarily tropical, and occurs throughout the Indo-Malayan region. One variably sized species (?*O. vaga* itself) is abundant in a wide range of habitats throughout the monsoonal region. It is honey-brown in colour, and in rainforest, riparian vegetation and denser savanna it is replaced by what appears to be a darker sibling species. A relatively small, pale species occurs in and around the Arnhem escarpment of the Top End, and a small-eyed species is known from the northern Kimberley. The *minutula* group is distributed throughout Australia, with about a dozen species occurring in the monsoonal region. Two of these are particularly common and widespread, one in savanna and the other (brighter yellow in colour, and with smaller eyes) in rainforest and other shady habitats.

The elongate, dark brown 'crazy ant', *P. longicornis*, occurs in association with human settlement throughout the monsoonal region, where it is one of the most common of the tramp species. It lives in temporary nests inside, behind or underneath any form of shelter. Its common name is derived from the apparent chaos that reigns when nests are disturbed, with workers dashing madly around with brood in their mandibles, looking for a place to hide.

Key to species-groups

1. Antennal scapes exceeding occipital margin by two-thirds their total length ..... ***longicornis***
   Antennal scapes exceeding occipital margin by half or less their total length **2**
2. Trunk with 3–5 pairs of long setae only, all of approximately equal length **3**
   Trunk with numerous short setae interspersed among pairs of long setae .. ***obscura* group**
3. Total length ≤1.5 mm; propodeum feebly if at all differentiated from rest of trunk (Fig. 32) ..... ***minutula* group**
   Total length ≥2 mm; propodeum clearly differentiated from rest of trunk (Plate 20) ..... ***vaga* group**

Plagiolepis

This genus occurs primarily in the Old World tropics, and is distributed throughout eastern and southern Australia. It has the general appearance of *Acropyga* (Fig. 30), but with large eyes. A few rarely collected species are known from the monsoonal region, primarily from Queensland.

Polyrhachis (Figs 33–38, Plate 21)

Polyrhachis is one of the world's largest ant genera, with nearly 500 described species (Bolton 1995*a*; Dorow 1995). However, unlike other very large genera such as *Camponotus* and *Pheidole*, it has a rather restricted distribution, occurring predominantly in the Old World tropics, and being absent altogether from the New World. Morphological diversity is extraordinary within *Polyrhachis*, with many groups having spectacularly elaborate spines and other processes. The genus also has extremely diverse nesting habits, and includes numerous arboreal as well as terrestrial groups, with nests often incorporating larval silk (Hung 1967). The genus is exceptionally rich in Australia, and is diverse in the cool-temperate and arid zones as well as the tropics. Over a hundred Australian species are currently named, but this represents less than half of the species currently known in collections. The genus can be usefully divided into reasonably well-defined sub-genera (Hung 1967; Dorow 1995), and these are treated separately below.

Key to sub-genera

1. Dorsum of trunk flattened and separated from lateral faces by conspicuous carinae, at least on the pronotum **2**

   Dorsum of trunk broadly rounded, without any lateral carinae **8**

2. Pronotal shoulders acutely angled, usually projecting forward as teeth or spines **3**

   Pronotal shoulders at most obtusely angled, usually rounded, never with teeth or spines **6**

3. Propodeum unarmed or with short, upward-curving teeth; petiole with a central pair of erect spines, each flanked by a lateral tooth (north Queensland only) ..... ***Myrma* (p. 94)**

   Propodeum armed with long, backward-projecting spines; petiole with a lateral pair of backward-projecting spines that curve to embrace the base of the gaster **4**

4. Petiolar spines at most as long as width of node in profile (Queensland only) ..... ***Myrmhopla* (*viehmeyeri* group) (p. 95)**

   Petiolar spines at least one-and-a-half times as long as width of node in profile **5**

5. Petiolar node with a broad, usually flattened dorsal face; trunk usually elongate, in dorsal view often about twice as long as maximum pronotal width; arboreal species (Fig. 37) ..... ***Hedomyrma* (p. 93)**

   Petiolar node with a narrowly rounded or ridge-like dorsum; trunk usually short and stout, in dorsal view only about one-and-a-half times as long as maximum pronotal width (*P. sokolova* (Fig. 35*a*) from mangroves is an exception); terrestrial species (Fig. 35, Plate 21) ..... ***Chariomyrma* (p. 89)**

6. Propodeum with long, backward-projecting spines; petiolar node armed only with a lateral pair of backward-projecting spines, which curve to embrace the base of the gaster (Fig. 36) ..... ***Hagiomyrma* (p. 92)**

Propodeum with erect teeth or small spines (sometimes very feebly produced); if with backward-projecting spines, then petiole with a central as well as lateral pair of spines, neither of which curve to embrace the gaster 7

7. Petiole with an unpaired central spine projecting backwards at a 45° angle, and flanked by a pair of erect lateral spines; arboreal rainforest species ..... ***Myrmothrinax* (p. 95)**

Petiole never with an unpaired central spine, except in *P. pseudothrinax* where the spine is erect and flanked by a pair of blunt teeth (Fig. 34*c*); terrestrial species (Figs 33, 34) ..... ***Campomyrma* (p. 86)**

8. Trunk shiny black and strongly dome-shaped in profile; petiolar node with four erect teeth or short spines ..... ***Cyrtomyrma* (p. 91)**

Trunk not as above; petiolar node with a single lateral pair of backward-projecting spines that embrace the base of the gaster (Fig. 38)..... ***Myrmhopla* (part; p. 95)**

Polyrhachis *sub-genus* ***Campomyrma*** *(Figs 33, 34)*

This is a primarily Australian sub-genus of terrestrial species with reduced armature of the trunk and petiole. The pronotal shoulders are broadly rounded, never with teeth or spines, and propodeal armature is often reduced to small teeth. The petiole typically has both a central and lateral pair of teeth or short spines, although there are several modifications to this theme. In many species the trunk is entirely glabrous, unlike most species from other sub-genera. *Campomyrma* occurs throughout the continent (all other sub-genera have strongly tropical distributions), and its species are the only representatives of *Polyrhachis* throughout most of central and southern Australia.

Almost all monsoonal species belong to groups in which the propodeal spines are reduced to small, erect, curved teeth. The one exception is a rare, undescribed species with a strongly flanged gaster (Group A in the key below) that is known only from the northern Kimberley. The most common *Campomyrma* species throughout the monsoonal zone are members of the *inconspicua* group, which are among the smallest representatives of the sub-genus. *Polyrhachis inconspicua* itself (Figs 33, 34*e*) is the most widespread of these, occurring throughout the region. There are several extremely similar species. One of these is the more heavily sculptured *P. io*, an uncommon species distributed from the Top End to the Kimberley. Another is the New

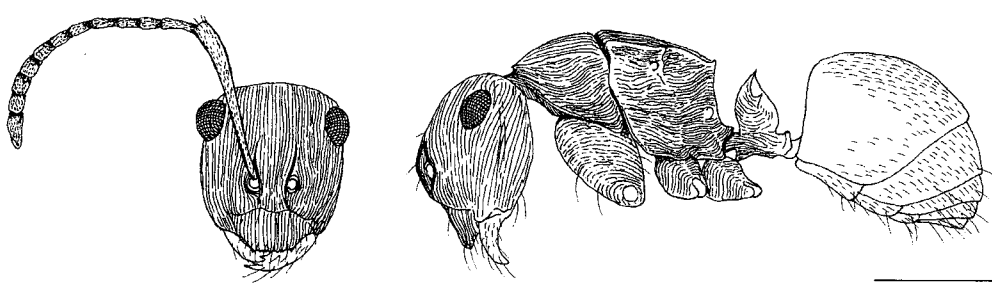


Fig. 33 ***Polyrhachis inconspicua***

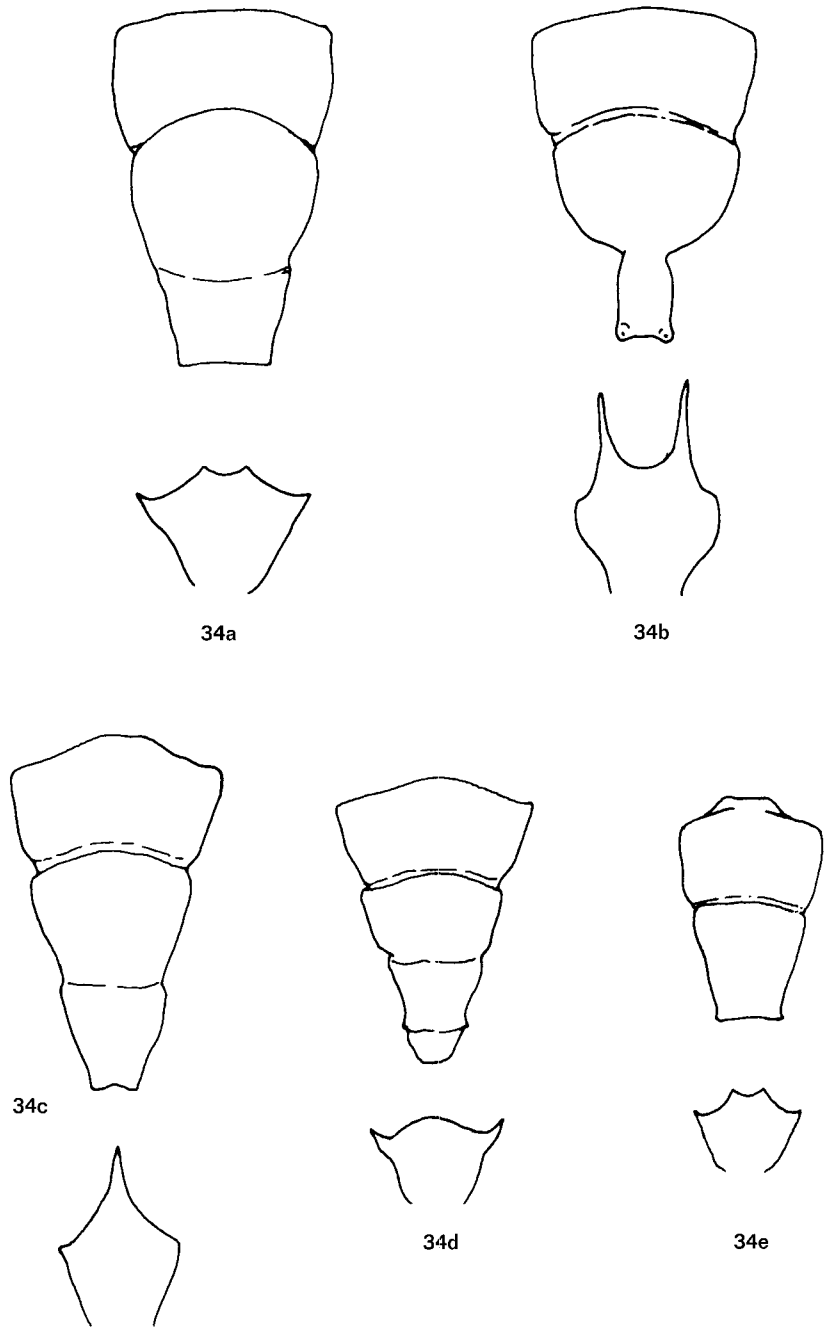


Fig. 34 ***Polyrhachis* (*Campomyrma*) spp., dorsal views of trunks and front views of petiolar nodes** (a) ***schwiedlandi* group** (b) ***prometheus*** (c) ***pseudothrinax*** (d) ***creusa*** (e) ***inconspicua***

Guinean species *P. insularis*, that occurs in north Queensland (Taylor 1989), and others occur in central Queensland and in the northern Kimberley. One rare species from the Kimberley has a prominent dorsal ridge on its propodeum.

The extremely rich *schwiedlandi* group (Fig. 34*a*) appears to be closely related to the *inconspicua* group, but is distributed primarily in the arid zone. It includes a sub-group of large, bulky species with a highly distinctive, curled petiolar node, with strongly curved carinae running between the central and lateral teeth. The *creusa* group (Fig. 34*d*), consisting of one or two species restricted to higher rainfall areas of the monsoonal region, could possibly be considered another sub-group of the *schwiedlandi* group. *Polyrhachis creusa* itself is a New Guinea species occurring also in north Queensland. A very similar, possibly same, species is common in the Top End (where it is often associated with riparian vegetation), and less so in the northern Kimberley.

Species of the *micans* group are easily recognised by their *Myrma*-like petiole, with a central pair of long, sharp spines. *Polyrhachis micans* itself is common in north Queensland, but the most widespread species is *P. prometheus*, which occurs throughout the lower rainfall zone of the region, from central Queensland through the Gulf country to the southern Kimberley. It has a distinctive propodeum that is strongly narrowed dorsally, such that in dorsal view the propodeum is only about a third as wide as the mesonotum (Fig. 34*b*). A very similar species, but with even narrower propodeum and longer petiolar spines, is known from Groote Eylandt and Melville Island off the Top End coast. Despite the highly distinctive petiolar spines, the *micans* group appears also to be closely related to the *schwiedlandi* group.

The *gravis* group includes some of the most spectacular-looking of all *Campomyrma*, and is probably also part of the above radiation of the *schwiedlandi* and allied groups. The species are hairy and conspicuously striate (although often rather shiny), often with contrasting reddish legs. They typically have a scale-like petiolar node, with four erect, approximately equal teeth or small spines. Such species are widely distributed in the arid zone, and include *P. gravis* itself. Two striking exceptions are known from the monsoonal region. One is *P. pseudothrinax*, which has a *Myrmothrinax*-like petiole with a long, unpaired central spine (Fig. 34*c*). It occurs from northern central Queensland to the Kimberley. The other is an undescribed species known from central Queensland to the northern Victoria River District. It has a very broad petiole in profile, with the central spines being markedly longer than the lateral teeth.

Key to species-groups

1. Propodeum with long, broadly based, backward-projecting spines; gaster with very conspicuous basal flanges ..... **Group A**

   Propodeum with small, curved, erect teeth, that are sometimes very feebly produced; gaster without conspicuous basal flanges **2**

2. Trunk and antennal scapes with numerous short, erect hairs ..... ***gravis* group**

   Trunk and antennal scapes glabrous **3**

3. Petiolar node with a central pair of long, sharp spines, with or without a lateral pair of small teeth ..... ***micans* group**

   Petiolar node not as above **4**

4. Smaller species, total length ≤5 mm ..... ***inconspicua* group**

   Larger species, total length >5 mm **5**

5. Lateral teeth of petiolar node developed into semi-erect spines that reach the highest level of the node; dorsum of both mesonotum and propodeum sinuate in profile ..... ***creusa* group**

   Lateral teeth of petiolar node feebly developed (sometimes absent), nowhere near reaching the highest level of the node; dorsum of mesonotum and propodeum forming a simple curve in profile ..... ***schwiedlandi* group**

Polyrhachis *sub-genus* ***Chariomyrma*** *(Fig. 35, Plate 21)*

Chariomyrma is a ground-nesting, predominantly savanna sub-genus occurring primarily in New Guinea and northern Australia, and is the richest sub-genus in the monsoonal region. It includes the mangrove specialists of the *sokolova* group, which remarkably nest in intertidal mud (Kohout 1988*a*; Nielsen 1997). The group consists of two species, the very large and elongate *P. sokolova* (Fig. 35*a*), which occurs throughout the monsoonal coast, and *P. constricta*, which appears to be restricted to the Top End.

The *hookeri* group consists of red-legged species with relatively small and straight propodeal spines. *Polyrhachis hookeri* itself is a metallic green, blue or purple species that occurs from north Queensland to central New South Wales (Kohout & Taylor 1990). There are other very similar species in north Queensland, including *P. lownei* and *P. obscura* (Kohout & Taylor 1990). *Polyrhachis urania* is a small member of the group that is covered with golden adpressed pubescence, and occurs both in north Queensland and the Top End.

The very rich *appendiculata* group is easily recognised by the lateral processes on the anterior half of the propodeum (Fig. 35*d*), and is distributed throughout the monsoonal region. Many species are relatively small (total length <4 mm), but several large (about 6 mm) species with short, broad petiolar spines occur in the western monsoonal region, usually in rocky habitats.

The *obtusa* group comprises species in which the pronotal shoulders are acutely angled or broadly toothed, rather than produced into narrow spines. One species (Fig. 35*c*) with acutely angled rather than toothed pronotal shoulders is very common in north Queensland and the Top End, where it typically occurs in riparian habitats. *Polyrhachis lata* and *P. vermiculosa* are two Queensland species with short pronotal teeth. The former has rather stout propodeal spines and a densely punctate gaster, and

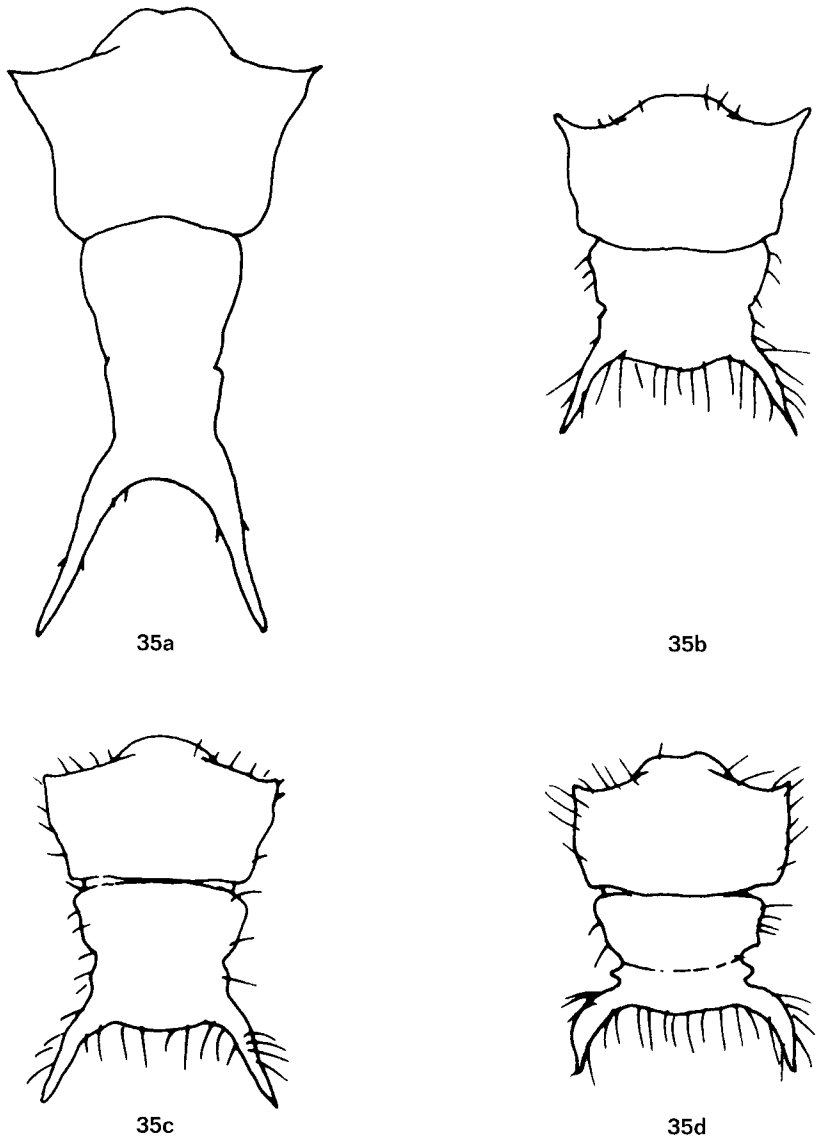


Fig. 35 ***Polyrhachis* (*Chariomyrma*) spp., dorsal views of trunks** (a) ***sokolova*** (b) ***gab* group** (c) ***obtusa* group** (d) ***appendiculata* group**

also occurs in central Northern Territory. The latter extends down the eastern seaboard to central New South Wales.

Species in which the pronotal shoulders are produced into prominent spines belong to the *gab* group (Kohout 1988*b*; Fig. 35*b*). *Polyrhachis gab* itself has a very silvery appearance due to a dense covering of adpressed pubescence, and is extremely abundant in rocky habitats throughout the monsoonal region. The savanna species

P. senilis (Plate 21) has an equally wide distribution, and is one of the most conspicuous ants in the region. It's gaster is covered with bright golden pubescence, and head usually likewise covered with silvery white pubescence, producing a striking coloration. Unlike *P. gab*, the dorsal surface of its trunk is not obscured by silvery pubescence. It usually nests at the bases of trees or logs. Throughout the Top End, *P. senilis* co-occurs with a similar (undescribed) species that is more coarsely sculptured and has longer hairs. Some species of the *gab* group, such as *P. aurea* from north Queensland, have golden pubescence on the dorsal surface of the trunk. A similar, undescribed species is common throughout the rocky ranges of central Australia, extending to the Perth region of Western Australia.

Key to species and species-groups

1. Specialist mangrove species, nesting in intertidal mud; propodeal spines very long and straight, about twice as long as distance between their bases (*sokolova* group) 2

   Savanna species nesting on dry land; propodeal spines often markedly curved at their base, and only about as long as distance between their bases 3

2. Total length 6–8 mm (Fig. 35*a*) ..... ***sokolova***

   Total length 4–5 mm ..... ***constricta***

3. Legs and antennae reddish brown; propodeal spines only feebly curved or straight; scapes with sparse hairs ..... ***hookeri* group**

   Legs and antennae black; propodeal spines often markedly curved at their base; scapes with numerous hairs 4

4. Dorsal surface of propodeum with a lateral pair of rounded processes anterior to the spines; propodeal spines often bull-horn shaped, with broad, extremely curved bases (Fig. 35*d*) ..... ***appendiculata* group**

   Not as above 5

5. Pronotal shoulders acutely angled or produced into short teeth (Fig. 35*c*) .... ***obtusa* group**

   Pronotal shoulders produced into prominent spines (Fig. 35*b*) ..... ***gab* group**

Polyrhachis sub-genus Cyrtomyrma

This is a rich but morphologically uniform sub-genus of arboreal, leaf-nesting rainforest ants distributed throughout south-east Asia. The species have shiny black, hemispherical trunks that are, at most, armed with teeth or small spines. The petiole is similar to that in many species of *Campomyrma*, with four erect teeth rather than a single pair of long, backward-projecting spines. Australian species occur in rainforest along the eastern seaboard from north Queensland to central New South Wales. One north Queensland species has also been recorded on Melville Island off the Darwin coast (Reichel & Andersen 1996).

Polyrhachis sub-genus Hagiomyrma (Fig. 36)

This is a ground-nesting sub-genus occurring primarily in sclerophyll habitats of northern Australia. The most common and widespread species in the monsoonal region are members of the *ammon* group. *Polyrhachis ammon* itself is a large (6–8 mm) species covered with golden pubescence that occurs from north Queensland to central new South Wales. The very similar but more gracile *P. angusta* has a comparable but more patchy distribution (Kohout 1988*a*). Several other, similarly large species also occur in Queensland. However, most species in the monsoonal region are smaller (about 5 mm) and often lack conspicuous golden pubescence. Most are undescribed, with exceptions including *P. semiobscura* (body covered with golden pubescence; also known from New Guinea) and *P. tubifera* from north Queensland, and *P. crawleyi* (dorsum of trunk long and narrow, with broadly rounded and conspicuously flanged pronotal shoulders), which occurs throughout sub-coastal northern Australia, usually associated with riparian or swampy habitats. One undescribed species is widely distributed in well-drained habitats throughout the region, and a distinctive silvery species with parallel petiolar spines occurs in the Top End and Kimberley.

The *schenkii* group consists of several reddish, rather coarsely punctate species. The most widely distributed is *P. schenkii* itself, which occurs in relatively shady habitats in New Guinea, north Queensland and the northern Top End. The slightly larger (total length about 6 mm) *P. lachesis* occurs in north Queensland. Both these as well as other, undescribed species are uniformly reddish brown, whereas *P. lydiae* has a predominantly metallic green or blue-black trunk. It occurs from north Queensland to central New South Wales (Kohout 1988*a*).

A few species of *Hagiomyrma* have dorsally flattened petiolar nodes like those characteristic of *Hedomyrma*. One of these is the widespread *P. trapezoidea*, which occurs from north Queensland to the Top End, often in rocky habitats. The others

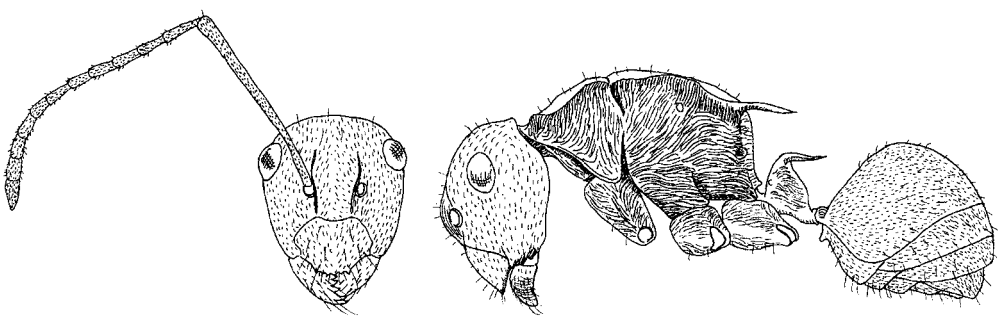


Fig. 36 ***Polyrhachis* (*Hagiomyrma*) sp.**

(Group A in the key below) are smaller, more gracile species with very reduced petiolar spines. One of these is endemic to sandstone escarpments of the northern Top End.

Key to species and species-groups

1. Petiolar node with a distinct, flattened dorsal face, that is longer than maximum width of antennal scapes **2**

   Petiolar node with a narrowly rounded or ridge-shaped dorsum, without a distinct, flattened face **3**

2. Petiolar spines short, about half as long as propodeal spines; scapes exceeding occipital border by about three-quarters their length ..... **Group A**

   Petiolar spines about as long as propodeal spines; scapes exceeding occipital border by about two-thirds their length ..... ***trapezoidea* group**

3. Integument at least partly reddish, and never obscured by adpressed pubescence; antennal scapes often with erect hairs ..... ***schenkii* group**

   Integument uniformly black, often obscured by golden or silver pubescence; antennal scapes usually glabrous ..... ***ammon* group**

Polyrhachis sub-genus *Hedomyrma* (Fig. 37)

This is a predominantly Australian sub-genus of arboreal ants nesting in hollow plant parts, primarily in rainforest. Most species occur along the northeastern seaboard, but many extend into the monsoonal zone, and a few are endemic to the region. The most common monsoonal species are members of the golden or silvery *cupreata* group, which is distributed in rainforest throughout the higher rainfall zone. One such species, *P. terpsichore* (Fig. 37), is restricted to the Top End and the Kimberley, and has unusually long and narrow spines (Kohout 1988*a*). *Polyrhachis clio* is a small, shiny black species occurring in rainforest in both north Queensland and the Top End. The *atropos* group consists of several other small rainforest species, one of which is endemic to the Top End (Reichel & Andersen 1996).

Fig. 37 ***Polyrhachis terpsichore***

The *euterpe* group consists of several coarsely sculptured species that occur in a range of coastal and sub-coastal habitats. Two species are known only from mangroves in the Darwin area of the Top End, and another Top End species occurs in savanna. Another coarsely sculptured species is the enigmatic *P. consimilis* (Kohout 1988*a*), a large species with extremely long antennal scapes that appears to be endemic to the northern Kimberley. Another large species is *P. clotho*, which occurs in dense savanna in both north Queensland and the Top End.

Key to species and species-groups

1. Smaller species, total length <4.5 mm **2**

   Larger species, total length >4.5 mm **3**

2. Trunk shiny; pronotal spines small and tooth-like, much shorter than maximum width of antennal scapes ..... ***clio***

   Trunk dull; pronotal spines as long as maximum width of antennal scapes ... ***atropos* group**

3. Very large species, total length ≥7 mm; antennal scapes with numerous erect hairs **4**

   Smaller species, total length ≤6 mm; antennal scapes glabrous or nearly so **5**

4. Dorsum of trunk with only feeble lateral carinae; hairs on trunk as long as pronotal spines ..... ***clotho***

   Dorsum of trunk with very conspicuous lateral carinae; hairs on trunk shorter than pronotal spines; antennal scapes extremely long, exceeding occipital margin by about three-quarters their total length ..... ***consimilis***

5. Dorsum of trunk coarsely and irregularly pitted, without any adpressed pubescence ..... ***euterpe* group**

   Pronotal dorsum with not so coarse, often longitudinally striate sculpture; remaining dorsal surface of trunk totally obscured by adpressed golden or silvery pubescence ..... ***cupreata* group**

Polyrhachis sub-genus Myrma

Myrma is an arboreal sub-genus, nesting primarily in hollow plant parts and, less commonly, on the ground in logs and under stones. It occurs throughout the Old World tropics, and is particularly rich in Africa and south-east Asia. All species have a very distinctive morphology, with long, forward-projecting pronotal spines, mesonotum and propodeum that are strongly downward-curving in profile, and petiole with a long, widely spaced, central pair of spines. Only four Australian species are known, all from rainforest in north Queensland's humid tropics (Kohout 1989*a*). One of these, *P. andromache*, extends to rainforest patches on western Cape York

Peninsula. It is a spectacularly coloured ant, with the body completely covered in golden adpressed pubescence, and contrasting orange legs.

Polyrhachis *sub-genus* ***Myrmhopla*** *(Fig. 38)*

This is a predominantly arboreal sub-genus, centred on south-east Asian rainforests. Three species-groups are known from monsoonal Australia. The first is represented by *P. dives*, a south-east Asian species occurring also in north Queensland and the Top End (Kohout 1988*a*), where it is likely to have been accidentally introduced. It is black with golden, adpressed pubescence, and is most commonly observed foraging on low vegetation on the fringes of floodplains and swamps, where it builds nests using foliage and twigs. The second group is represented by *P. bicolor* (Fig. 38), also a south-east Asian species but undoubtedly native to Australia. It has a dark head and trunk with contrasting reddish-brown gaster, legs, antennae and mandibles. Its trunk is covered with long, silvery pubescence, and clothed with cotton wool-like hairs. It is a leaf-nesting species that is relatively common in monsoon rainforest of the Top End. Finally, there are several Queensland species of the *viehmeyeri* group (Kohout 1989*b*), which differ from most other *Myrmhopla* in having distinct carinae separating the dorsal from lateral faces. Three of these: *P. eremita*, *P. loweryi* and *P. rustica*, all occur in sclerophyll habitats of central and north Queensland, where they appear to be closely associated with nests and foragers of *Rhytidoponera* species (Kohout 1989*b*).

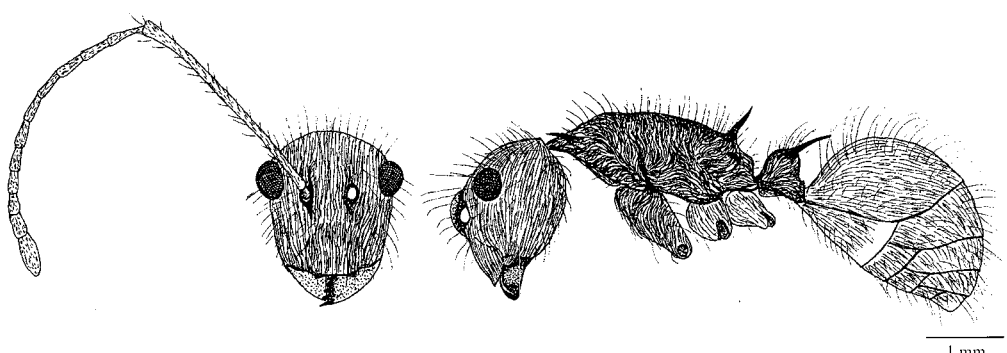


Fig. 38 ***Polyrhachis bicolour***

Polyrhachis *sub-genus* ***Myrmothrinax***

This is an arboreal, leaf-nesting sub-genus occurring primarily in Indonesia and New Guinea. Two closely related species are known from Australia, one of which (*P. delicata*) is relatively common in moist rainforest of the northern Top End (Kohout

1994). It is a gracile, dark reddish-brown species that exhibits distinctive gaster-tapping behaviour when nests are disturbed.

Stigmacros

This is a rich genus endemic to Australia, where it occurs primarily in forests and woodlands of the southern temperate and semi-arid zones. Nevertheless, a considerable number of monsoonal species are known, mostly in central Queensland. McAreavey (1957) has divided the genus into several sub-genera, and I generally follow this classification here. A major exception is that I do not recognise the sub-genus *Pseudostigmacros*, and place *S. inermis* in *Cyrtostigmacros*.

Most species in the region belong to the sub-genus *Campostigmacros*. The most distinctive of these is an undescribed black species with silvery pubescence and red legs (Group A in key below). It is widely distributed in the southern semi-arid zone, extending into central Queensland. Another widespread species from the southern semi-arid zone, *S. aemula*, also extends into central Queensland. Several species of the *intacta* group, characterised by a deep metanotal groove, occur in the eastern monsoonal region, including one that appears to be endemic to the Top End.

The sub-genus *Hagiostigmacros* consists of particularly spiny species, with the most spectacular belonging to the *spinosa* group. *Stigmacros spinosa* itself occurs from central New South Wales to central Queensland, with a very similar (undescribed) species with glabrous rather than hairy gaster occurring across northern South Australia and central western Australia. The *punctatissima* group is also represented in central Queensland, whereas the *barretti* group, a third group within *Hagiostigmacros*, has been included in the key below although it is yet to be recorded from the monsoonal region.

The sub-genus *Stigmacros* consists of many, usually small (about 1.5 mm) species of wet forests. An undescribed species near *impressa* has been collected from the northern Top End, which is the only record of the sub-genus in northwestern Australia.

Key to species-groups

1. Dorso-lateral corners of petiolar node projecting backwards as spines; propodeum with at least one set of spines that is as long as length of propodeum (sub-genus *Hagiostigmacros*) **2**

   Not as above **4**

2. Propodeal spines all of approximately equal length ..... ***spinosa* group**

   Upper pair of propodeal spines considerably shorter than lower pair **3**

3. Pro-mesonotum extremely convex in profile, with deep and broad metanotal depression ..... ***barretti* group**

   Entire trunk virtually straight in profile, with small metanotal notch..... ***punctatissima* group**

4. Conspicuous tubercles present on anterior side of metanotal groove (sub-genus *Cyrtostigmacros*)..... **5**

   Metanotal tubercles absent **6**

5. Dorsum of petiolar node with conspicuous notch, such that it is concave in front view ..... ***aciculata* group**

   Dorsum of petiolar node without dorsal notch, entire in front view..... ***inermis* group**

6. Pro-mesonotum prominently rounded, markedly convex in profile (sub-genus *Stigmacros*) ..... ***impressa* group**

   Pro-mesonotum virtually straight and horizontal in profile (sub-genus *Campostigmacros*) **7**

7. Profile of trunk interrupted by a small, triangular metanotal notch **8**

   Profile of trunk interrupted by a relatively deep, U-shaped groove, such that both mesonotum and propodeum have small but distinct posterior and anterior faces respectively..... ***intacta* group**

8. Integument with adpressed pubescence, giving it a silvery appearance ..... **Group A**

   Not as above ..... ***aemula* group**

GLOSSARY

anterior nearer the front

Bassian biogeographical zone within Australia corresponding to the cool-temperate southern regions

carina (plural **carinae**) a narrow ridge

clypeus the plate forming the anterior border of the head, bounded posteriorly by a distinct suture (Fig. 39)

clypeal margin the anterior margin of the clypeus

cryptic foraging primarily in soil, leaf litter or rotting logs

decumbent lying down

dimorphic having a worker caste with two distinct forms (minors and majors)

dorsum upper surface

Eyrean biogeographical zone within Australia corresponding to the arid interior

facet the unit of a compound eye

femur (plural **femora**) the much-elongated third segment of a leg (Fig. 39)

frontal area the area on the 'front' (dorsum) of the head between the frontal carinae

frontal carinae a pair of narrow ridges running between the eyes from just above the clypeus (Fig. 39)

funiculus the multi-segmented whip-like section of an antenna, consisting of the second and all subsequent antennal segments (Fig. 39)

gaster the body section posterior to the waist, consisting of abdominal segments 3–7 (when waist 1-segmented) or 4–7 (when waist 2-segmented) (Fig. 39)

glabrous entirely hairless

hirsute extremely hairy

infuscated clouded with dark pigment

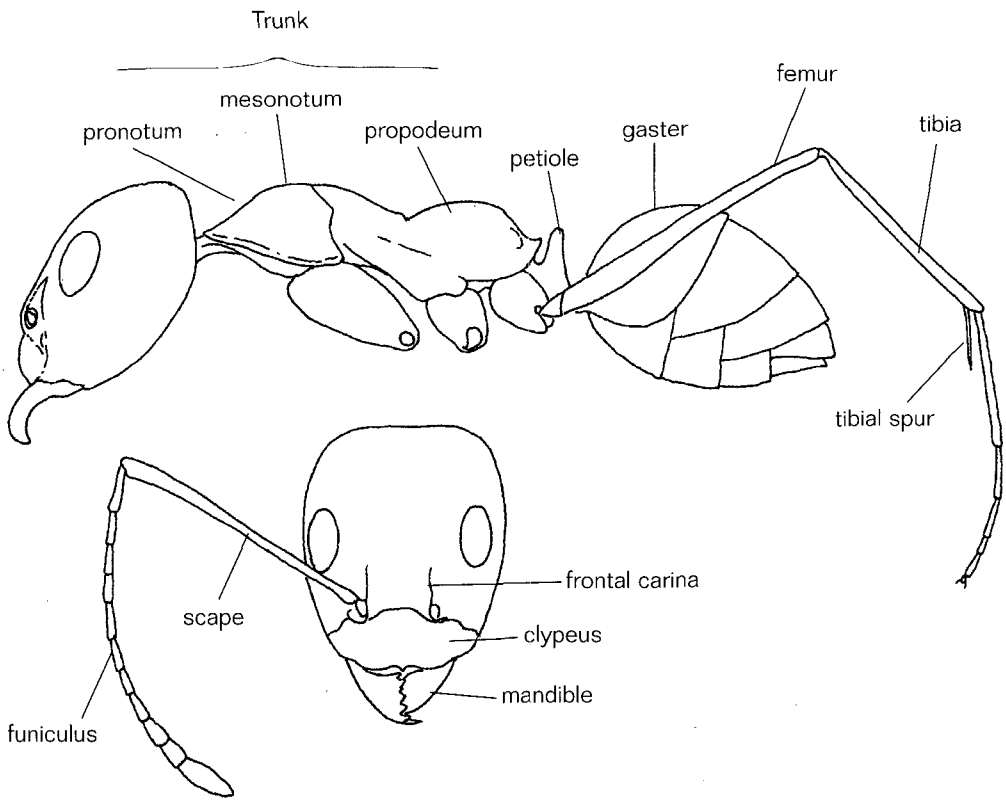
integument outer skin

iridescence reflection of colour in the manner of mother-of-pearl

lateral relating to the side

mesonotum the central of the three major sections of the trunk (Fig. 39)

metanotal groove or notch an indentation separating the mesonotum and pronotum



occiput the 'top' (posterior) portion of the head in face view

occipital corners the postero-lateral angles of the head in face view

occipital margin the 'top' (posterior) border of the head in face view

palp multi-segmented sensory organ associated with mouthparts

petiole waist segment immediately posterior to the trunk (morphologically the second abdominal segment)

petiolar node the erect scale-like or cubiform part of the petiole

polydomic single colony having many nests

polymorphic having a worker caste with multiple forms, with major workers having disproportionately large heads

posterior nearer the back

post-petiole the posterior segment of a 2-segmented waist (morphologically the third abdominal segment)

pro-mesonotum the pronotum and mesonotum collectively

pronotum the first of the three major sections of the trunk (Fig. 39)

propodeum the last of the three major sections of the trunk (Fig. 39)

pubescence short (and usually dense) hairs

punctate integument having dot-like sculpture

pygidium	the last visible segment of the gaster
reticulate	net-like
rugose	coarsely and irregularly wrinkled
scape	first and much-elongated antennal segment (Fig. 39)
scrobes (antennal)	depressions or grooves alongside the frontal carinae, which receive the antennal scapes in resting position
sculpture	patterning of the integument
spatulate	broadly flattened like a spatula
striation	raised, line-like sculpture
tarsal	relating to the tarsus, the apical segments of the leg beyond the tibia (Fig. 39)
teeth	small, angular projections
tibia	the fourth section of a leg, between femur and tarsus (Fig. 39)
tibial spur	a narrow projection at the apex of the tibia (Fig. 39)
Torresian	biogeographical zone within Australia corresponding to the tropical north
trunk	the middle of the three main body parts, between head and gaster (Fig. 39) (also known as alitrunk or mesosoma)
waist	the constricted area between trunk and gaster, consisting of one (petiole) or two (petiole plus post-petiole) segments

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Plate 1 ***Tetraponera punctulata***

Plate 2 ***Bothroponera hera***

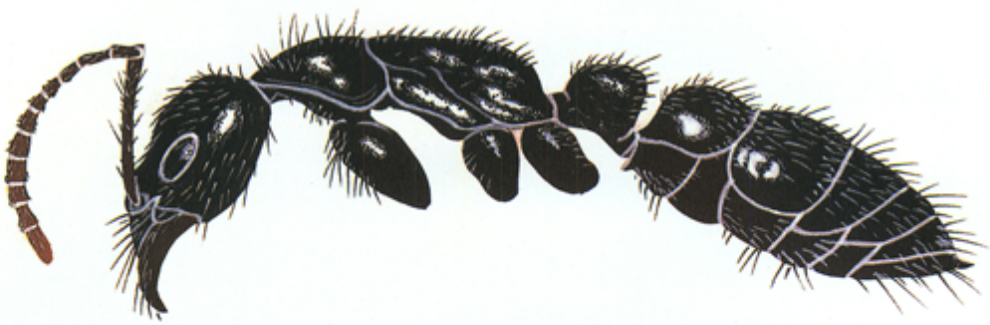

Plate 3 ***Leptogenys exigua***

Plate 4 ***Odontomachus turneri***

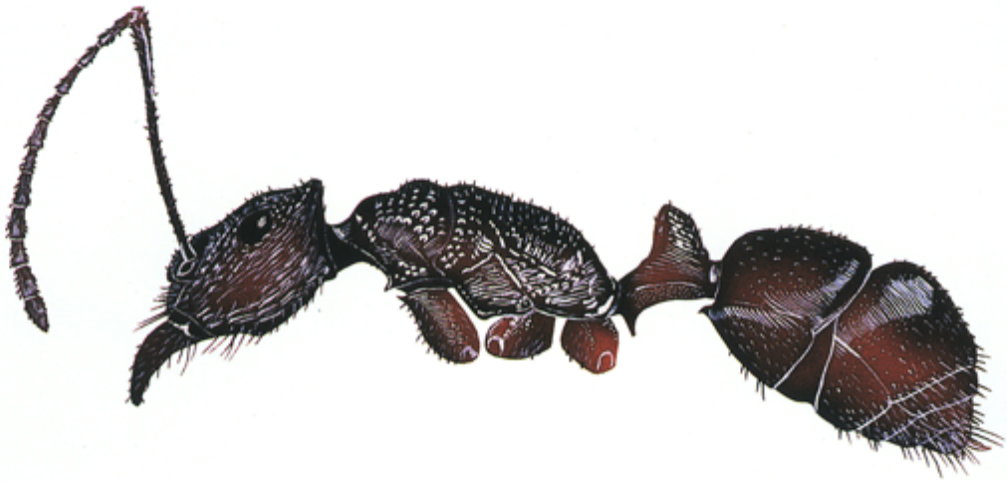

Plate 5 ***Rhytidoponera aurata***

Plate 6 ***Cerapachys*** **sp. (*singularis* gp.)**

Plate 7 ***Crematogaster*** **sp. (*laeviceps* gp.)**

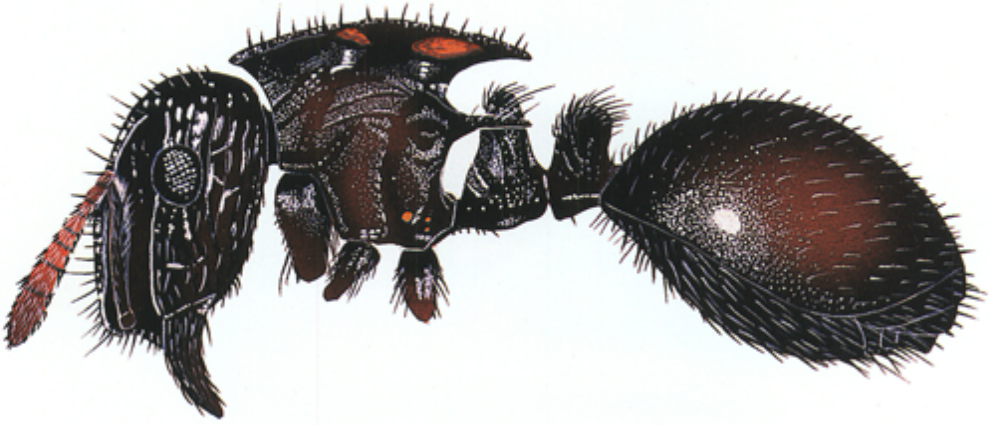

Plate 8 ***Meranoplus mjobergi***

Plate 9 ***Monomorium*** **sp. (*nigrius* gp.)**

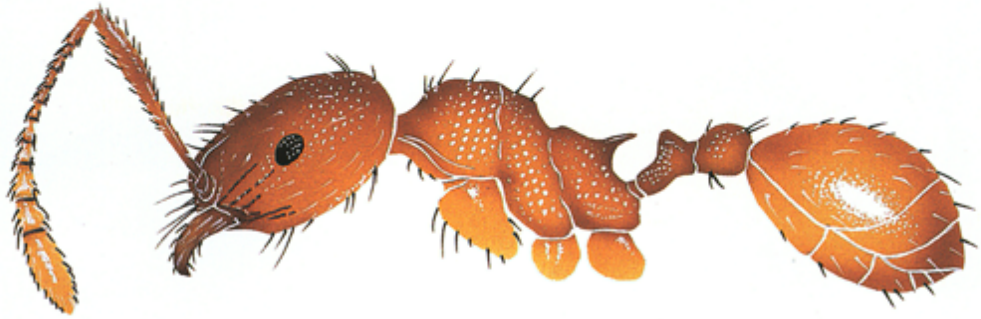

Plate 10 ***Pheidole*** **sp. (minor)**

Plate 11 ***Pheidole*** **sp. (major)**

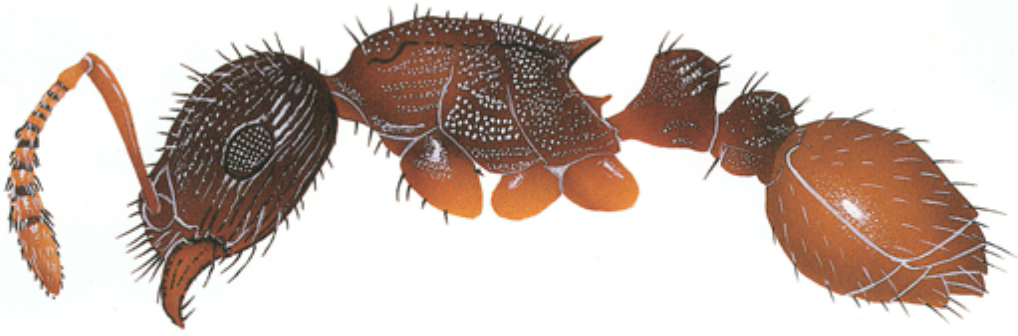

Plate 12 ***Tetramorium*** **sp. (*striolatum* gp.)**

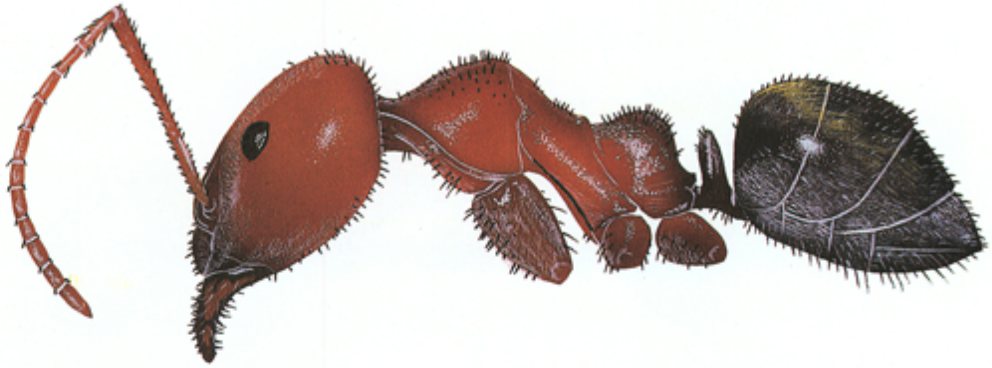

Plate 13 ***Iridomyrmex sanguineus***

Plate 14 ***Papyrius* sp.(*nitidus* gp.)**

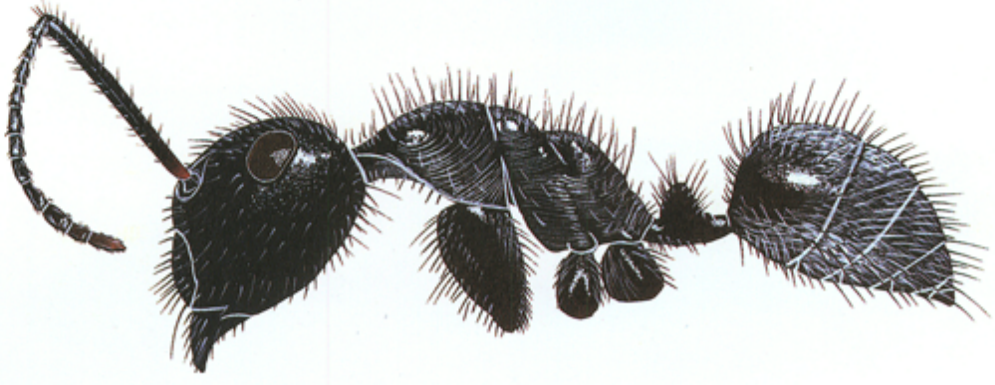

Plate 15 ***Calomyrmex impavidus***

Plate 16 ***Camponotus* sp. (*novaehollandiae* gp.)**

Plate 17 ***Melophorus* sp. (*fieldae* gp.)**

Plate 18 ***Oecophylla smaragdina***

Plate 19 ***Opisthopsis haddoni***

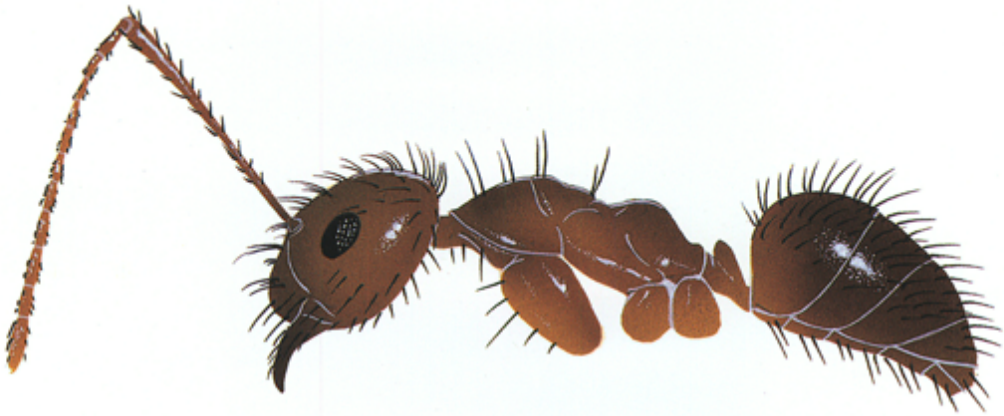

Plate 20 ***Paratrechina*** **sp. (*vaga* gp.)**

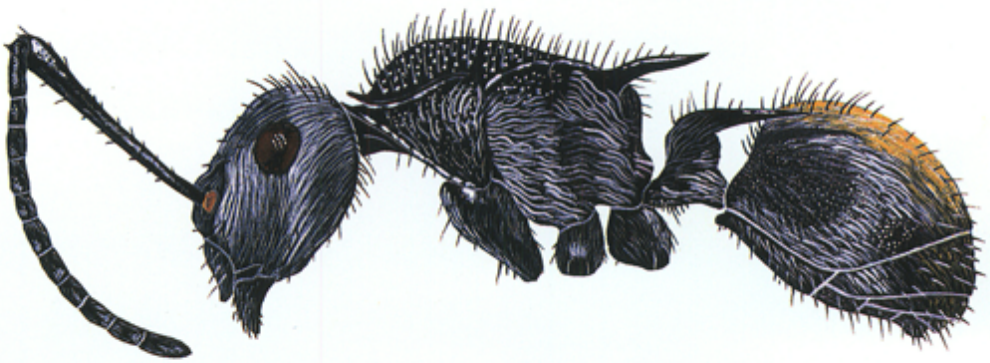

Plate 21 ***Polyrhachis senilis***