

Revision of the Australian ants of the genus *Monomorium* (Hymenoptera: Formicidae)

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Abstract. The Australian ants of the genus *Monomorium* are revised. Fifty-nine species are recognised. Of these, 41 are described as new: *Monomorium aithoderum*, *M. albipes*, *M. anderseni*, *M. anthracinum*, *M. arenarium*, *M. bifidum*, *M. bihamatum*, *M. brachythrix*, *M. burchera*, *M. capito*, *M. carinatum*, *M. castaneum*, *M. crinitum*, *M. decuria*, *M. disetigerum*, *M. draculai*, *M. durokoppinense*, *M. elegantulum*, *M. eremophilum*, *M. euryodon*, *M. flavonigrum*, *M. lacunosum*, *M. legulus*, *M. longinode*, *M. macarthuri*, *M. majeri*, *M. megalops*, *M. micula*, *M. nanum*, *M. nightcapense*, *M. nigriceps*, *M. parantarcticum*, *M. petiolatum*, *M. pubescens*, *M. ravenshoense*, *M. rufonigrum*, *M. shattucki*, *M. silaceum*, *M. stictonotum*, *M. striatifrons*, and *M. xantheklemma*. Thirteen species pass into synonymy: *M. armstrongi* with *M. whitei*, *M. broomense* and *M. ilia* with *M. laeve*, *M. donisthorpei* and *M. fraterculus* with *M. fieldi*, *M. flavipes* and *M. insularis* with *M. leae*, *M. foreli* with *M. sordidum*, *M. howense* with *M. tambourinense*, *M. macareaveyi* with *M. bicornes*, *M. sanguinolentum* with *M. rubriceps*, *M. subapterum* with *M. rothsteini*, and *M. turneri* with *M. gilberti*. Sixteen infraspecific forms are also synonymised: *M. kilianii obscurellum* into *M. kilianii*, *M. laeve nigrius* and *M. laeve fraterculus* into *M. fieldi*, *M. ilia lamingtonensis* into *M. laeve*, *M. rothsteini humilior*, *M. rothsteini leda*, *M. rothsteini doddi* and *M. subapterum bogischi* into *M. rothsteini*, *M. rothsteini squamigena*, *M. rothsteini tostum* and *M. sordidum nigriventris* into *M. sordidum*, *M. fraterculus barretti* and *M. sydneyense nigella* into *M. sydneyense*, *M. gilberti mediorubra* into *M. gilberti*, and *M. rubriceps cinctum* and *M. rubriceps rubrum* into *M. rubriceps*. Seventeen species and one subspecies are unchanged. *Monomorium kiliani* reverts to *M. kilianii*, *M. kilianii tambourinense* is raised to species status, *M. occidaneus* is here treated as a *species inquirenda*, and *M. flavigaster* is removed from the genus *Monomorium*. Since the generic status of the latter taxon is uncertain, *M. flavigaster* is here regarded as *incertae sedis*. The supposedly extralimital *Monomorium talpa* is synonymised under *Monomorium australicum*. At a higher taxonomic level the South American genus *Antichthonidris* is synonymised under *Monomorium*. Seven species-groups are proposed for the Australian fauna, (the *bicornes*-, *falcatum*-, *insolescens*-, *kilianii*-, *longinode*-, *monomorium*-, and *rubriceps*-groups). A cladistic analysis was undertaken of species for which all castes were examined (identifiable males and/or queens were lacking for all members of the *falcatum*-, *insolescens*- and *longinode*-groups). In all, fifteen species of Australian *Monomorium* were examined (*M. bicornes*, *M. whitei*, *M. striatifrons* and *M. rufonigrum* from the *bicornes*-group, *M. crinitum* and *M. kilianii* from the *kilianii*-group, *M. fieldi*, *M. laeve*, *M. rothsteini*, *M. sordidum* and *M. sydneyense* from the *monomorium*-group, and *M. centrale*, *M. leae*, *M. euryodon* and *M. rubriceps* from the *rubriceps*-group), together with *Monomorium antarcticum* (from New Zealand) and the Neotropical *Antichthonidris denticulatus*. The taxon used for the outgroup was the Neotropical ant *Megalomyrmex modestus*. Using the PAUP program, 37 characters for worker, queen and male castes were analysed. The clade incorporating the tiny generalists (*M. fieldi*, *M. laeve*, *M. sordidum*, and *M. sydneyense*), together with *M. rothsteini*, was found to be the clade most strongly supported as a monophyletic grouping. In this analysis *M. euryodon* was the sister taxon to the above clade. These ants were shown on this analysis to share a common ancestor with the other members of the *rubriceps*-group, with *M. antarcticum* and *A. denticulatus*, and with the *kilianii*-group. The relationships between these latter four sets of species were left unresolved, except that *M. crinitum* was shown to be the sister taxon to *M. kilianii*. The large, arid zone species in the *bicornes*-group were also shown as ancestral to the other Australian *Monomorium*. A key is provided to enable researchers to identify the workers of all Australian *Monomorium*, as well as extralimital species established in Australia.

Introduction

Monomorium is a large genus of myrmicine ants. The total extent of the world fauna is unknown, but Bolton (1995) lists 296 species in this genus. Such a figure could be considered rather conservative, especially since Bolton (1987) refers to 145 Afrotropical species elsewhere, none of which are included among the 59 Australian species identified in this work. The bulk of the known taxa are Afrotropical. Another large component of the *Monomorium* fauna inhabits southeast Asia and Australasia. A future revision including the examination and comparison of southeast Asian, Australasian and Polynesian *Monomorium* may well uncover some synonymies among the very small, generalist species. Conversely, the Palearctic and Neotropical faunas are relatively small. The closely related genus *Solenopsis* largely replaces *Monomorium* in the Americas.

Despite the ubiquity of *Monomorium* species in Australia, and the numbers of specimens that can be found in museums or are regularly collected in ecological surveys, the genus has never been the subject of a monographic revision in this country. In their compilation of described Australian Formicidae, Taylor and Brown (1985) list nine species and four subspecies of *Monomorium* under the genus name *Monomorium*, and 24 species and 13 subspecies under the now defunct genus name *Chelaner*. It is clear from a glance at Taylor and Brown's listing that descriptions of taxa in the genus are heavily biased towards species occurring around major population centres in eastern Australia, with a consequent neglect of the relatively rich tropical and western fauna. This study, therefore, is an attempt to rectify the current state of affairs, and to go some way towards supplying a comprehensive taxonomic coverage of the Australian fauna. Keys are here provided to enable researchers to identify workers of both endemic *Monomorium* and all known extralimital species now established in Australia.

Taxonomic history

The generic name *Monomorium* originated with Mayr (1855). However, Linnaeus had described the first *Monomorium* species (as *Formica pharaonis*) in 1758, almost a hundred years before Mayr's publication. This ant was none other than the well-known tramp species now known as *Monomorium pharaonis* (L.).

Carlo Emery introduced subgeneric names for various *Monomorium* species, based on characters of the antennal club and number of antennomeres. Some names were later raised to genus level. Perhaps the most significant of these in the Australian context was *Chelaner*, published by Emery (1914a) to accommodate two new species from New Caledonia, *Monomorium* (*Chelaner*) *forcipatum* and *Monomorium* (*Chelaner*) *longipes*. Other subgenera erected by Emery that included Australian taxa were *Holcomyrme*

(Emery 1908), *Monomorium sensu stricto* (Emery 1922), *Notomyrmex* (Emery 1915) and *Parholcomyrme* (Emery 1915). Forel (1907b) added the subgenus *Martia*, and Wheeler (1915a) assigned the subgenus *Lampromyrme* to Baltic amber specimens. Subsequent authors working with Australian species tended to assign new taxa to one or other of these subgenera, a practice that continued till 1949. Emery's use of antennal characters has been criticised by Bolton (1987), but worker antennal characters appear to be useful, at least at the nominal species-group level, for Australian taxa.

In his revision of the Solenopsidini, Ettershank (1966) raised the subgenus *Chelaner* to generic level, though on rather a flimsy foundation. Ettershank's distinction between the taxa remaining in *Monomorium* and those assigned to *Chelaner* was made on the basis of a very few characters, most of them not peculiar to one taxon alone. Bolton (1987), in his revision of the Afrotropical fauna, has discussed these at some length. The presence of a vestibular propodeal spiracle, supposedly an autapomorphy in *Chelaner*, is variably developed in *Monomorium*. Bolton concluded that this structure has no value as a generic determinant. Bolton also dismissed the only other significant character: the presence of visible notauli and parapsidal furrows in *Chelaner* males (but supposedly absent in male *Monomorium*). Again these characters are variable in both groups. Bolton concluded by placing *Chelaner* under the synonymy of *Monomorium*.

In the above work, Bolton did not assign Afrotropical species to subgenera, preferring instead to identify eight recognisable species-groups. While tramp species present in Australia belong to several of the species-groups nominated by Bolton, the native Australian fauna appears to fit (but not very well) only the *monomorium*-group. (Bolton's analysis is covered in more detail in the discussion of Australian species-groups below.)

Besides the revisions of Ettershank (1966) and Bolton (1987), little systematic work has been published on the Australian fauna. No new species have been described for many years. What is known at present of the taxonomy of Australian *Monomorium* is largely confined to the descriptions of pre-World War II researchers including Clark, Wheeler, Emery, Forel and Viehmeyer. In recent years, three semi-popular publications have partially filled the vacuum: 'A Guide to the Ants of the South Australia' (Greenslade 1979), 'The Ants of Southern Australia/A Guide to the Bassian Fauna' (Andersen 1991c) and 'Australian Ants: Their Biology and Identification' (Shattuck 1999). The first two publications discuss the morphology and biology of several of the more conspicuous clusters of *Monomorium* species found in the region. More extensive work has been done on extralimital faunas. DuBois (1980, 1986) has revised the New World *Monomorium minimum* group. Kusnezov (1949) has examined the

Argentinean *Monomorium*, Wilson and Taylor (1967) the Polynesian fauna, Brown (1958) the New Zealand fauna, Baroni Urbani (1964a, 1964b and 1968) the ants of Italy, Bernard (1968) west European *Monomorium*, and Collingwood (1978) and Collingwood and Yarrow (1969) the fauna of the Iberian Peninsula. Both Brown (1958) and Wilson and Taylor (1967) make some useful references to Australian forms.

Perhaps surprisingly, the most thorough descriptions of taxa are found in the early, rather than more recent, publications. Bingham (1903) is a good case in point. On the other hand, Viehmeyer's papers occasionally contain errors (see the comments under 'Remarks' for *Monomorium sordidum* below).

The biology and pharmacology of some Australasian *Monomorium* species (both native and introduced) have recently been examined (Davison 1982, 1987; Briese 1983; Blum *et al.* 1985; Jones *et al.* 1988; Andersen *et al.* 1991). More general references to the behaviour of *Monomorium* species in the Australian environment can be found in several articles by Andersen (e.g. Andersen 1986a, 1986b, 1990, 1991a, 1991b, and 1992). Kugler (1978) has examined the sting apparatus of *Monomorium* and other myrmicines.

Cladistic analysis of *Monomorium*

Materials and methods

Material examined

Fifteen Australian species of *Monomorium* were examined. These were species for which male and female reproductives were known. They were: *Monomorium bicornis* Wheeler, *M. rufonigrum*, sp. nov., *M. striatifrons*, sp. nov. and *M. whitei* Wheeler from the *bicornis*-group proposed in this paper, *M. fieldi* Forel, *M. laeve* Mayr, *M. rothsteini* Forel, *M. sordidum* Forel and *M. sydneyense* Forel from the *monomorium*-group, *M. crinitum*, sp. nov. and *M. kilianii* Forel from the proposed *kilianii*-group, and *M. centrale* Forel, *M. euryodon*, sp. nov., *M. leae* Forel and *M. rubriceps* Mayr from the proposed *rubriceps*-group. Unfortunately, members of both reproductive castes were not available for the proposed *falcatum*, *insolescens* and *longinode*-groups.

In order to assess the relationship between the Australian taxa formerly placed in *Chelaner* and extralimital *Chelaner* and *Chelaner*-like species, *Monomorium antarcticum* (Smith) and *Antichthonidris denticulatus* (Mayr) were included in the analysis. Outgroup comparison was used to determine character polarity (Nixon and Carpenter 1993). The Neotropical *Megalomyrmex modestus* Emery, also from the tribe Solenopsidini, was used as the outgroup (Dr C. R. F. Brandão (MZUSP) and Dr J. Longino (Evergreen State College, Washington) supplied workers, males and dealate queens of this species).

Characters

Thirty-seven characters for workers, queens and males were analysed. Character states were assigned the values '0', '1', '2' or '3'. If a character state was unknown, it was coded as '?' (This was the case for wing venation in the alate *Megalomyrmex modestus* queen. No alate queens were available.) Where the character state was ambiguous or polymorphic within a species '0&1' was coded for binary characters and '0&1', '0&2' or '1&2' for multistate characters.

Worker characters

1. *Eye size* moderate (i.e. eye width 0.5–1.5× greatest width of antennal scape) [0], or large (eye width >1.5× greatest width of antennal scape) [1].
2. *Eye shape* elliptical (shape of eye in the form of an ellipse) [0] (e.g. Fig. 53), or circular/subcircular [1], or ovoid (eye more narrowly rounded at one end) [2] (e.g. Fig. 51).
3. *Number of antennal segments* 12 [0], or 11 [1].
4. *First funicular segment of largest workers* at least twice as long [0], or much less than twice as long [1] as second funicular segment of antenna.
5. *Club formed by the apical antennal segments* absent or weakly 4-segmented [0] (Fig. 5), or clearly defined and 3-segmented [1] (e.g. Fig. 69). (In Australian *Monomorium* the funiculus may be evenly tapering, with the individual antennomeres gradually increasing in length, or weakly four-segmented. In such cases '0' was coded. Alternatively, the segments comprising the apical club are distinctly longer than the remaining funicular segments, and the club is often constricted at its base. For the latter '1' was coded.)
6. *Median clypeal carinae* absent, clypeus smooth and protuberant [0], or median clypeal carinae multiple or indistinct, anteromedial clypeal margin convex, straight or slightly emarginate [1] (Fig. 89), or median clypeal carinae distinct, produced as teeth or denticles [2] (e.g. Figs 69–75), or median clypeal carinae distinct, not produced as teeth or denticles [3] (e.g. Figs 102, 126).
7. *Number of maxillary palpal segments* 4 [0], 2 [1], or 1 [2].
8. *Number of labial palpal segments* 3 [0], or 2 [1].
9. *Maximum number of teeth on masticatory border of mandibles* 6 [0], 5 [1], 4 [2], or 3 [3]. (The basal tooth, in particular, may be notched in some specimens of *kilianii*, so that the appearance is of two small denticles sharing the same base (Fig. 14a). In many other species, the basal tooth may be reduced to a small or minute offset denticle or angle (Fig. 14b).
10. *Mandibles* either triangular in shape [0] (Fig. 14a), or with basal and external margins subparallel or nearly so [1] (Fig. 14b).
11. *Mandibles* striate [0] (Fig. 14a), or smooth [1] (Fig. 14b) in appearance. The striae may be partially obsolete, and most noticeable near the masticatory edge and the mandibular angle.
12. *Basal tooth* of mandible not enlarged [0] (e.g. Figs 72, 73, 90), or enlarged and much broader than other non-apical teeth [1] (e.g. Fig. 91).
13. *Promesonotal suture* present externally as a faint ridge [0] (e.g. Figs 52, 53), or absent [1] (e.g. Figs 107–135).
14. *Metanotal groove* present as a distinct and deep trough between the promesonotum and the propodeum [0] (e.g. Figs 51, 111), or feebly impressed [1] (e.g. Figs 83, 86), or absent [2] (e.g. Figs 67, 95).
15. *Propodeum* with distinct teeth or denticles at propodeal angles [0] (e.g. Figs 51, 56, 93), or propodeal armament absent, propodeal angle distinct [1] (e.g. Figs 95, 108), or propodeum more or less rounded [2] (e.g. Figs 86, 110, 122).
16. *Propodeal spiracle* with vestibule behind it [0] (Fig. 15), or vestibule absent [1].
17. *Transverse propodeal carina* present between metapleural lobes [0], or absent [1] (Fig. 16).
18. *Metapleural lobes* present as discrete flanges [0] (Fig. 17a), or lamellar strips flanking propodeal declivity [1] (Fig. 17b).
19. *Anteroventral petiolar process* always present as a distinct spur or carinae [0] (e.g. Figs 56–58), or distinct in some individuals only as a slender carina tapering posteriad [1] (e.g. Figs 98, 110), or absent or vestigial [2] (e.g. Fig. 64, 68).
20. *Petiolar spiracle* situated well anterior of [0] (e.g. Figs 53, 68, 87), slightly anterior of [1] (e.g. Figs 56, 58, 84), or in [2] petiolar node (e.g. Figs 97, 107–111).

21. *Anteroventral postpetiolar process* present [0] (e.g. Figs 67, 68), or absent or vestigial [1] (e.g. Fig. 108–111).

22. *Postpetiole* compact and strongly constricted anteriorly [0] (e.g. Fig. 93–97), or more elongate and attenuated anteriorly [1] (e.g. Figs 87, 92).

23. *Erect and suberect setae* present on head and alitrunk [0], or absent from these parts [1].

24. *Worker caste* monomorphic [0], or exhibiting monophasic allometry [1], or polymorphic [2].

Queen characters

25. *Wing veins* tubular [0] (Figs 12, 166–173), or weakly sclerotised and depigmented [1] (Figs 174–177).

26. *Vein m-cu* present as entire vein [0] (Figs 12, 166–173), or this vein absent [1] (Figs 174–177).

27. *Vein cu-a* present [0] (Figs 166–173), or absent [1] (Fig. 174–177).

28. *Axillae* widely [0] (Figs 6, 11, 153), or narrowly [1] separated (Fig. 154). ('Widely separated' refers to axillae that are separated by a distance of half or more than half the greatest width of the scutellum. 'Narrowly separated' refers to axillae that are nearly contiguous or separated by a distance of less than half the greatest width of the scutellum.)

Male characters

29. *Ocelli* on raised prominence (i.e. turreted) [0] (Fig. 18), or more-or-less on same level as frons [1] (Fig. 9).

30. *Wing veins* tubular [0], or weakly sclerotised and depigmented [1] (as for queen).

31. *Vein m-cu* present as entire vein [0] (Figs 12, 166–173), or as appendix [1], or this vein absent [2] (Figs 174–177).

32. *Vein cu-a* present [0], or absent [1] (as for queen).

33. *Axillae* widely [0] (Figs 6, 11, 153), or narrowly separated [1] (as for queen).

34. *Parapsidal furrows* present [0] (Fig. 11), or absent or vestigial [1].

35. *Notauli* present [0] (Fig. 11), or absent [1].

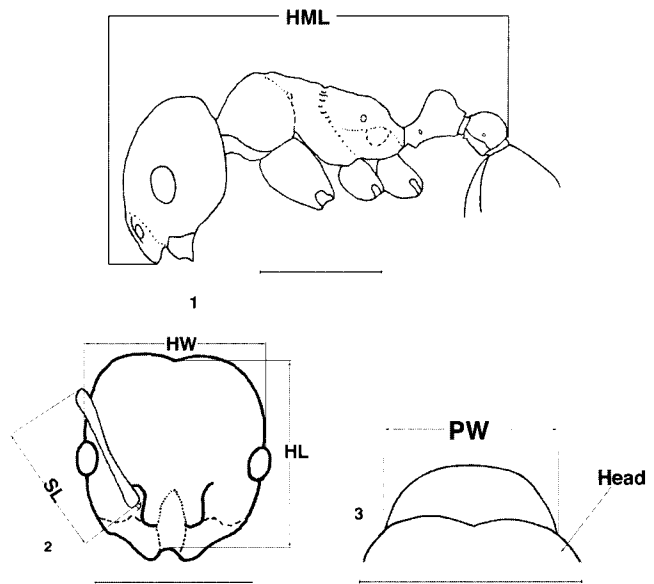
36. *Brush of setae* absent [0], or present [1] on gastral sternites (Fig. 165).

37. *Setae* on body surface pale [0], or dark [1].

Several other characters were examined, but these proved unsatisfactory. An example of one such character was number of mandibular teeth in the male. In *M. striatifrons*, a large graminivore, three males had two large teeth (other graminivorous species examined had three smaller teeth). However, three cusps were distinctly present in a fourth male. Therefore, the species is polymorphic for this character. Since nearly all *Monomorium* species were represented by less than half-a-dozen males, some with fewer teeth than might be expected from comparison with similar taxa, the risk of wrongly assuming monomorphism in this very limited number of specimens was judged to be unacceptable. As a result the character was discarded.

Phylogenetic analysis

The data set was placed into a matrix using McClade Version 3 (Maddison and Maddison 1992) (Table 1) and the analysis was performed using PAUP Version 4.0b2a (Swofford 1998). The PAUP program supplies data on the number of rearrangements tried, the length of the shortest tree(s), the number of trees, the time used, tree length, and also gives sets of indices. The consistency index (*CI*) and retention index (*RI*) are derived by scaling the number of steps required by a tree by the minimum and/or maximum conceivable number of steps the character could have on a tree. Homoplasy occurs when a



Figs 1–3. Measurements used in this study (*M. rufonigrum* worker). 1. HML, length of head+mesosoma+petiole+postpetiole; 2. HL, head length; HW, head width; SL, scape length; 3. PW, pronotum width. (Pilosity is omitted in Figs 1–12.) Scale bars = 1 mm.

character state evolves more than once in different branches of a tree. The homoplasy index (*HI*) is equal to $1 - CI$ (Maddison and Maddison 1992: 368). The rescaled consistency index (*RC*) is the character *CI* \times character *RI* (Maddison and Maddison 1992: 270).

Several combinations of assumptions and program settings were tested. These included both additive and non-additive analysis for characters 3, 7, 8 and 9, 'uncertainty' (i.e. ambiguous state) and 'polymorphism' (i.e. multiple state) for polymorphic characters, different branch swapping algorithms (i.e. tree-bisection-reconnection (TBR) versus subtree-pruning-regrafting (SBR)), and accelerated transformation (ACCTRAN) versus delayed transformation (DELTRAN). By using an additive transformation series for characters

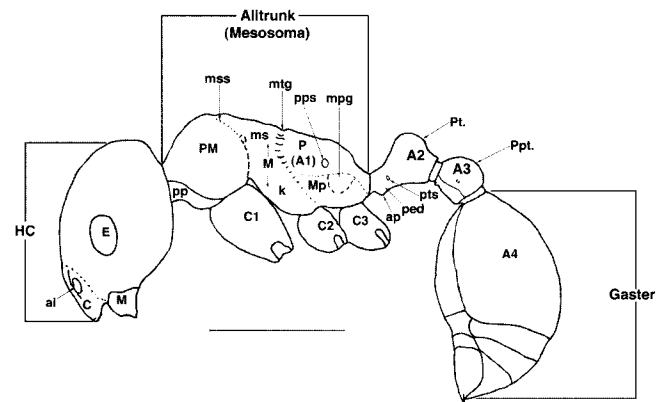
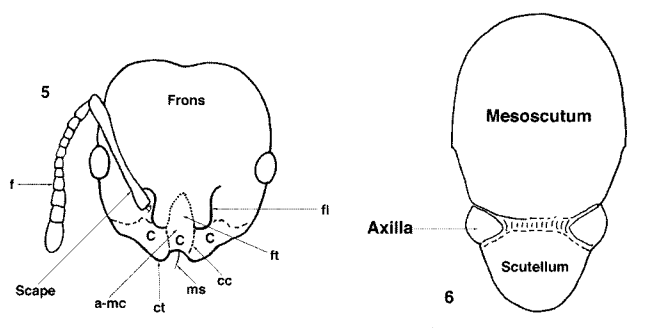


Fig. 4. Profile of *M. rufonigrum* worker. A, abdominal segment number; ai, antennal insertion; ap, anteroventral process; E, eye; HC, head capsule; k, katapisternum; M, mesopleuron; Mp, metapleuron; mpg, metapleuron gland bulla; ms, mesonotum; mss, mesonotal suture (obsolete here); mtg, metanotal groove; P, propodeum; ped, peduncle of petiole; PM, pronotum; pp, propleuron; pps, propodeal spiracle; Ppt, postpetiole; Pt, petiole; pts, petiolar spiracle. Scale bar = 1 mm.



Figs 5, 6. 5. Full-face view of head of *M. rufonigrum* worker. a-mc, anteromedian clypeal sector; C, clypeus; cc, median clypeal carina; ct, clypeal tooth; f, funiculus of antenna; fl, frontal lobe; frons, frons of head capsule; ft, frontal triangle; ms, median seta; scape, scape of antenna. 6. Dorsal view of *M. rufonigrum* queen mesosoma. Scale bars = 1 mm.

3, 7, 8, and 9, the assumption was made that the number of antennal segments or mandibular teeth are more likely to be reduced through evolution than to be increased in number. Therefore, exclusion of autapomorphic characters was also examined. However, no characters were weighted. Finally, the effects of nominating *Antichthonidris denticulatus* as a second outgroup were investigated.

Results

Tree and indices

For this data set 10 000 random addition sequences using the 'stepwise' option, the 'polymorphism' option and ACCTRAN, produced 13 most parsimonious trees with a shortest tree length of 117 steps (Fig. 19). The *CI* was 0.70, the *HI* was 0.58, the *RI* was 0.74 and the *RC* was 0.52. Excluding uninformative characters, the *CI* was 0.68 and the *HI* was 0.31. The consensus tree computed by combining the individual trees (Fig. 20) indicated varying levels of support for four groupings of taxa ('tree islands'). The number of trees was not altered using any of the other analyses mentioned above, and the indices were little affected, except where the 'uncertainty' option was coded. In the latter case

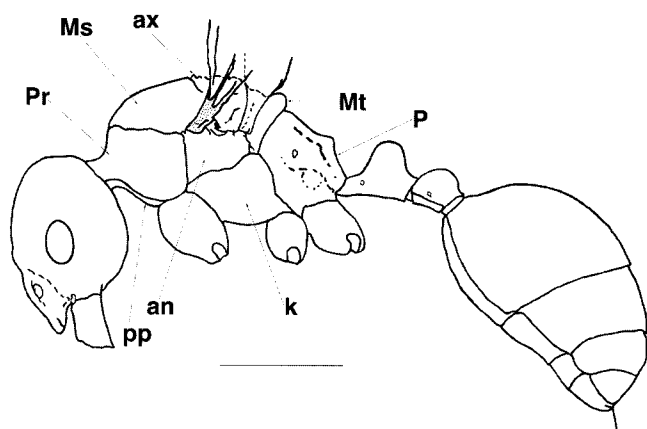
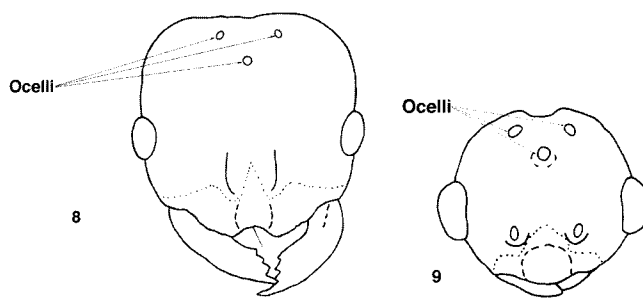


Fig. 7. Profile of *M. rufonigrum* queen. an, anepisternum; ax, axilla; k, katepisternum; Ms, mesonotum; Mt, metanotum; P, propodeum; pp, propodeum; Pr, pronotum. Scale bar = 1 mm.



Figs 8, 9. 8. Full-face view of head of *M. rufonigrum* queen. 9. Full-face view of head of *M. rufonigrum* male. Scale bar = 1 mm.

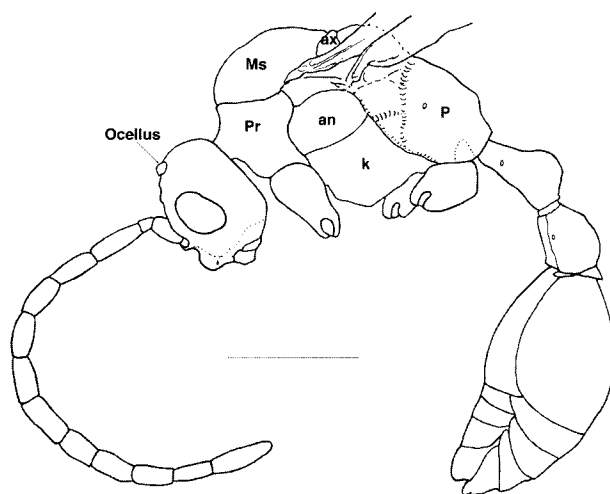


Fig. 10. Profile of *M. rufonigrum* male. an, anepisternum; ax, axilla; k, katepisternum; Ms, mesonotum; P, propodeum; Pr, pronotum. Scale bar = 1 mm.

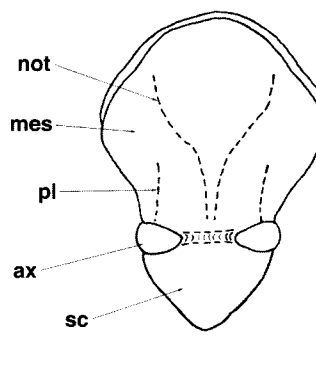


Fig. 11. Dorsal view of *M. euryodon* male mesosoma. ax, axilla; mes, mesoscutum; not, notaulus; pl, parapsidal line; sc, scutellum. Scale bar = 1 mm.

tree length was given as 79, the *CI* was 0.56, the *HI* was 0.44, the *RC* was 0.41 and the *RI* was unchanged. Where *Antichthonidris denticulatus* was nominated as a second outgroup the program warned that the specified ingroup was not monophyletic.

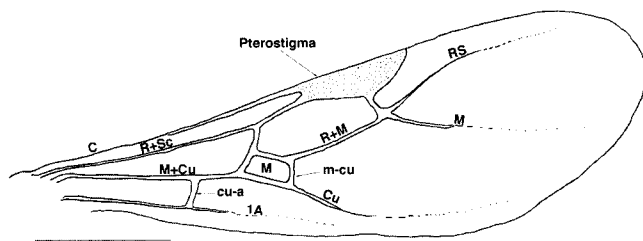


Fig. 12. Wing of *M. rufonigrum* male. This species possesses the full complement of *Monomorium* wing veins. Scale bar = 1 mm.

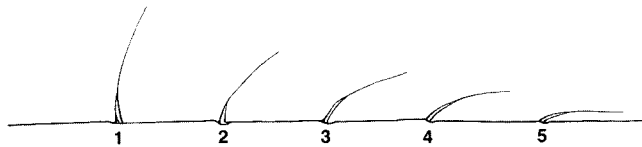


Fig. 13. Inclination of a seta on body surface (terms used are taken from Dubois, 1986). 1, erect; 2, suberect; 3, subdecumbent; 4, decumbent; 5, appressed.

Taxa

The clade most strongly supported by the analysis as a monophyletic grouping is the *monomorium*-group incorporating the small generalists *M. fieldi*, *M. laeve*, *M. sydneyense* and *M. sordidum* and the predominantly graminivorous *M. rothsteini*. The length of the branch connecting this clade with the rest of the tree varied, depending on the reconstruction, from eight steps to ten steps (Fig. 19). When the 'trace character' facility of McClade Version 3.0 was used, worker synapomorphies common to all trees were found to include similar clypeal structure

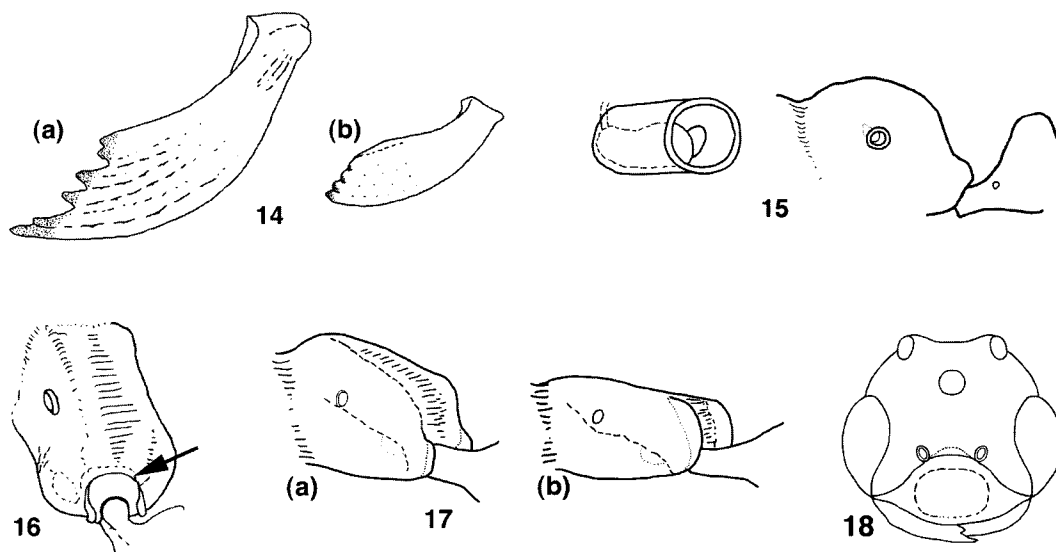
(character 6), the same mandibular dentition (character 9), and a similar mandibular shape (character 10). Both queens and males lack strongly sclerotised wing veins (characters 25 and 30, respectively), and the wing vein m-cu is absent in both queens (character 27) and males (character 32).

In all trees *M. euryodon*, sp. nov. is shown as the nearest relation to the small generalists. The mesic species *Antichthonidris denticulatus*, *Monomorium antarcticum*, *M. centrale*, *M. crinitum*, *M. kilianii*, *M. laeae*, and *M. rubriceps* share a common ancestor with the clade that includes the small generalists plus *M. euryodon*, sp. nov. (Fig. 20). The relationship between these species was left unresolved, except for *Monomorium crinitum*, sp. nov. and *M. kilianii*, which are shown as sister taxa.

Ancestral to the above groups in the reconstruction shown in Fig. 20 is the clade containing the large graminivorous and semi-arid *Monomorium* here placed in the *bicorne*-group. *Monomorium bicorne* is the sister taxon to *M. whitei*. The relationships between *M. rufonigrum*, sp. nov. *M. striatifrons*, sp. nov. and *M. bicorne*–*M. whitei* were left unresolved.

Discussion

The strict consensus tree provides strong support for the distinctiveness of the small generalist species. The reduction in segments in antennae and palps may not be purely a function of size, since even minute former *Chelaner* species such as *M. anthracinum*, sp. nov. and *M. elegantulum*, sp. nov. have the full complement of palp and antennal segments. Similarly, the loss of venation in the wings of alates appears to have phylogenetic significance, e.g. the



Figs 14–18. Characters and character states. 14 (a) striate, triangular mandible, (b) subparallel mandible, smooth except for piliferous punctures; 15, vestibulate condition of the propodeal spiracle; 16, transverse carina on declivitous face of propodeum; 17, (a) metapleural lobes small and discrete (b) metapleural lobes extended to propodeum; 18, turreted ocelli in male.

Table 1. Data matrix showing characters and character states used in a cladistic analysis of *Monomorium*

Species	Character No.																																					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	
<i>Me. modestus</i>	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2	0	0	0	0	1	0	0	0	0	0	0	?	?	0	0	0	0	0	0	0	1	0	0
<i>An. denticulatus</i>	0	0	0	0	0	1	1	1	0	0	1	1	1	0	1	0	1	0	1	0&1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
<i>M. antarcticum</i>	1	0	0	1	0	2	1	0	1	0	1	1	1	0	1	0	1	0	0	1	0	0	0	1	0	0	0	0	1	1	0	0&1	0	0	0	1	0	0
<i>M. bicornis</i>	0&1	2	0	0	1	2	1	0	2	1	1	0	0	0	1&2	0	1	0	0	1	1	0&1	0	1	0	0	0	1	1	0	0&2	0	0	0	1	0	1	
<i>M. centrale</i>	0	0	0	0	1	2	1	0	1	0	1	0	1	1&2	1	0	1	0	0	2	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	
<i>M. crinitum</i>	0	0	0	0	1	1	1	1	1	0	1	0&1	0&1	0	1&2	0	1	0	1	0	1	1	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	
<i>M. euryodon</i>	0	0	0	0	1	1	1	0	1	0	1	1	1	1	2	0	1	0	1	2	0	0	0	2	0	1	0	1	0	1	0	2	0	0	0	0	0	
<i>M. fieldi</i>	0	0	1	0	1	3	2	1	2	1	1	0	1	0	2	1	1	0	1	2	1	0	0	0	1	1	1	1	1	1	2	1	0	1	1	0	0	
<i>M. kilianii</i>	0	0	0	0	1	1	1	0	0	0	0	0	0&1	0	2	0	1	0	2	1	1	1	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	
<i>M. laevis</i>	0	0	1	0	1	3	2	1	2	1	1	0	1	0	2	1	1	0	1	2	1	0	0	0	1	1	1	1	1	1	2	1	1	1	1	0	0	
<i>M. laevi</i>	0	0&1	0	0	1	1&3	1	0	1	0	1	0	1	0&1	0&1&2	0	1	0	0	1	0	0	1	0	0	1	0	0	1	1	0	0	0	0	0&1	0	0	
<i>M. robustus</i>	0	0	0	0	1	2&3	1	1	3	1	0	0	0&1	0	2	0	1	0	1	2	1	0	0	0	1	1	1	1	1	1	2	1	0	0&1	1	0	0	
<i>M. rubricaps</i>	0	0	0	0	1	1	1	0	1	0&1	0	0	1	0&1	0&1&2	0	1	0	1	1&2	0	0	0	0	1	0	0	0	1	1	0	0&1	0	0	0	0	1	
<i>M. rufonigrum</i>	0	0&2	0	1	1	2	1	0	2	1	0	0	0&1	1	0&1&2	0	0	0	0	0	0	0&1	0	1	0	0	0	0	0	0	0	0	0	0&1	0	1	0	
<i>M. sordidum</i>	0	0	0	0	1	3	2	1	2	1	1	0	1	0	2	1	1	0	1	2	1	0	0	0	1	1	1	1	1	1	2	1	0	0	1	0	0	
<i>M. stratifrons</i>	0	0	0	1	0	1	1	0	2	1	0	1	0	0	2	0	1	0	2	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	
<i>M. sydneyense</i>	0	0	1	0	1	2&3	2	1	2	1	0&1	0	1	0	2	1	1	1	1	2	1	0	0&1	0	1	1	1	1	1	1	2	1	0	1	1	0	0	
<i>M. whitei</i>	1	2	0	1	0	2	1	0	2	1	0	0	0	0	0&1&2	0	1	0	0	0	1	0&1	0	1	0	1	0	0	1	1	0	0	0	0	0	1	0	1

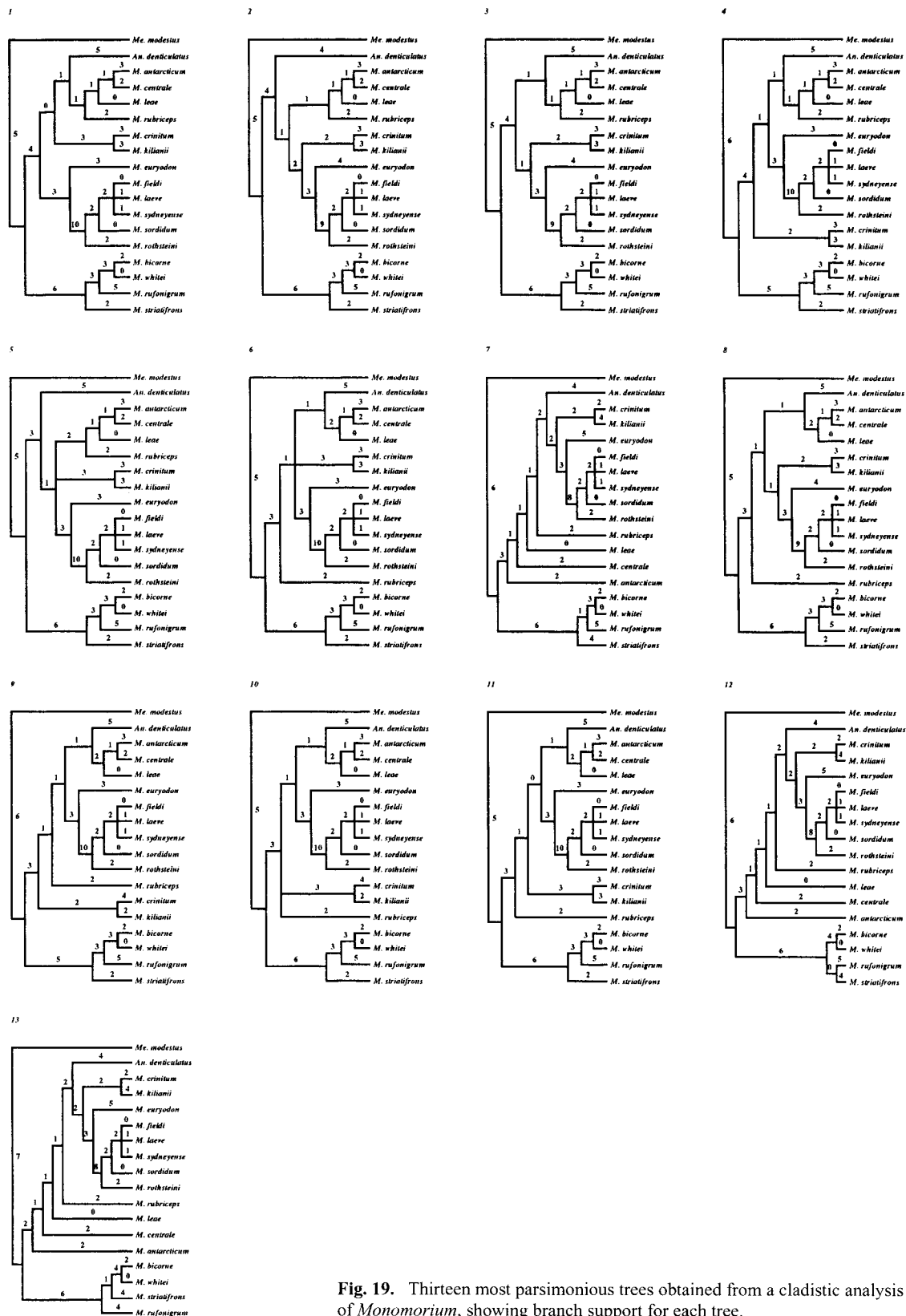


Fig. 19. Thirteen most parsimonious trees obtained from a cladistic analysis of *Monomorium*, showing branch support for each tree.

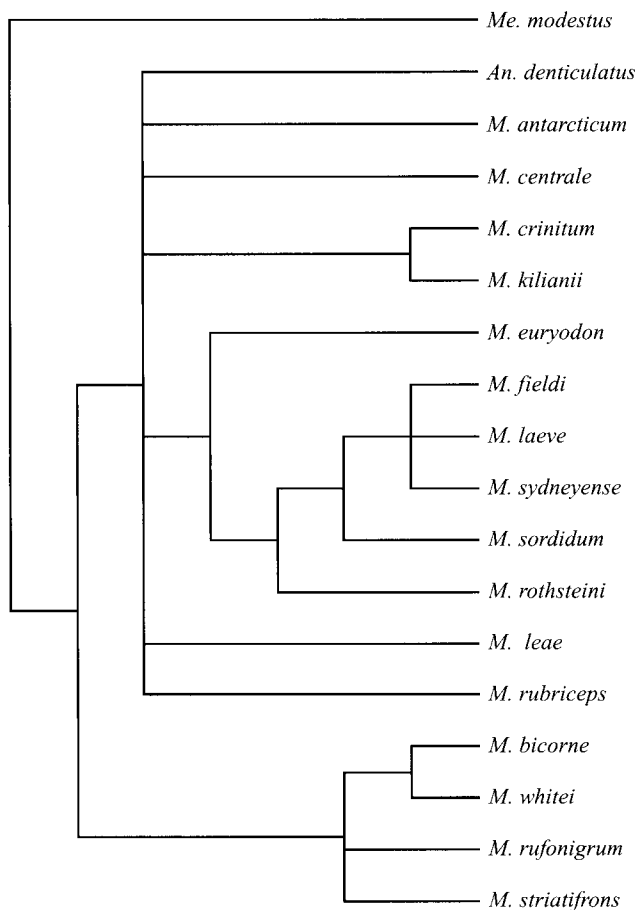


Fig. 20. Strict consensus of 13 most parsimonious trees resulting from cladistic analysis of *Monomorium* with *Megalomyrmex modestus* Emery as the outgroup. Best tree length is 117 steps.

queen of *M. rothsteini* is a relatively large ant, but shares the same pattern of venation as the queens of its much smaller relatives in the *monomorium*-group. Features of the other species-groups proposed in this work are less clear, but the monophyly of the large arid zone species is fairly well attested. However, this group may not in fact be the most ancient among the groups examined: the close morphological similarities between the Australian *M. leae* complex, *M. antarcticum* from New Zealand and the New Caledonian *Chelaner* species mask the fact that their ancestor or ancestors possibly became separated as long ago as 60–80 million years ago. Cranston and Naumann (1991) cite the latter dates as the time during which Australia separated from New Zealand and South America.

Another feature of the cladistic reconstruction is the position of *Antichthonidris denticulatus* as a member of the ingroup. In view of the above analysis there appears no justification for retaining *Antichthonidris denticulatus* in a separate genus to *Monomorium*. Only the odd palp formula of 3,2 in the *Antichthonidris* male (Snelling 1975)

distinguishes the two taxa at a generic level. However, this is a solitary autapomorphy, and otherwise the taxonomic disparity is slight. Even a lack of spurs on middle and hind tibiae is shared by both genera.

The second *Antichthonidris* species was not available for this study, but biological data alone is sufficient to associate *A. denticulatus* and *A. bidentatus* (Bolton 1987). Therefore, *Antichthonidris* is synonymised as a junior synonym of *Monomorium* in this work. Specimens of a genus closely allied with *Antichthonidris*, *Nothidris*, were unavailable for study. However, these could be fruitfully examined in any further large-scale analysis of the genus *Monomorium*.

Finally, the use of genitalic and molecular characters would probably assist considerably in the resolution of currently unresolved relationships. Genitalic characters could not be used here because of the paucity of reliably identified reproductives available for study.

Biogeographical reconstruction

Although an analysis based on a small subset of Australian *Monomorium* is speculative, perhaps some biogeographical suggestions can be offered. Firstly, the tiny generalists represent an incursion of northern elements. Members of the *monomorium*-group occur in all zoogeographical regions but are predominantly Afrotropical (Bolton 1987). Possibly they did not reach Australia until the Australian Plate came into contact with the Sunda Island Arc in the mid-Miocene (about 15 million years ago). Relatively little speciation of this group seems to have taken place in Australia, the superficial appearance of many species being due to colour polymorphism and morphological plasticity. These features may also explain its ubiquity in nearly all Australian ecosystems. There is a need to compare the Australian fauna with taxa from Indonesia and the Malaysian Peninsula.

The derivation of the other elements of the Australian fauna is considerably more problematic. The graminivores may represent a distinct adaptation to widespread grasslands and the development of extensive arid-adapted monocotyledons and forbs. The first graminivores could have appeared during the Oligocene, but speciation may have been enhanced with the appearance of large areas of grassland in the mid-Miocene. The history of the mesic *Chelaner* species is even more shadowy, but they could represent a far more ancient stock than this cladistic analysis suggests. Apart from the taxa already mentioned, *Monomorium kilianii* and its allies are not dissimilar to the American taxa *M. bidentatus* and *M. denticulatus*, and some features of the former group, e.g. their mandibular dentition, are certainly plesiomorphic among Australian *Monomorium*. The elongate postpetiole in *M. kilianii* and similar species may represent a later development.

Taxonomic analysis of *Monomorium*

Materials and methods

Material examined

Specimens borrowed from major Australian museums and other institutions included pinned and wet material, and were sorted phenotypically. Ants were examined to see if they belonged to the genus *Monomorium* as defined by Bolton (1987). Specimens referable to *M. flavigaster* (Clark 1938) and related species are not now regarded as *Monomorium* (see 'Taxonomic position of *M. flavigaster* (Clark)' in this work). Specimens belonging to the genus *Monomorium sensu stricto* were placed in species or species-groups on the basis of shared characters (in the sense of attributes, Davis and Nixon 1992).

[Note: '2+3' refers to one pin bearing two specimens and one pin bearing three specimens; '2×3' refers to two pins, each bearing three specimens.]

Distribution data

The geographic data from each specimen label was used for the generation of distribution maps. Localities could not be identified in some cases. Other localities are remote from human habitation, and their latitudes and longitudes can be regarded as of only approximate accuracy.

Type specimens

Type specimens were sought from institutions mentioned in the literature as the depositories. The types of *M. bicornis* (Forel 1907a) and *M. whitei* (Wheeler 1915b) could not be located and these are believed destroyed. In addition, the types of *M. occidaneum* (Crawley 1922) and *M. rubriceps extremigrum* (Forel 1915) were not made available.

Sources of borrowed material

The following institutions provided material. An asterisk (*) denotes collections containing types.

AMS	Australian Museum, Sydney, NSW, Australia
ANAC	Alan Andersen Personal Ant Collection, Darwin, NT, Australia
ANIC	Australian National Insect Collection, CSIRO Division of Entomology, Canberra, ACT, Australia*
BMNH	The Natural History Museum, London, UK*
HNHM	Museum Nationalis Hungarici, Budapest, Hungary*
JDM	The Jonathan Majer Ant Collection, Curtin University of Technology, Bentley, Western Australia, Australia
JTLC	John T. Longino Personal Ant Collection, Evergreen State College, Olympia, Washington, USA.
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, Mass., USA*
MHNB	Museum d'Histoire Naturelle, Genève, Switzerland*
MSNM	Museo Civico di Storia Natural 'Giacomo Doria', Genoa, Italy*
MV	Museum of Victoria, Melbourne, Victoria, Australia*
MZUSP	Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil
NMBA	Naturhistorisches Museum, Basel, Switzerland*
NMW	Naturhistorisches Museum, Wien, Austria*
NTM	Museum and Art Gallery of the Northern Territory, Darwin, Australia
QM	Queensland Museum, South Brisbane, Qld, Australia
QVMT	Queen Victoria Museum and Art Gallery, Launceston, Tasmania, Australia
SAM	South Australian Museum, Adelaide, South Australia, Australia*

WAM Western Australian Museum, Perth, Western Australia, Australia

ZMHB Zoologisches Museum an der Humboldt-Universität zu Berlin, Berlin, Germany*

Electron microscopy

Scanning electron microscope (SEM) photomicrography was used to reveal taxonomically important distinctions between the major species-groups in *Monomorium*. Specimens of workers used for electron microscopy were chosen from alcohol preserved material. These were critical point dried in an E300 Polaron critical point drying apparatus. Ants shown in Figs 179–181 and 185–199 were gold-coated in a BioRad SC502 gold sputter coater. The specimens in Figs 182–184 and 200–202 were given an additional coating of carbon in a JEE-4× vacuum evaporator before being gold coated. Combined carbon and gold coats reduced charging problems to negligible proportions.

Use of the DELTA program

Standardised descriptions of each of the Australian *Monomorium* species and species-groups were produced using the DELTA (DEscription Language for TAXonomy) computer program. Data entry followed principles outlined in the 'Delta Primer' (Partridge *et al.* 1986) and the more comprehensive 'Delta User's Guide' (Dallwitz *et al.* 1993).

For the purposes of this project, four DELTA files were created, namely, CHARS, ITEMS, SPECS and TONAT. The CHARS file contained characters considered suitable for the diagnosis of individual *Monomorium* species. (DELTA recognises five character types, i.e. integer, ordered multi-state, real number, text, and unordered multi-state.) The ITEMS file contained a list of character states for each species, itemised for all worker castes, and also queens and males (where the latter were known). The SPECS file contained specifications of character types, numbers of character states, and dependent characters. Finally, the TONAT file gave instructions for running the program. Only external morphological characters were utilised, resulting in a total of 58 worker characters, 43 queen characters and 32 male characters. Descriptions were in natural language. In this work most descriptions generated have been edited in the interests of conciseness.

Measurements and indices (Figs 1–3)

In all but a few cases involving rare species, measurements were obtained from dried specimens mounted on points. These specimens were examined under a stereomicroscope fitted with an ocular micrometer and a square graticule. Measurements were made using the ocular micrometer and were converted to the nearest 0.01 mm. The square graticule was useful for identifying the shape of structures, particularly the head capsule. To cover as much morphological variation as possible, at least 20 specimens (if available) from each 'morphospecies' were measured. Extreme values were rechecked. Drawings were made using a camera lucida fitted to a Wild Heerbrugg stereomicroscope.

Comments on characters 1–7

Seven measurements of the gross morphology (i.e. head and alitrunk) were taken for the worker. Measurements were in millimetres. The head–alitrunk–petiole–postpetiole length (HML) (Fig. 1) consisted of three combined measurements. The first was an adjusted Weber's length (WL), in which the measurement was taken from the anterior base of the promesonotal hump (i.e. where the occiput of the head would extend if the head were tilted upwards to its full extent) to the apex of the metapleural lobe. This measurement was performed with the ant in lateral view. The second measurement was the length of the combined petiole and postpetiole (measured from the apex of the metapleural lobe to the posteromedial margin of the postpetiole). This

measurement was also performed with the ant in lateral view. The third measurement was head length. (The gaster was not included in measurements as its length can vary with the physiological status of the ant.) The head length (HL) (Fig. 2) is defined as the length of the head capsule (in face view) measured in a straight line from the midpoint of the anterior clypeal margin to the midpoint of the occipital margin. The head width (HW) (Fig. 2) is the maximum width of the head in full-face view, disregarding the bulge made by the eyes.

The cephalic index (CeI) was determined by the formula:

$$\text{CeI} = \text{HW}/\text{HL} \times 100$$

The antennal scape length (SL) (Fig. 2) is the maximum length of the appendage, excluding the condylar bulb and the neck distal of the condylar bulb. Provision was made for the considerable curvature of this organ in some taxa. The right scape was measured in all cases, except where this organ was damaged or obscured. In the latter instance the left scape was measured.

The scape index (SI) was determined by the formula:

$$\text{SI} = \text{SL}/\text{HW} \times 10$$

The promesonotal width (PW) (Fig. 3) is the maximum width of the promesonotum viewed from the front (i.e. so that it appeared behind the head). (The promesonotal width was easier to estimate using this method than assessing the width of the promesonotum from a dorsal aspect.)

Other characters studied (character numbers are bracketed)

Worker (Figs 1–5, 13)

Head. The following characters were selected: shape of the occiput (8–9), appearance of the frons (10), eye size and shape (11–14), number of antennal segments and appearance of the antennal club (15–16), anatomy of the anteromedian clypeal margin (17), length of the longest lateral anterior clypeal setae (18), position of the posteromedial clypeal margin (19), position of the anterior tentorial pits and shape of the frontal lobes (20–21), presence or absence of setae possibly functioning as a psammophore (22), palp formula (23), maximum number of mandibular teeth and denticles, appearance of the mandibles and nature of the basal angle of the mandible (see Figs 14a, 14b) (28–31).

Alitrunk and nodes. These characters were selected: presence or absence of the promesonotal suture (32), appearance of the metanotal groove (33), appearance and conformation of the propodeum and metapleural lobes (34–42), position and appearance of the propodeal spiracle (43–44), position of the petiolar spiracle (45), shape, appearance and height-breadth ratio of the petiolar node (46–48), presence or absence of an anteroventral process and a lobe on the petiole (49–50), height ratio of the petiole to the postpetiole (51), height-breadth ratio of the postpetiole (52), and sculpture of the postpetiole (53–54).

Other worker characters. Those selected were: pilosity of first gastral tergite (55), overall colouration (56), and degree of worker caste polymorphism (57).

Queen (Figs 6–8)

Characters 1–14 were as for the worker. However, the thoracic region of formicid queens has several characters peculiar to the reproductive castes. Those analysed for the queen were: profile, sculpture and pilosity of the mesoscutum (15–17), length-width ratio of the combined mesoscutum-scutellum (18), distance between the axillae (19), and nature of the prominent wing veins (28–30). Other morphological characters selected (20–41), were, in general, as for the worker. The remaining characters chosen were presence or absence of brachyptery (42), and evidence for ergatoid or worker-gyne intergrades (43).

Male (Figs 9–12)

The few additional characters examined for the male were head width-mesoscutal width (8), the elevation of the ocelli (11), the ratio of

the length of the first funicular segment of the antenna to the length of the second funicular segment (12), presence or absence of notauli (17) and presence or absence of parapsidal furrows (18). Remaining characters (i.e. 1–7, 9, 10, 13–16, and 19–32) were as for the worker and/or queen.

Note on type specimens

All type specimens were individually measured and analysed in the same way as non-type material. The data from types and non-types was compared. Where numerical values or character states differed from non-type material believed to be of the same species, the types were rechecked. If differences remained, a subjective decision was made on the taxonomic relationship between the two sets of material. Where the difference was regarded as trivial (e.g. pilosity on the type may have been lost through abrasion), the difference was noted for the type or was amalgamated in the description for the morphospecies. No major differences (i.e. those involving reliable characters) were noted.

***Monomorium* Mayr**

Monomorium Mayr 1855: 273–478.

Type species: *Monomorium monomorium* Bolton, 1987.

Diagnosis of worker of Australian species

Minute to moderate sized (total length c.1–6 mm) monomorphic to polymorphic myrmicine ants. Dimorphic forms not known for Australian species. Palp formula (PF) 2,3 or 2,2 for most larger *Monomorium* (i.e. ‘*Chelaner*’), 1,2 or rarely 2,2 for small *Monomorium*. Mandible with two to six teeth and denticles that normally decrease in size from apex to base; basal tooth enlarged and broader than preceding non-apical teeth in a few species; sometimes reduced to minute offset denticle in other species. Median clypeal seta usually conspicuous, sometimes difficult to distinguish from surrounding setae; rarely, a pair of setae straddle the anteromedian clypeal midpoint. Median seta occasionally offset, usually to left of midpoint (seen in full-face view). Clypeus raised medially, the raised section longitudinally bicarinate; carinae often distinct but sometimes reduced, blunt and rounded, or represented by several small ridges. Frontal carinae diverging slightly posteriad, absent behind frontal lobes. Frontal lobes typically straight in midsection, occasionally slightly sinuate, rarely diverging. Antennal scrobes absent. Antennae 10-, 11- or 12-segmented; club usually with three distinct segments; occasionally antenna without distinct club, but club never two-segmented. Eyes conspicuous, moderate to large in all unequivocally Australian species. Viewed from front, eyes mostly in anterior sector of head capsule, occasionally situated at midline or slightly posteriad of midline of head. Viewed laterally, eyes situated in front of, at, or behind midline of head.

Metanotal groove present or absent, most commonly deeply impressed. Propodeal dorsum rounded into declivitous surface, angulate, denticulate or (rarely) spinose at propodeal angle. Propodeum unarmed in all *Monomorium*

with PF of 1,2. Propodeal spiracle circular or nearly so, usually situated near midlength of sclerite; located near declivitous surface of propodeum in *M. insolescens*, and slightly anterior of midlength in a few other taxa. Metapleural glands of moderate size, hypertrophy never marked. Metapleural lobes typically distinct; usually small and rounded; occasionally prominent and forming acute angles, or present as laminae extending to or nearly to propodeal angle, but never produced as spines. Fore coxa larger than middle and hind coxa. Petiole with anterior peduncle; petiolar spiracle slightly in front of, or at node in most Australian *Monomorium*, but well in front of node in some species. Petiolar node cuboidal to narrowly cuneate in shape; usually conical, cuneate or tumular and narrowly rounded above. Node frequently inclined anteriorly or posteriorly. Petiolar peduncle often with small anteroventral process in the form of a spur or tapering carina; less commonly this process vestigial or lacking. Anteroventral margin of postpetiolar sternite usually conspicuous in larger species; rounded and inconspicuous in species with elongate postpetiole, and in smaller *Monomorium*. Gaster dorsoventrally compressed. Sting strongly to weakly developed, lacking lamelliform appendages at an angle to long axis of sting.

Diagnosis of queen of Australian species

Always larger than conspecific worker. Palp formula, number of mandibular teeth and denticles, and number of antennal segments as for conspecific worker. Ocellar triangle of three ocelli present in all specimens examined. Eyes usually large (larger than in conspecific worker), commonly elliptical, but circular, ovoid and elongate eye shapes also occur.

Mesoscutum in profile mostly evenly convex anteriorly and thereafter flattened; occasionally uniformly convex or flattened. Mesoscutal pilosity consists of dense incurved setulae and setae in most taxa, but occasionally of sparse setae. Mesoscutum often smooth and shining, but may be microreticulate, striolate or a combination of latter two states. Length-width ratio of mesoscutum and scutellum combined ranges from near 2:1 to near 4:3. Axillae usually well separated, occasionally contiguous or nearly so. Propodeal sculpture often present; frequently more marked than in conspecific worker. Dorsal face of propodeum nearly always sloped with wedge-shaped flattening, rarely gently convex or obliquely flattened. Propodeal processes absent, or present as small denticles or sharp flanges, or as sharp spines (*M. sculpturatum*). Wing veins tubular and strongly sclerotised in 'Chelaner' groups; predominantly depigmented in *M. rothsteini* and small species with PF of 1,2. Vein m-cu usually present entire or, rarely, as appendix among 'Chelaner'. In *M. rothsteini* this vein is marked by a shadow, and in small *Monomorium* vein m-cu is always absent. Latter groups and *M. rothsteini* also lack cross-vein cu-a, that is present in most 'Chelaner'. Configuration of

female petiole as for conspecific worker. Numerous species with brachypterous females; ergatoid females less common, but found occasionally; e.g. in *M. kilianii*, *M. tambourinense* and *M. rubriceps* groups; these specimens smaller than normal females.

Diagnosis of male of Australian species

Among 'Chelaner' males usually about same size as workers, but can be larger or smaller. In *M. rothsteini* and small species with PF of 1,2 males invariably much larger than conspecific workers. Head width mostly as wide as or wider than mesoscutal width, occasionally narrower. Eyes always very large and protuberant; elliptical eyes predominate, but circular or subcircular and slightly reniform eye shapes also occur. Ocelli conspicuous, turreted in some groups. Antenna 13-segmented. Scape and first funicular segment more or less cylindrical in Australian *Monomorium* males, never distinctly globose. Ratio of length of first funicular segment of antenna to second funicular segment 1:2–1:4 in most 'Chelaner' (longest in large desert forms), 2:5 to 1:2 in *M. rubriceps*, *M. rothsteini* and small *Monomorium*. Number of teeth and denticles two to five.

Mesoscutum usually evenly convex in profile, occasionally convex anteriorly thereafter flattened, or uniformly flattened, shagreenate in appearance. Dorsal surface of mesonotum commonly finely microreticulate with appearance, or striolate and microreticulate, but smooth or reticulate in a few taxa. Where mesoscutum sculptured, polished median strip often present. Mesoscutal pilosity usually consists of long dense setae, or medially in-curved short setae, more rarely setae and setulae sparse or absent. Parapsidal furrows distinct in most 'Chelaner', usually vestigial in small *Monomorium*. Notauli present or absent among 'Chelaner' (may be incomplete), but appear to be always lacking in small *Monomorium*. Axillae commonly well separated, never contiguous in Australian species. Wing veins usually as for alate female. Petiole always nodiform, petiolar spiracle positioned in pedicel well anteriorly of node in several desert species, positioned in or slightly anteriorly of node in remaining groups.

Australian species-groups

The Australian *Monomorium* fauna consists of three clear aggregations of species. The first of these is the autochthonous 'Chelaner' element. Several 'Chelaner' species exhibit primitive features shared with some South American taxa. These include an anteriorly situated petiolar spiracle, a triangular mandible with up to six teeth, and the presence of complete notauli on the male mesoscutum. Overall, six species-groups can be identified among the 'Chelaner' aggregations, and these include some easily recognisable complexes (e.g. the *gilberti* complex within the *rubriceps*-group, and the *longiceps* complex) (see Table 2 for details of the proposed groups and their constituent taxa).

Table 2. Synonymic list of Australian *Monomorium*
(Species recognised in this work are shown in bold; synonymised forms in regular font)

<i>bicorne</i> -group (7 spp.)	<i>falcatum</i> -group (4 spp.)	<i>insolens</i> -group (1 sp.)	<i>kilianii</i> -group (5 spp.)	<i>longinode</i> -group (4 spp.)	<i>monomorium</i> -group (17 spp.)	<i>rubriceps</i> -group (21 spp.)
<i>anthracinum</i> , sp. nov.	<i>decuria</i> , sp. nov.	<i>insolens</i> Wheeler	<i>crinitum</i> , sp. nov.	<i>bifidum</i> , sp. nov.	<i>albidum</i> , sp. nov.	<i>albipes</i> , sp. nov.
<i>bicorne</i> Forel	<i>elegantulum</i> , sp. nov.		<i>kilianii</i> Forel	<i>capito</i> , sp. nov.	<i>anderseni</i> , sp. nov.	<i>bihamatum</i> , sp. nov.
<i>niger</i> McAreevey (unav.)	<i>falcatum</i> (McAreevey)		<i>kilianii</i> Forel	<i>flavonigrum</i> , sp. nov.	<i>arenarium</i> , sp. nov.	<i>brachythrix</i> , sp. nov.
<i>macaraveyi</i> Eitershank syn. nov.	<i>lacunosum</i> , sp. nov.		(misspelling)	<i>longinode</i> , sp. nov.	<i>carinatum</i> , sp. nov.	<i>burchera</i> , sp. nov.
<i>majeri</i> , sp. nov.			<i>kilianii</i> subsp. <i>obscurillum</i> Viehmeyer syn. nov.		<i>castaneum</i> , sp. nov.	<i>centrale</i> Forel
			<i>petiolatum</i> , sp. nov.		<i>discolorum</i> , sp. nov.	<i>draculai</i> , sp. nov.
<i>pubescens</i> , sp. nov.			<i>shattucki</i> , sp. nov.		<i>eremophilum</i> , sp. nov.	<i>durskoppinense</i> , sp. nov.
<i>rufonigrum</i> , sp. nov.			<i>tambourinense</i> Forel		<i>fieldi</i> Forel	<i>euryodon</i> , sp. nov.
<i>striatifrons</i> , sp. nov.			<i>howense</i> Wheeler syn. nov.		<i>donisthorpei</i> Crawley syn. nov.	<i>gilberti</i> Forel
<i>whitiei</i> Wheeler					<i>laeve</i> <i>r. nigritus</i> Forel syn. nov.	<i>gilberti</i> var. <i>medianibra</i> Forel syn. nov.
<i>armstrongi</i> McAreevey syn. nov.					<i>luce</i> st. <i>fraterculus</i> Santschi syn. nov.	<i>turneri</i> (Forel) syn. nov.
					<i>laeve</i> Mayr	<i>leae</i> Forel
					<i>broomense</i> Forel syn. nov.	<i>flavipes</i> Clark syn. nov.
					<i>ilia</i> Forel syn. nov.	<i>hemiphacum</i> Clark
					<i>illa</i> v. <i>lamingtonensis</i> Forel syn. nov.	<i>insularis</i> Clark syn. nov.
					<i>megaloops</i> , sp. nov.	<i>legulus</i> , sp. nov.
					<i>micula</i> , sp. nov.	<i>longiceps</i> Wheeler
					<i>nanum</i> , sp. nov.	<i>macarthuri</i> , sp. nov.
					<i>rolfssteini</i> Forel	<i>nightcapense</i> , sp. nov.
					<i>rolfssteini</i> v. <i>humilior</i> Forel syn. nov.	<i>nigriceps</i> , sp. nov.
					<i>rolfssteini</i> v. <i>lida</i> Forel syn. nov.	<i>paranlarcticum</i> , sp. nov.
					<i>rolfssteini</i> v. <i>doddi</i> Santschi syn. nov.	<i>ravenshoense</i> , sp. nov.
					<i>subapterum</i> Wheeler syn. nov.	<i>rubriceps</i> Mayr
					<i>subapterum</i> var. <i>boggschi</i> Wheeler syn. nov.	<i>rubriceps</i> var. <i>rubrum</i> Forel syn. nov.
					<i>silaceum</i> , sp. nov.	<i>rubriceps</i> var. <i>cinctum</i> Wheeler syn. nov.
					<i>stictonotum</i> , sp. nov.	<i>sanguinolentum</i> Wheeler syn. nov.
					<i>sordidum</i> Forel	<i>rubriceps</i> var. <i>extreminigrum</i> Forel
					<i>foreti</i> Viehmeyer syn. nov.	<i>sculpturatum</i> Clark
					<i>microm</i> Crawley syn. nov.	<i>xantheklemma</i> , sp. nov.
					<i>rolfssteini</i> var. <i>squamigena</i> Viehmeyer syn. nov.	(<i>incertae sedis</i>) <i>occidaneus</i> Crawley
					<i>rolfssteini</i> var. <i>testum</i> Wheeler syn. nov.	
					<i>sordidum</i> subsp. <i>nigriventris</i> Forel syn. nov.	
					<i>sydneyense</i> Forel	
					<i>barretti</i> Santschi syn. nov.	
					<i>fraterculus</i> var. <i>barretti</i> Santschi syn. nov.	
					<i>sydneyense</i> subsp. <i>nigella</i> Emery syn. nov.	

Here, a cluster of taxa is defined as a 'species-group' on the basis of several shared structural characters that appear to be synapomorphies for the group. 'Species-complexes' are defined by evident similarity, such that the component species can often only be separated on the basis of one or two minor characters (e.g. colour pattern or small but consistent differences in sculpture). Species-groups have either been assigned names already provided by Bolton (1987), or have been named after the earliest described species. The name of the most widespread and abundant taxon has been assigned to species-groups containing only undescribed species.

The species-groups identified here include three that are given support from the cladistic analysis reported earlier in this paper (i.e. the *bicorne*-, *kilianii*-, and *monomorium*-groups). Almost certainly *M. falcatum*, *M. longinode*, sp. nov., *M. rubriceps* and their allies represent three additional species-groups, and *M. insolescens* may constitute an additional group. The phylogenetic affinities of taxa clustered around *M. longiceps* are uncertain, but this complex shares several synapomorphies associated with members of the *rubriceps*-group. The *bicorne*-group includes species associated by Bolton (1987) with *M. falcatum*, but several important characters separate these two sets of taxa. Most notably, the pilosity and sculpture differ markedly. Moreover, the primitive mandibular dentition in the *falcatum*-group appears to be five (*M. decuria*, sp. nov.), though it varies from three to five. Taxa in the *bicorne*-group always have four teeth. The species-groups originally lumped together under '*Chelaner*' will certainly require further revision. Additional information gained from the accurate identification of reproductives would be most helpful.

The *rubriceps*-group consists of those species linked by Bolton (1987) with *M. forcipatum*. The *rubriceps* and *gilberti* complexes are predominantly arboreal compared with a mainly terrestrial habit for the remainder of the *rubriceps*-group. The relatively small morphological differences between the *rubriceps*–*gilberti* complexes and taxa associated with *M. laeve* may mask greater genetic differences. *Monomorium crinitum*, sp. nov. possesses the elongate postpetiole of the *kilianii*-group, but has the general habitus of the *rubriceps*-group. Phylogenetically, this species may occupy an intermediate position between these two sets of taxa, although the cladistic analysis reported on in this work identifies it closely with *M. kilianii*.

The second element corresponds to the *monomorium*-group of Bolton (1987), though it is more morphologically variable on this continent than the species dealt with in Bolton's key to the Afrotropical members of the *monomorium*-group. Most of the constituent taxa are probably indigenous, though a few of the most abundant species, e.g. *M. fieldi* and *M. laeve*, may also occur in other Indo-Pacific countries. (I have seen tiny, yellow *Monomorium* from Malaysian rainforests that can scarcely

be separated from *M. laeve*.) *Monomorium rothsteini*, *M. sordidum* and *M. megalops*, sp. nov. possess more plesiomorphic features than the remainder of the Australian members of the *monomorium*-group. This element is the most strongly supported in the cladistic analysis reported above, with more than half-a-dozen unambiguous synapomorphies shared by members of the group.

As mentioned previously, Bolton's (1987) key to the *monomorium*-group does not fit the Australian fauna very well. For example, *M. sydneyense* sometimes has sculptured mandibles, and *M. nanum*, sp. nov. and associated species have reniform or anteriorly pointed eyes. Taxonomic features of the latter two groups leads to the suggestion that they are closely related to *M. laeve*, *M. fieldi* and the other taxa mentioned by Bolton as belonging to the *monomorium*-group, but they are excluded by the descriptions in his couplets. *Monomorium nanum* and other Australian members of the *monomorium*-group are superficially similar to species in the Afrotropical *setuliferum*-group, but differ in certain important respects (e.g. size, and the most common antennomere count of 11 in the Australian species compared with a uniform count of 12 in the *setuliferum*-group). The eye shape is probably an example of convergent evolution.

The small Australian *Monomorium* pose particular difficulties for taxonomic analysis, not only because of their small size, but because of the probable convergence of many character states in many species. This may suggest relatively recent speciation. Unlike the more habitat-specific, larger '*Chelaner*', nearly all of the *monomorium*-group members are abundant and widespread.

The third element includes species recently introduced into this country, usually by human agency. The *destructor*-group is represented in Australia only by the naturalised *M. destructor*, the *salomonis*-group by *M. pharaonis*, and the *monomorium*-group by *M. floricola* and possibly *M. intrudens*. The *fossulatum*-group is certainly represented by *M. australicum*, a probable import, and by at least one, if not two other species (i.e. *M. fossulatum* and possibly *M. subcoecum*). While these exotic species are included in the key to Australian *Monomorium* workers, discussion is limited to the members of the *fossulatum*-group. This is because *M. australicum* is the only species from the third element described from Australian material.

Key to *Monomorium* species found in Australia

The following key to *Monomorium* workers is comprehensive and covers all taxa, including exotic species, known to occur in Australia. However, exotic species are not included in the discussion of individual species below. Only those figures with structures or dimensions relevant to the key are mentioned. Characters mentioned for exotic species belonging to non-Australian species-groups are sufficient only to identify the individual species occurring in Australia,

and do not characterise extralimital members of those species-groups. No key is provided here for queens and males, as only a subset of these forms within the Australian fauna can be assigned to species.

1. Antenna 10-segmented *M. decuria*, sp. nov.
– Antenna with more than 10 segments. 2
2. Antenna 11-segmented. 3
– Antenna 12-segmented. 22
3. Eye minute, with 1 or 2 ommatidia. 4
– Eye moderate to large, with many ommatidia. 6
4. Promesonotum distinctly humped, mesopleuron shining with little or no sculpturing. *M. australicum* Forel
– Promesonotum flattened posteriad, mesopleuron and lateral surfaces of propodeum usually microreticulate. 5
5. Mesopleuron shining and unsculptured (series from Cannon Vale, Qld). *M. cf. subcoecum* Emery
– Mesopleuron matt and microreticulate. *M. cf. fossulatum* Emery
6. Viewed in profile, eye distinctly oblique, often reaching to venter of head capsule, distance from mandible usually much less than length of eye. 7
– Viewed in profile, eye situated along longitudinal axis of head capsule, distance from mandible at most only slightly less than length of eye. 8
7. PF 2,2; head square (Cel 91–102) (Fig. 137). *M. eremophilum*, sp. nov.
– PF 1,2; head rectangular (Cel 78–90) (Figs 140, 141). *M. nanum*, sp. nov.
8. Propodeum distinctly cuboidal, or with metapleural lobes lamellate and extending to or near propodeum; propodeal and mesopleural sculpture often shagreenate-punctate 9
– Propodeum more or less rounded, with small, inconspicuous metapleural lobes; propodeal and mesopleural sculpture never shagreenate-punctate, usually absent, if present confined to a few striae, particularly around the katepisternum. 15
9. Propodeum strongly laterally compressed with diagonal impression from metanotal groove to bulla of metapleural gland, dorsal and lateral surfaces of propodeum separated by carina along entire length, dorsal face of propodeum attenuated anteriorly; dark brown with yellow legs (northern species) (Fig. 136). *M. carinatum*, sp. nov.
– Propodeum not as above; colour variable. 10
10. Smooth and shining with only vestigial striae; mandible with three distinct teeth; eye rather small (approx. width of antennal scape); propodeum with declivitous face long and oblique, carinate at sides and sometimes with small lamellae at propodeal angle; anterior clypeal margin rounded; long erect and suberect setae absent from trunk; colour tawny (Figs 135, 144). *M. arenarium*, sp. nov.
– Propodeum shagreenate or otherwise sculptured; mandible typically with four teeth and denticles; clypeus usually distinctly bicarinate, clypeal carinae often produced as small denticles. If anterior clypeal margin rounded, then eye large; colour variable. 11
11. Yellow species with erect and suberect setae on head and alitrunk; propodeum cuboidal; eye large (Fig. 130) ... *M. silaceum*, sp. nov.
– Never with above combination of characters; if yellow with a cuboidal propodeum and large eye, erect and suberect setae absent from head and alitrunk 12
12. Viewed in profile, promesonotum flattened and truncated; eye generally moderate in size; erect and suberect setae rarely present on head and alitrunk (Figs 123, 139) ... *M. sydneyense* Forel (part)
– Viewed in profile, promesonotum rounded, more elongate; eye size moderate or large; erect and suberect present or absent on head and alitrunk 13
13. Pale yellow; minute (HML <1.15 mm); eye large (Figs 123, 139) .
..... *M. micula*, sp. nov.
– Dark brown or russet species (head and gaster often darker than alitrunk); never pale yellow; generally larger (HML 1.05–1.55 mm); eye size large or moderate 14
14. Eye large, reniform (Figs 124, 142) *M. stictonotum*, sp. nov.
– Eye moderate, elliptical (Fig. 131) *M. aithoderum*, sp. nov.
15. Eye large and reniform, with posterior margin of eye emarginated .
..... *M. castaneum*, sp. nov.
– Eye moderate or large, elliptical 16
16. Erect and suberect setae absent from head and alitrunk 17
– Erect and suberect setae present on head and alitrunk 18
17. Eye large (Figs 121, 129) *M. disetigerum*, sp. nov. (part)
– Eye moderate (Figs 123, 139) *M. sydneyense* Forel (part)
18. Long erect and suberect setae lacking on cephalic vertex and propodeum; promesonotum with one pair of long erect setae on humeral angles; long, erect and suberect setae occasionally present on alitrunk and frons; eye large; always yellow (Figs 121, 129) *M. disetigerum*, sp. nov. (part)
– Cephalic vertex, promesonotum and propodeum with multiple, long erect and suberect setae; eye usually moderate; yellow, brown or bicoloured yellow or yellow-brown and dark brown ...
..... 19
19. Head, alitrunk and waist segments bright yellow, gaster shining dark brown, often iridescent in some lights (introduced; NE Qld) *M. cf. intrudens* F. Smith
– Colour not as above; either concolorous yellow or brown, or with both head and gaster darker than alitrunk, or tawny yellow with light brown gaster 20
20. Brown to dark brown; propodeum usually relatively short and smoothly rounded (Figs 110, 111) *M. fieldi* Forel
– Almost invariably yellow; propodeum usually relatively elongate. (only known brown specimens, from Mt Cook, NE Qld, have typical long propodeum of *laeve* 21
21. Petiolar node conical; postpetiole small and rounded; propodeal spiracle small to moderate in size (mainland Australia) (Fig. 119) *M. laeve* Mayr
– Petiolar node and postpetiole cuneate in profile, broadly flattened in full-face view; propodeal spiracle usually large and conspicuous (Kimberley region and NT only) (Figs 120, 125) ...
..... *M. anderseni*, sp. nov.
22. Number of mandibular teeth two (big-headed northern species with a pair of stout clypeal teeth) (Figs 63, 70) *M. bifidum*, sp. nov.
– Number of mandibular teeth and denticles more than two 23
23. Number of mandibular teeth and denticles three 24
– Number of mandibular teeth and denticles four to six 26
24. Petiolar node elongate and barrel-shaped (Fig. 64) *M. capito*, sp. nov.
– Petiolar node cuneate or tumular 25
25. Petiolar node cuneate; anterior clypeal margin broadly and shallowly emarginate with median clypeal carinae produced, at most, as pair of blunt denticles; metanotal groove present as distinct and deeply impressed trough between promesonotum and propodeum (Figs 108, 115) *M. rothsteini* Forel
– Petiolar node tumular and inclined anteriorly; anterior clypeal margin emarginate with median carinae produced apically as pair of pronounced teeth (known from one locality in central NSW) (Figs 56, 62) *M. falcatum* (McAreevey)
26. Eye elongate or reniform, much longer than wide; HW <0.55 mm; brown or dark brown species 27
– Eye circular, subcircular, elliptical or ovoid; HW usually >0.55 mm; colour variable 28
27. Eye elongate, reaching almost to mandible; alitrunk, propodeum and petiole strongly microreticulate; pilosity on promesonotum

- and propodeum consisting of dense, short setae; colour uniform dark brown (Fig. 55) *M. anthracinum*, sp. nov.
- Eye reniform; microreticulation on body surface less marked and confined to katapisternum and propodeum, otherwise smooth and shining; pilosity consisting of sparse erect and suberect setae; colour brown or tawny orange with dark brown gaster (Figs 117, 118) *M. megalops*, sp. nov.
28. Petiolar node long and low, barrel-shaped (southwestern WA) . . . 29
- Petiolar node variable, usually cuboidal, conical, cuneate or tumular, but not as above 30
29. Head capsule trapezoidal in full face view, narrowest at vertex; frons longitudinally striate with combination of appressed setulae and erect and suberect setae; promesonotal sculpture in form of microreticulation, striolae and striae on mesopleuron, and striolae on posterodorsal surface; head orange, alitrunk, petiole and postpetiole dark brown to black, gaster bright yellow, legs brown (Figs 65, 71) *M. flavonigrum*, sp. nov.
- Head capsule rectangular in full face view; frons longitudinally striate and reticulate with combination of incurved decumbent and subdecumbent setulae and erect and suberect setae; promesonotal sculpture in form of microreticulation and rugosity over entire promesonotum; otherwise coloured (usually a combination of a tawny or red head and alitrunk with some brown infuscation, and dark brown or black gaster) (Fig. 72) *M. longinode*, sp. nov.
30. Petiolar peduncle elongate and very thin, tapering towards its articulation with propodeum; PF 2,2; number of teeth and mandibular denticles 4 31
- Petiolar peduncle not thin and tapering as above; other features variable 32
31. Viewed in profile, post-petiole elliptical or cuboidal and rounded above (Fig. 79) *M. shattucki*, sp. nov.
- Viewed in profile, post-petiole without node and attenuated anteriorly, much longer than high (Fig. 80) *M. petiolatum*, sp. nov.
32. Very small (HML <2 mm); elongate, smooth and shining; viewed in profile, postpetiolar node of similar size to or slightly smaller than petiolar node; dorsum of propodeum without sculpture (introduced to Australian tropics) *M. floricola* (Jerdon)
- Usually larger, but if HML <2 mm, either dorsum of propodeum sculptured, or post-petiole much shorter than petiole when seen in profile 33
33. Anteromedian margin of clypeus a broadly U-shaped cleft between the median clypeal carinae that are often produced as teeth, denticles or lobes (includes arid and semi-arid graminivores, e.g. polymorphic species with disproportionately large, square heads in major caste; generally mat in appearance with rugose alitrunk) 34
- Anteromedian margin of clypeus either convex and protuberant, straight, slightly emarginate, or shallow V-shaped groove; at most, median clypeal carinae (if present) produced as weak lobes or denticles (includes mainly wet sclerophyll and rainforest species, often smooth and shining in appearance) 51
34. Median portion of clypeus protuberant, clypeal carinae produced as two spinose, parallel teeth (Mt Tozer, north Qld) (Figs 86, 88) . . . *M. draculai*, sp. nov.
- Conformation of clypeus not as above 35
35. Anteroventral postpetiolar process conspicuous as large, obliquely projecting lip; petiolar node strongly inclined posteriorly, posterior face of node much shorter than anterior face; alitrunk in profile forming an almost uninterrupted arc from cervical sclerite to metapleural lobe (northern Australia) . . . *M. insolescens* Wheeler
- Anteroventral postpetiolar process visible, but usually small; posterior face of petiolar node about same length as anterior face or only slightly shorter; alitrunk not as above, metanotal groove often deeply impressed 36
36. Petiolar node cuboidal or nearly so, about as high as wide; postpetiole cuboidal or rounded in outline 37
- Petiolar node conical, cuneate, or tumular, usually tapered dorsally, but in profile always higher than wide; postpetiole rounded or slightly elongate 42
37. Propodeum armed with small denticles (reddish-orange species, semi-arid woodland) (Fig. 84) . . . *M. longiceps* Wheeler (part)
- Propodeum unarmed 38
38. Smooth and shining in appearance, with sculpture confined to mesopleuron and propodeum 39
- Usually sculptured and mat in appearance; if shining, then head capsule and promesonotum foveate and striolate 40
39. Head, promesonotum, gaster and appendages dark brown, propodeum, petiole and postpetiole crimson; median clypeal carinae a series of ridges and not produced beyond lateral margin of clypeus (Fig. 112) *M. gilberti* Forel
- Body uniformly brick-red, legs tan, gaster with a pale, transverse brown band at junction of first and second gastral tergites; median clypeal carinae produced as stout denticles (Fig. 103) *M. parantarcticum*, sp. nov. (part)
40. Frons and alitrunk shining and polished in appearance with scattered foveae and striolae; distinct lateral striae present on propodeum; median clypeal carinae raised and distinct, produced as blunt lobes; petiolar node rugose (SA and WA: only known specimens from Clare Valley and north of Kellerberrin) (Fig. 66) *M. xantheklemma*, sp. nov.
- Frons and alitrunk mat in appearance, with promesonotum, propodeum and petiole either rugose or granulose-reticulate; clypeal carinae developed as stout, incurved denticles or teeth . . 41
41. Frons longitudinally striate; promesonotum microreticulate and rugose; red or reddish orange; posterior promesonotum, propodeum, petiole and postpetiole strongly infuscated with black (Figs 198, 199) *M. legulus*, sp. nov.
- Frons finely granulose-microreticulate and striolate; promesonotum finely granulose-microreticulate; concolorous reddish-orange, without infuscation . . . *M. bihamatum*, sp. nov.
42. Smooth and shining rainforest species; sculpture confined to mesopleuron and sides of propodeum; most specimens with five mandibular teeth and denticles; occasionally four 43
- Arid and semi-arid species of mat appearance; head, alitrunk, petiole and post-petiole strongly sculptured; *M. longiceps* usually with five teeth and denticles, remaining species always with four stout mandibular teeth 44
43. Median clypeal carinae often a series of ridges, not produced beyond lateral margins of clypeus (Figs 107, 113) *M. rubriceps* Mayr (part)
- Clypeus bicarinate, median clypeal carinae produced as stout denticles (Figs 96, 103) . . . *M. parantarcticum*, sp. nov. (part)
44. Frons densely foveate and microreticulate; propodeal declivity strongly delimited anteriorly by bevelled surface with well-defined anterior border (Figs 18, 57) *M. elegantulum*, sp. nov.
- Frons not foveate, propodeal declivity not as above 45
45. Head, alitrunk and gaster covered with decumbent setulae only, erect and suberect setae lacking; small (HML >1.55 mm) (southwest WA) *M. pubescens*, sp. nov.
- Erect and suberect setae always present on body; larger (HML <1.55 mm) 46
46. Head capsule rectangular (CeI 76–84); usually five teeth and denticles, rarely four; monomorphic; colour tawny orange or red, often with some infuscation around propodeum, petiole and postpetiole, gaster orange appendages brown (Fig. 84) *M. longiceps* Wheeler (part)
- Head capsule square and massive (CeI often >90); always with four stout teeth; monomorphic or polymorphic or displaying monophasic allometry; colour variable 47
47. Monomorphic; colour predominantly orange or red 48

- Polymorphic or displaying monophasic allometry, with considerable size range between largest and smallest workers; colour variable but black, brown, black and orange and black and red predominate 49
- 48. Anteromedian margin of clypeus with two broad, longitudinally striate lobes; frons longitudinally striate with erect and suberect setae, setae short (= width of eye); propodeum rounded, transversely striate; crimson to orange (Figs 53, 61) *M. striatifrons*, sp. nov.
- Median clypeal carinae produced apically as pair of pronounced teeth; frons microreticulate and striolate with erect and suberect setae; propodeum smoothly rounded or angulate in profile or armed with small denticles or flanges, but without transverse striae; crimson to reddish orange with head, gaster and appendages darker (Fig. 54) (mid-western WA only) *M. majeri*, sp. nov.
- 49. Smallest minor workers dissimilar in morphology and pilosity to media and major workers; major workers rather hirsute and rugose, minor workers with shorter setae and more angulate, microreticulate propodeum; typically among major and media workers head, gaster and appendages black, dark brown or brown, alitrunk, propodeum and waist segments orange to crimson; minor workers similar in colour, or uniformly brown or dark brown; median clypeal carinae produced as single pair of lobes or denticles in major and minor workers, occasionally feebly bilobate in media workers. (Possibly a complex of two or more species is represented here.) (Figs 1, 2, 4, 5) *M. rufonigrum*, sp. nov.
- Morphology of minor, media and major workers similar, colouration never as above in major and media workers (usually either concolourous orange, brown or black, or brown with yellow gaster); median clypeal carinae always produced as bifurcated lobes or denticles 50
- 50. Eyes larger (width 0.21 – 0.36 mm, length 0.34 – 0.51 mm) [20 specimens] (Figs 51, 59) *M. whitei* Wheeler
- Eyes smaller (width 0.16 – 0.20 mm, length 0.23 – 0.32 mm) [20 specimens] (Figs 52, 60) *M. bicornis* Forel
- 51. Propodeum with two sharp spines, directed upward at angle of 45° (Fig. 93) *M. sculpturatum* Clark
- Propodeum with a most a pair of short denticles 52
- 52. Viewed in profile, postpetiole a curved, horizontal cone, narrowest at its junction with petiole and widest at or near its junction with gaster 53
- Viewed in profile, postpetiole strongly constricted both anterior and posterior, so that its greatest diameter is at its midpoint; postpetiolar shape round or square or round with slight dorsal lip facing posterior 55
- 53. Pilosity on head, alitrunk, petiole and postpetiole consisting of abundant, curved decumbent and subdecumbent setae and setulae; basal tooth usually enlarged, larger than other subapical teeth; peduncle of petiole thick; petiolar node low and conical (Fig. 87, 89) *M. crinitum*, sp. nov.
- Pilosity on head, alitrunk, petiole and postpetiole more sparse; basal tooth not enlarged; peduncle of petiole often thin; petiolar node larger, often cuneate or tumular 54
- 54. PF 2,2; frontal lobes closely approximated so that median portion of clypeus between them is less than greatest width of antennal scape; median clypeal carinae variable; often distinctly bicarinate so anteromedian clypeal border is slightly emarginate or shallow V-shaped groove (Fig. 99) *M. tambourinense* Forel
- PF 2,3; median portion of clypeus between frontal lobes slightly greater than greatest width of antennal scape; median clypeal carina a series of indistinct ridges, anteromedian clypeal margin usually elliptical and projecting well beyond lateral clypeal margins (Fig. 90) *M. kilianii* Forel
- 55. PF 1,2; small (HML 1.25–1.75 mm); four mandibular teeth and denticles; frons of head capsule and petiolar node unsculptured, smooth and shining (Figs 109, 116) *M. sordidum* Forel
- PF 2,2 or 2,3; size often larger, if small with four mandibular teeth and denticles, head and petiolar node distinctly sculptured 56
- 56. Postpetiole circular and massive, twice size of petiolar node; frons and promesonotum foveate (yellow-and-reddish-orange species known from two localities in SA) (Figs 82, 83) *M. macarthuri*, sp. nov.
- Postpetiole only as large as or smaller than petiolar node 57
- 57. Dorsum of head and entire alitrunk finely reticulate-punctate; PF 2,2 (introduced orange or yellow species, only found in highly disturbed, predominantly urban environments in Australia) *M. pharaonis* (L.)
- Sculpture not as above, species generally smooth; PF predominantly 2,3 58
- 58. Frons densely foveate and microreticulate; propodeal declivity strongly delimited anteriorly by bevelled surface with well-defined anterior border 59
- Frons not sculptured as above (sculpture often reduced with cuticle smooth and shining); propodeal declivity not as above 60
- 59. Four mandibular teeth and denticles; alitrunk with sparse pilosity mainly of appressed setulae (Fig. 57) *M. elegantulum*, sp. nov.
- Five mandibular teeth and denticles; alitrunk covered with short decumbent and subdecumbent setulae (Fig. 58) *M. lacinosum*, sp. nov.
- 60. Basal tooth much broader than other pre-apical teeth; distinctly polymorphic, with large headed major workers having rather small eyes (Fig. 91) *M. euryodon*, sp. nov.
- Basal tooth of same size or smaller than other pre-apical teeth; worker monomorphic or exhibiting monophasic allometry 61
- 61. Frons and promesonotum with many evenly spaced short (= width of eye) erect and suberect setae (Figs 76, 85) *M. brachythrix*, sp. nov.
- Pilosity consisting mainly of longer erect and suberect setae, setation less dense 62
- 62. Femur enlarged, often twice as thick as tibia; HW usually >0.80 mm (smooth, shining, medium-sized arboreal ants in *rubriceps* complex; eastern Australia) 63
- Femur not enlarged; of similar diameter to tibia or only slightly thicker; HW usually <0.80 mm (mainly terrestrial species in *leae* complex) 67
- 63. Glistening and polished in appearance, without sculpture; promesonotum flattened, with rounded margin when viewed dorsally; uniformly russet to dark brown, with amber tarsi and funiculi (NE Qld) (Fig. 105) *M. albipes*, sp. nov.
- Promesonotum usually rounded; if flattened, sculpturing present on propodeum; colour very variable, but not uniformly dark brown and rarely russet 64
- 64. Head narrow (Cel 76–82); propodeum rounded in profile with minute striolae over much of its surface; petiolar node cuboidal; postpetiole stout, almost spherical; head reddish-orange, alitrunk, petiole and postpetiole piceous, gaster orange with one or more broad transverse brown bands, appendages brown (northern NSW only) (Figs 97, 104) *M. burchera*, sp. nov.
- Head broader (Cel =86); propodeum, not sculptured as above; colour variable 65
- 65. Eye large (eye width >1.5× width of antennal scape at widest point); promesonotum flattened; katapisternum and lateral surface of propodeum with a band of faintly impressed striolae; head, alitrunk, petiole, postpetiole and appendages russet, gaster dark brown, tending to black apically (known from one series from Ravenshoe, NE Qld) (Fig. 114) *M. ravenshoeense*, sp. nov.
- Eye moderate (eye width <1.5× width of antennal scape at widest point), except in species from Nightcap Ra. that lack any

- sculpturing on alitrunk; promesonotum usually rounded profile 66
66. Eye large (eye width $>1.5\times$ width of antennal scape at widest point); scape relatively long (SI 93–96); promesonotum and propodeum unsculptured (known only from Nightcap Ra., northern NSW) *M. nightcapense*, sp. nov.
- Eye moderate (eye width $<1.5\times$ width of antennal scape at widest point); scape shorter (SI 72–88); promesonotum with microreticulation and striolae on and around katapisternum; propodeum with faint microreticulation and a few striae on lower lateral surface (Figs 107, 113) *M. rubriceps* Mayr (part)
67. Distinctly bicoloured species, with head and gaster dark brown to black; promesonotum, petiole and postpetiole orange (NE Qld; arboreal rainforest species) *M. nigriceps*, sp. nov.
- Usually concolorous; if bicoloured, without this pattern of colouration 68
68. PF 2,2; mandible with four teeth and denticles; often only three visible; propodeum unarmed (introduced species in urban or otherwise disturbed habitats) *M. destructor* (Jerdon)
- PF 2,3; four teeth always visible; propodeum usually angulate, propodeal angles often with denticles, especially in larger workers (*M. centrale*, *M. leae*) 69
69. Anteromedian margin of clypeus often projecting as narrow ellipse or rectangle, sometimes slightly emarginate, but never forming a shallow groove; clypeal denticles or lobes absent; petiolar node usually cuneate or tumular, only rarely subcuboidal or cuboidal (Figs 94–95, 101–102) *M. leae* Forel
- Anteromedian margin of clypeus forming a shallow V-shaped groove between median clypeal carinae, that are developed as denticles; petiolar node cuboidal or subcuboidal 70
70. Eye moderate in size; head capsule nearly always darker than promesonotum in full-face view, but never lighter in colour; petiolar node higher than wide and tending to subcuboidal; number of mandibular teeth and denticles usually five (minute basal denticle may occasionally be lacking) (Fig. 81)
- *M. centrale* Forel
- Eye large; head capsule lighter coloured than promesonotum in full-face view; petiolar node low and cuboidal in shape; four mandibular teeth and denticles; (known from one locality in Western Australian wheatbelt) *M. durokoppinense*, sp. nov.

The *bicorne*-group

Monomorium anthracinum, sp. nov.

(Figs 21, 55)

Material examined

Holotype. Worker, Western Australia, Avondale Reserve, Beverley, 16–23 xi. 1983, K. Brown, pitfall trap (ANIC).

Paratypes. **Western Australia:** one worker with the same data as the holotype (MCZ).

Other material examined. **Western Australia:** 1 worker, 20 km E Hyden, voucher no. 397/6MonBH27 (JDM).

Worker description

As for minor worker of *M. rufonigrum* but with the following apomorphies.

Head. Vertex of head planar; frons smooth and shining with incurved decumbent and subdecumbent setulae.

Compound eyes elongate, much longer than wide; (viewed laterally) compound eyes set posterior of midline of head capsule; eye large, eye width greater than $1.5\times$ greatest width of antennal scape. Posteromedial clypeal margin situated between anterior and posterior surfaces of antennal fossae. Mandibles smooth with piliferous punctures.

Alitrunk. Promesonotal sculpture present in form of uniform microreticulation with few mesopleural striolae; dorsal promesonotal face convex anteriorly, otherwise flattened; setulae decumbent and subdecumbent. Propodeal angle present; length ratio of dorsal face to declivitous face near 4:3 to near 1:1. Erect and suberect propodeal setae 5–10; propodeal setulae absent.

Petiole and postpetiole. Petiolar spiracle lateral and slightly anterior of petiolar node. Petiolar node tumular and inclined anteriorly. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3. Anteroventral process always present as pronounced spur. Ventral lobe always absent. Height ratio of petiole to postpetiole near 1:1; height–length ratio of postpetiole near 4:3. Sculpture present in form of microreticulation.

General characters. Colour dark chocolate, mandibles orange. Worker caste monomorphic

Holotype worker measurements. HML 1.24; HL 0.48; HW 0.44; CeI 90; SL 0.28; SI 68; PW 0.28.

Other worker measurements. HML 1.28–1.47; HL 0.52–0.57; HW 0.46–0.52; 89–91; SL 0.30–0.33; SI 64–65; PW 0.28–0.33 (2 measured).

Etymology

Greek: ‘coal-black’.

Remarks

This inconspicuous species strongly resembles minor workers of *M. rufonigrum*, sp. nov., but can be distinguished from them on the basis of eye shape (elongate versus elliptical or ovoid). A few stray workers only have been taken, and the biology of the ant is unknown.

Monomorium bicorne Forel

(Figs 22, 52, 60, 146, 167)

Monomorium bicorne Forel, 1907a: 276–277.

Monomorium (*Holcomyrme*) *niger* McAvey, 1949: 12, figs 36–41.

Chelaner bicornis (Forel); [comb. nov. Ettershank, 1966: 96].

Chelaner macareaveyi (Ettershank, 1966: 97) [nom. nov. for

Monomorium niger nec Forel, 1902: 220]; **syn. nov.**

Monomorium bicorne Forel [comb. Bolton, 1987: 300, 301].

Monomorium macareaveyi Ettershank [comb. nov. Bolton, 1987: 300, 301].

*Material examined**M. bicornis*

Holotype. Requests for the holotype ♀ from the Universität von Hamburg have not been successful. Bombing of Hamburg during WWII probably destroyed the holotype (Taylor and Brown 1985).

M. macareaveyi

Holotype. Worker (major), New South Wales, Bogan R., 9.vi.1946, [J.] Armstrong (ANIC, '*Holcomyrme niger*' McAreavey).

Paratypes. **New South Wales:** Dealate queen and worker (minor) on same pin as holotype (ANIC); 1♂, 1 alate ♀ and 2 workers, Nyngan, 10.x.1947, J. Armstrong (MV, T-15053 worker, T-15054 worker, T-15055 ♀, T-15056 ♂).

Other material examined. 40 workers, 6♀, 4♂ (ANIC); 2 workers (JDM); 22 workers (MV); 1 worker (QM); 2 workers, 1♀ (SAM); 29 workers (WAM) (see Fig. 22 for distribution).

Worker description

Head. Head square or rectangular; vertex slightly concave; frons smooth and shining with combination of appressed setulae and erect and suberect setae, or microreticulate and striolate with combination of appressed setulae and erect and suberect setae, or longitudinally striate with erect and suberect setae. Compound eyes ovoid; (viewed from front) compound eyes set in anterior half of head capsule; (viewed laterally) compound eyes set anterior of midline of head capsule; eye moderate, eye width 0.5–1.5× greatest width of antennal scape to large, eye width greater than 1.5× greatest width of antennal scape. Antennal segments 12; club gradually tapering and barely discernible. Anteromedial clypeal margin emarginate, median clypeal carinae produced apically as pair of pronounced teeth, with an additional tooth or denticle on either side. Longest lateral anterior clypeal setae long, extending beyond dorsal margin of closed mandibles. Posteromedial clypeal margin situated between anterior and posterior surfaces of antennal fossae. Anterior tentorial pits situated nearer antennal fossae than mandibular insertions. Frontal lobes parallel, straight. Venter of head capsule without elongate, basket-shaped setae. Palp formula 2,3. Maximum number of mandibular teeth and denticles: four; mandibles (viewed from front) strap-like with inner and outer edges subparallel, smooth with piliferous punctures; basal tooth not enlarged; basal angle indistinct; apical and basal mandibular margins meeting in curve.

Alitrunk. Promesonotal sculpture present in form of uniform microreticulation with few mesopleural striolae; dorsal promesonotal face evenly convex; erect and suberect promesonotal setae greater than 10; setulae appressed. Mesonotal suture visible externally as faint ridge. Metanotal groove present as distinct and deeply impressed trough between promesonotum and propodeum. Propodeal sculpture present as uniform rugosity, with well defined costulae on declivitous face of propodeum; dorsal propodeal face sloping posteriad, with wedge-shaped flattening or shallow depression that is widest between propodeal angles; processes absent (propodeum smoothly rounded in profile or

with slight hump at propodeal angle), or absent (propodeum angulate in profile); lobes present as blunt flanges. Propodeal angle absent, or present; length ratio of dorsal face to declivitous face near 2:1, or not applicable; declivitous face of propodeum flat. Erect and suberect propodeal setae >5; propodeal setulae appressed. Propodeal spiracle lateral and about midway between metanotal groove and declivitous face of propodeum; vestibule conspicuous through cuticle.

Petiole and postpetiole. Petiolar spiracle lateral and slightly anteriad of petiolar node. Petiolar node tumular and inclined posteriad; sculpture present in form of microreticulation, or present; petiolar node rugose. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3 to near 1:1. Anteroventral process present as pronounced spur, or slender carina that tapers posteriad. Ventral lobe always absent. Height ratio of petiole to postpetiole near 4:3; height-length ratio of postpetiole near 4:3 to near 1:1. Sculpture present in form of microreticulation or rugosity. Ventral process absent or vestigial.

Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour dark brown to black, gaster reddish orange through to black. Worker caste monomorphic but variable in size, with series of intercastes between largest and smallest workers (monophasic allometry).

Worker measurements. HML 2.74–4.26; HL 1.04–1.72; HW 1.04–1.68; CeI 91–106; SL 0.61–1.09; SI 59–69; PW 0.51–0.88 (50 measured).

Queen description

Head. Head square or rectangular; vertex planar; frons longitudinally striate with combination of incurved decumbent and subdecumbent setulae and erect and suberect setae. Compound eyes elliptical; (viewed from front) compound eyes set in anterior half of head capsule; (viewed laterally) compound eyes set at midline of head capsule; eye large, eye width greater than 1.5× greatest width of antennal scape.

Alitrunk. Mesoscutum in profile evenly flattened. Mesoscutal pilosity consisting of decumbent and subdecumbent setulae anteriad and erect and suberect setae posteriad; dorsal appearance of mesoscutum longitudinally striate; length-width ratio of mesoscutum and scutellum combined near 4:3. Axillae separated by distance less than half greatest width of scutellum. Propodeal sculpture present as uniform rugosity, with well-defined costulae on declivitous face of propodeum; dorsal propodeal face flattened. Propodeal processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle), or absent (propodeum angulate in profile), or present on posterior propodeal angles as small denticles or sharp flanges; lobes present as blunt flanges. Propodeal angle

absent, or present. Erect and suberect propodeal setae greater than 10; propodeal setulae decumbent and subdecumbent. Propodeal spiracle lateral and about midway between metanotal groove and declivitous face of propodeum.

Wing. Wing veins tubular and strongly sclerotised; vein m-cu present as an entire vein enclosing first discoidal cell; vein cu-a present.

Petiole and postpetiole. Petiolar spiracle lateral and slightly anterior of petiolar node, or lateral and positioned in pedicel well anterior of petiolar node. Petiolar node cuneate, dorsally rounded; sculpture present in form of microreticulation, or present; petiolar node rugose. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 1:1. Anteroventral process always absent or vestigial. Height ratio of petiole to postpetiole near 1:1 to near 4:3; height-length ratio of postpetiole near 4:3. Sculpture present in form of microreticulation; ventral process absent or vestigial.

Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour of head, alitrunk, petiole and postpetiole dark chocolate to black; appendages brown; gaster tawny yellow to black; appendages brown. Brachypterous alates not seen. Ergatoid or worker-female intercastes not seen.

Queen measurements. HML 4.37–4.73; HL 1.21–1.37; HW 1.35–1.50; CeI 108–116; SL 0.88–0.98; SI 61–70; PW 1.03–1.35 (7 measured).

Male description

Head. Head width–mesoscutal width ratio near 3:4. Compound eyes protuberant and elliptical; (viewed laterally) compound eyes set at midline of head capsule; ocelli not turreted. Ratio of length of first funicular segment of antenna to length of second funicular segment near 1:3 to near 1:4. Maximum number of mandibular teeth and denticles: three.

Alitrunk. Mesoscutum in profile convex anterior; thereafter flattened; dorsal appearance of mesoscutum finely microreticulate; mesoscutal pilosity consisting of numerous short setae, incurved medially. Parapsidal furrows present and distinct; notauli absent. Axillae separated by distance of about half greatest width of scutellum.

Wing. Wing veins tubular and strongly sclerotised; vein m-cu present as an entire vein enclosing first discoidal cell, or absent; vein cu-a present.

Petiole and postpetiole. Petiolar spiracle lateral and positioned in pedicel well anterior of petiolar node. Sculpture present in form of microreticulation; ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 3:4. Anteroventral process distinct in some individuals as slender carina that tapers posteriorly; ventral lobe always absent. Height-length ratio of

postpetiole near 4:3 to near 1:1; sculpture present in form of microreticulation; ventral process absent or vestigial.

Gaster. Pilosity of first gastral tergite consisting entirely of well-spaced appressed setulae.

General characters. Colour black; gaster amber; legs dark chocolate.

Male measurements. HML 3.29–5.02; HL 0.78–1.14; HW 0.83–1.29; CeI 103–114; SL 0.21–0.31; SI 20–30; PW 0.83–1.32 (5 measured).

Remarks

The holotype of this species was collected at Gooseberry Hill, in the Darling Ranges, Western Australia. The assigning of Western Australian worker material to *M. bicorne* is necessarily tentative, as the holotype, an apparently dealate queen, appears to have been destroyed. Furthermore, no drawing accompanies Forel's description. An old pin with three workers collected from Tammin by J. Clark has a label bearing the name *M. bicorne*, but it is not known whether Clark was responsible for the label. Nonetheless, the characteristics particularly noted by Forel, namely the clypeal teeth and the colouration, are consistent with the appearance of the worker specimens mentioned above. The general description and the dimensions also agree with putative *M. bicorne*, and are unlikely to refer to any other southwestern Australian 'Chelaner', except *M. whitei*. *Monomorium whitei*, though, normally occurs in arid and semi-arid areas well inland from the coast.

Eastern Australian material referable to *M. macareaveyi* is identical to *M. bicorne* in all respects except for the colour of the gaster (chocolate to light brown compared with bright orange or gamboge in most specimens). However, some ants from the Fleurieu Peninsula in South Australia, as well as Tardun in Western Australia, are intermediate in colouration. Therefore, there appears to be no reason to maintain two distinct taxa, especially as many other Australian *Monomorium* are highly variable in colour. Since extant material is referred to *M. bicorne* on the basis of a description without figures and on some circumstantial evidence, no neotype has been assigned.

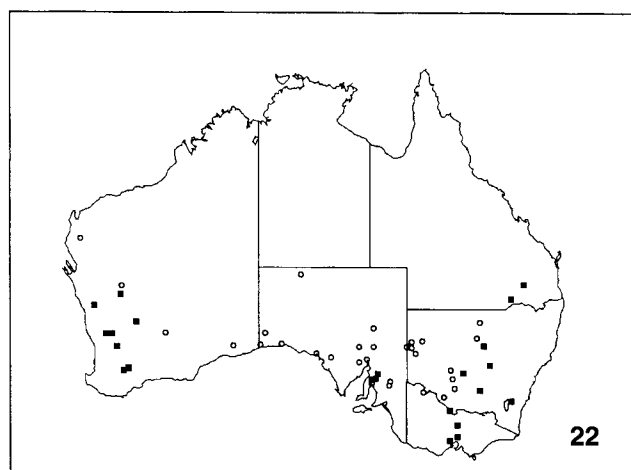
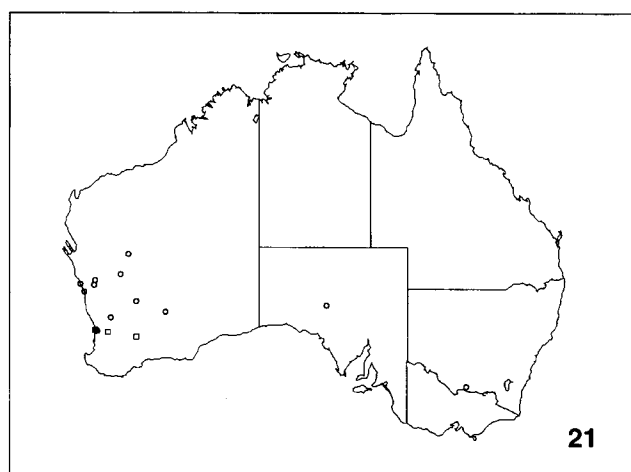
The Western Australian Department of Agriculture has workers of this species, which are said to have caused the death of poultry in southwestern country areas. The close resemblance of *M. bicorne* to *M. whitei* suggests that this species is also largely or wholly graminivorous.

Monomorium majeri, sp. nov.

(Figs 23, 54)

Material examined

Holotype. Worker (top point), Western Australia, Tardun, 90 miles E Geraldton, 22.v.1963, C. T. Mercovich, mallee 400 ft, ANIC vial 66–54 (ANIC).



Figs 21, 22. 21, Distribution of *M. anthracinum* (□), *M. pubescens* (■) and *M. rufonigrum* (○) specimens examined during this study. 22, Distribution of *M. bicornis* (■), and *M. whitei* (○) specimens examined during this study.

Paratypes. **Western Australia:** 2 workers, same data as holotype (ANIC); 3 workers, 'Woongowdy' [= Wongoody], 19.v.1963, C. T. Mercovich, ANIC vial no. 66–55 (MCZ).

Other material examined. **Western Australia:** 4 workers, 'Morowa' [= Morawa] (WAM); 5 workers, 'Woongowdy' [= Wongoody], 300 miles N of Perth (ANIC).

Worker description

As for the worker of *M. striatifrons*, but with the following apomorphies.

Head. Head cordate; vertex strongly concave; frons microreticulate and striolate with erect and suberect setae. Compound eyes ovoid; eye large, eye width greater than $1.5\times$ greatest width of antennal scape. Median clypeal carinae produced apically as pair of pronounced teeth. Basal mandibular tooth not enlarged.

Alitrunk. Promesonotal sculpture present in form of uniform microreticulation with few mesopleural striolae. Propodeal sculpture present as uniform microreticulation, with few or no striae or costulae; propodeal processes absent

(propodeum angulate in profile), or present on posterior propodeal angles as small denticles or sharp flanges. Propodeal angle absent, or present; declivitous face of propodeum flat. Erect and suberect propodeal setae >5 .

Petiole. Petiolar node tumular and inclined posteriad; sculpture present in form of microreticulation. Anteroventral process always present as pronounced spur. Height ratio of petiole to postpetiole near 4:3; height–length ratio of postpetiole near 3:4.

Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour of alitrunk, petiole and postpetiole reddish-orange to crimson, head darker (frons anteriorly infuscated in some individuals), gaster, antennae, and legs dark red-brown. Worker caste monomorphic.

Holotype worker measurements. HML 4.86; HL 1.87; HW 1.78; CeI 95; SL 1.09; SI 61; PW 0.95.

Worker measurements. HML 4.67–5.00; HL 1.75–1.99; HW 1.75–1.92; CeI 93–104; SL 1.06–1.17; SI 57–63; PW 0.69–0.90 (14 measured).

Etymology

Named in honour of Dr Jonathan Majer, of the School of Environmental Science, Curtin University of Technology, Western Australia.

Remarks

Monomorium majeri appears to have a very localised distribution in the Murchison area, where it occurs sympatrically with the rather similar *M. striatifrons*, sp. nov. When compared with the latter species, *M. majeri* can readily be distinguished by its larger eye, and the characters of the alitrunk, nodes and gaster listed above.

Monomorium pubescens, sp. nov.

(Fig. 21)

Material examined

Holotype. Worker, Western Australia, Mosman Park, 1.v.1988, B. E. Heterick, in remnant native vegetation on edge of urban golf-course (ANIC).

Paratypes. **Western Australia:** 1 worker with same data as holotype (MCZ); 1 worker, collection details as for holotype, other data 'mixed native/exotic veg., urban parkland, 393/6MonBH29' (BMNH).

Other material examined. **Western Australia:** 2 workers in alcohol with same data as holotype and paratypes.

Worker description

As for light coloured minor workers of *M. rufonigrum*, sp. nov. but with the following apomorphies.

Alitrunk. Promesonotal sculpture present in form of uniform microreticulation with few mesopleural striolae; dorsal promesonotal face convex anteriorly, otherwise

flattened; erect and suberect setae absent on promesonotum; setulae appressed. Propodeal angle present; length ratio of dorsal face to declivitous face near 2:1 to near 4:3; declivitous face of propodeum flat. Erect and suberect propodeal setae absent or very sparse; propodeal setulae appressed.

Petiole and postpetiole. Petiolar node conical, sharply tapered; sculpture present in form of microreticulation. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3. Height ratio of petiole to postpetiole near 1:1; height-length ratio of postpetiole near 2:1 to near 4:3.

Gaster. Pilosity of first gastral tergite consisting mainly of decumbent and subdecumbent setulae.

General characters. Colour of body and appendages tawny yellow, head darker. Worker caste monomorphic.

Holotype worker measurements. HML; 1.39; HL 0.53; HW 0.48; CeI 91; SL 0.36; SI 74; PW 0.30.

Other worker measurements. HML 1.35–1.51; HL 0.49–0.57; HW 0.43–0.52; CeI 88–96; SL 0.34–0.38; SI 72–79; PW 0.25–0.28 (4 measured, including alcohol specimens).

Etymology

Latin: 'the down of puberty'.

Remarks

Surprisingly, this ant is known from one series of five workers collected in the old established Perth suburb of Mosman Park, and (after completion of this study) a single worker from Rottnest Island, Western Australia. The taxon closely resembles *M. rufonigrum*, which also occurs in the Perth region, and may simply represent aberrant individuals (e.g. nanitic or callow minor workers) of this fairly common species. All individuals of *M. pubescens*, however, lack stout erect or suberect setae on the alitrunk, and are much paler than any *M. rufonigrum* minor worker I have seen.

Monomorium rufonigrum, sp. nov.

(Figs 1–10, 12, 21, 179–181)

Material examined

Holotype. Worker, Western Australia, Meekatharra, 20 May 1967, C. Mercovich, golf course, ANIC vial no. 66–43 (ANIC).

Paratypes. Western Australia: 1 ♀, 1 ♂, 4 workers, The Granites, Meekatharra, 23.v.1967, C. Mercovich (ANIC); 1 ♂, 2 workers, The Granites, Meekatharra, ANIC vial no. 66–41 (ANIC); 3 ♂, 5 workers, Mount Magnet area, 20 May 1967, C. Mercovich, golf course, ANIC vial 66.43 (MCZ); 8 workers (1 missing head), Mount Magnet area, 19.v.1967, C. T. Mercovich (BMNH).

Other material examined. **New South Wales:** 2 workers, 25 km N Barooga 34°45'S, 145°49'E (ANIC). **South Australia:** 3 workers, 50 km NNW Tarcoola (ANIC). **Western Australia:** 1 worker, near Amery Siding (JDM); 1 ♀, 30 workers, Clampton (WAM); 1 worker, 3.2 km

SSW Dongara (ANIC); 1 workers, 7 km N Dowerin (JDM); 1 ♀, 1 ♂, 3 workers, Geraldton (ANIC); 1 worker, 'Goldfields Survey' (JDM); 7 workers, Kalgoorlie (WAM); 2 workers, Kenwick (JDM); 10 workers (23.v.1963), 3 workers (23.v.1967) Pindar (ANIC); 1 ♂, 5 workers (22.v.1963), 7 ♂, 25 workers (24.v.1963), Tardun (ANIC).

Worker description

Head. Head square or rectangular; vertex slightly concave; frons microreticulate and striolate with incurved decumbent and subdecumbent setulae, or longitudinally striate with combination of appressed setulae and erect and suberect setae. Compound eyes elliptical, or ovoid; (viewed from front) compound eyes set in anterior half of head capsule; (viewed laterally) compound eyes set at midline of head capsule; eye moderate, eye width 0.5–1.5× greatest width of antennal scape to large, eye width greater than 1.5× greatest width of antennal scape. Antennal segments 12; club three-segmented. Anteromedial clypeal margin emarginate, median clypeal carinae produced apically as pair of pronounced teeth, or emarginate, median clypeal carinae produced apically as pair of pronounced teeth, with an additional tooth or denticle on either side, or emarginate, median clypeal carinae produced as pair of bluntly rounded denticles. Longest lateral anterior clypeal setae long, extending beyond dorsal margin of closed mandibles. Posteromedial clypeal margin level with posterior surface of antennal fossae. Anterior tentorial pits situated nearer antennal fossae than mandibular insertions. Frontal lobes parallel straight. Venter of head capsule without elongate, basket-shaped setae. Palp formula 2,3. Maximum number of mandibular teeth and denticles: four; mandibles (viewed from front) strap-like with inner and outer edges subparallel, striate, with piliferous punctures; basal tooth not enlarged; basal angle indistinct; apical and basal mandibular margins meeting in curve.

Alitrunk. Promesonotal sculpture present in form of microreticulation and rugosity over entire promesonotum; dorsal promesonotal face evenly convex; erect and suberect promesonotal setae greater than 10; setulae appressed. Mesonotal suture absent, or visible externally as faint ridge. Metanotal groove present as feebly impressed furrow between promesonotum and propodeum. Propodeal sculpture present as uniform microreticulation, with few or no striae or costulae, or present as uniform rugosity, with well defined costulae on declivitous face of propodeum; dorsal propodeal face flattened to sloping posteriad, with wedge-shaped flattening or shallow depression that is widest between propodeal angles; processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle), or absent (propodeum angulate in profile), or present on posterior propodeal angles as small denticles or sharp flanges; lobes present as blunt flanges. Propodeal angle absent, or present; declivitous face of propodeum flat. Erect and suberect propodeal setae greater than 10; propodeal setulae absent, or appressed. Propodeal spiracle lateral and

about midway between metanotal groove and declivitous face of propodeum; vestibule conspicuous through cuticle.

Petiole and postpetiole. Petiolar spiracle lateral and positioned in pedicel well anteriad of petiolar node. Petiolar node cuneate, dorsally rounded, or cuneate, sharply tapered; sculpture present in form of microreticulation. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3 to near 3:4. Anteroventral process present as pronounced spur, or slender carina that tapers posteriad. Ventral lobe present in some individuals. Height ratio of petiole to postpetiole near 1:1 to near 4:3; height-length ratio of postpetiole near 1:1 to near 3:4. Sculpture absent on dorsum, at least: postpetiole smooth and shining. Ventral process present and distinct.

Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour of body either uniformly brown to dark chocolate with legs lighter in some individuals, or orange to dark russet with head and coxae dark brown to black, mandibles orange, gaster fulvous to black, and legs brown. Worker caste monomorphic but variable in size, with series of intercastes between largest and smallest workers (monophasic allometry).

Holotype worker measurements. HML 3.78; HL 1.30; HW 1.30; CeI 100; SL 0.92; SI 71; PW 0.82.

Other worker measurements. HML 1.57–3.88; HL 0.56–1.34; HW 0.51–1.34; CeI 85–107; SL 0.34–0.89; SI 60–79; PW 0.31–0.79 (53 measured).

Queen description

Head. Head square or rectangular; vertex slightly concave, or planar; frons longitudinally striate with combination of incurved decumbent and subdecumbent setulae and erect and suberect setae. Compound eyes elliptical; (viewed from front) compound eyes set in anterior half of head capsule; (viewed laterally) compound eyes set at midline of head capsule; eye large, eye width greater than 1.5× greatest width of antennal scape.

Alitrunk. Mesoscutum in profile convex anteriad; thereafter flattened, or evenly flattened. Mesoscutal pilosity consisting of decumbent and subdecumbent setulae anteriad and erect and suberect setae posteriad; dorsal appearance of mesoscutum smooth and shining; length-width ratio of mesoscutum and scutellum combined near 4:3. Axillae separated by distance of about half greatest width of scutellum. Propodeal sculpture present as uniform rugosity, with well-defined costulae on declivitous face of propodeum; dorsal propodeal face flattened. Propodeal processes absent (propodeum angulate in profile); lobes present as blunt flanges. Propodeal angle present. Erect and suberect propodeal setae greater than 10; propodeal setulae decumbent and subdecumbent. Propodeal spiracle lateral and nearer metanotal groove than declivitous face of propodeum.

Wing. Wing veins tubular and strongly sclerotised; vein m-cu present as an entire vein enclosing first discoidal cell; vein cu-a present.

Petiole and postpetiole. Petiolar spiracle lateral and positioned in pedicel well anteriad of petiolar node. Petiolar node tumular; sculpture present in form of microreticulation. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 1:1. Anteroventral process distinct in some individuals as slender carina that tapers posteriad. Height ratio of petiole to postpetiole near 1:1 to near 4:3; height-length ratio of postpetiole near 4:3 to near 1:1. Sculpture present in form of microreticulation; ventral process absent or vestigial, or present and distinct.

Gaster. Pilosity of first gastral tergite consisting entirely of erect and suberect setae.

General characters. Colour of alitrunk, petiole and postpetiole orange to crimson; variously infuscated with dark brown; gaster and head brown to black. Brachypterous alates not seen. Ergatoid or worker-female intercastes not seen.

Queen measurements. HML 3.23–4.19; HL 1.01–1.35; HW 1.19–1.37; CeI 104–118; SL 0.83–0.93; SI 65–70; PW 0.78–0.93 (3 measured).

Male description

Head. Head width-mesoscutal width ratio near 1:1. Compound eyes protuberant and elliptical; (viewed laterally) compound eyes set at midline of head capsule; ocelli conspicuous and turreted. Ratio of length of first funicular segment of antenna to length of second funicular segment near 1:3 to near 1:4. Maximum number of mandibular teeth and denticles: three.

Alitrunk. Mesoscutum in profile convex anteriad; thereafter flattened; dorsal appearance of mesoscutum finely microreticulate; mesoscutal pilosity consisting of long, dense setae. Parapsidal furrows present and distinct; notauli absent. Axillae separated by distance less than half greatest width of scutellum, or separated by distance more than half greatest width of scutellum.

Wing. Wing veins tubular and strongly sclerotised; vein m-cu present as an entire vein enclosing first discoidal cell; vein cu-a present.

Petiole and postpetiole. Petiolar spiracle lateral and positioned in pedicel well anteriad of petiolar node. Sculpture present in form of microreticulation, or present; petiolar node rugose; ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 3:4. Anteroventral process always absent or vestigial; ventral lobe present in some individuals. Height-length ratio of postpetiole near 1:1; sculpture present in form of microreticulation, or present; postpetiole rugose; ventral process absent or vestigial, or present and distinct.

Gaster. Pilosity of first gastral tergite consisting mainly of decumbent and subdecumbent setulae.

General characters. Colour of body chocolate, legs and gaster brown to dark brown.

Male measurements. HML 1.91–4.09; HL 0.47–0.93; HW 0.47–1.03; CeI 97–111; SL 0.18–0.31; SI 25–44; PW 0.52–1.16 (12 measured).

Etymology

Latin: 'red-and-black'.

Remarks

Monomorium rufonigrum, as here described, may not be monophyletic. The workers of some series are dark brown to black, with a narrow and highly sculptured petiolar node, and the head capsule (viewed dorsally) is no broader than the promesonotum. The workers of *Monomorium rufonigrum sensu stricto* are red and black, the node is thicker with simple rugosity, and the head capsule (viewed dorsally) is broader than the promesonotum, at least in the major and media workers. Because of some variability of colour in the small, dark specimens, and the lack of comprehensive nest collections with good representation of different-sized workers, this variation may still fall within intraspecific boundaries. Individual specimens are distinguishable from *M. striatifrons* by the more angulate appearance of the propodeum, and often the colour, and from *M. majeri* by the more robust sculpture.

This ant occupies a variety of habitats, from mallee to *Callitris* scrub. In the southwest of Western Australia the species is quite common, and is found within the Perth metropolitan area. Outside of Western Australia the ant is known from single collections (i.e. Tarcoola, South Australia, and Barooga, New South Wales).

Monomorium striatifrons, sp. nov.

(Figs 23, 53, 61, 147, 157, 168)

Material examined

Holotype. Worker (top point), Western Australia, Mount Magnet area, 15.v.1967, C. Mercovich, ANIC vial no. 66–39 (ANIC).

Paratypes. **Western Australia:** 2 workers, same data as holotype (ANIC); 3 workers, no vial details, same data as holotype (BMNH); 1 ♀ and 2 ♂, ANIC vial no. 66–38, otherwise same data as holotype (ANIC); 3 workers, ANIC vial no. 66–38, otherwise same data as holotype (MCZ); 3 workers, ANIC vial no. 66–40, otherwise same data as holotype (BMNH); 1 worker, 30 km S 'The Overlander', 20.iii.1987, B. E. Heterick, soil, native veg., rural environ., 174/6MonBH32 (ANIC); 1 ♀, Tardun, 22.v.1963, C. T. Mercovich, mallee 400ft., ANIC vial no. 66–53 (MCZ).

Other material examined. **South Australia:** 8 workers, 20 miles W Mt Whinham (ANIC). **Western Australia:** 3 workers, Clampton (WAM); 13 workers, Clampton (WAM); 2 workers, 'Eastern

Goldfields' (JDM); 6 workers, Minilya (1 pin with label 'Manilya') (WAM); 3 workers, Minilya (WAM); 1 ♀, 1 ♂, 2 workers, Pindar (ANIC); 1 ♀, 1 ♂, 2 workers, Tardun (ANIC).

Worker description

Head. Head square or rectangular; vertex slightly concave; frons longitudinally striate with erect and suberect setae. Compound eyes elliptical; (viewed from front) compound eyes set in anterior half of head capsule; (viewed laterally) compound eyes set anterior of midline of head capsule; eye moderate, eye width 0.5–1.5× greatest width of antennal scape. Antennal segments 12; club gradually tapering and barely discernible. Anteromedial clypeal margin emarginate, median clypeal carinae produced as pair of bluntly rounded denticles. Longest lateral anterior clypeal setae long, extending beyond dorsal margin of closed mandibles. Posteromedial clypeal margin level with posterior surface of antennal fossae. Anterior tentorial pits situated nearer antennal fossae than mandibular insertions. Frontal lobes parallel straight. Venter of head capsule without elongate, basket-shaped setae. Palp formula 2,3. Maximum number of mandibular teeth and denticles: four; mandibles (viewed from front) strap-like with inner and outer edges subparallel, striate, with piliferous punctures; basal tooth enlarged, much broader than other non-apical teeth; basal angle indistinct; apical and basal mandibular margins meeting in curve.

Alitrunk. Promesonotal sculpture present in form of microreticulation and rugosity over entire promesonotum; dorsal promesonotal face evenly convex; erect and suberect promesonotal setae greater than 10; setulae absent. Mesonotal suture visible externally as faint ridge. Metanotal groove present as distinct and deeply impressed trough between promesonotum and propodeum. Propodeal sculpture present as uniform rugosity, with well defined costulae on declivitous face of propodeum; dorsal propodeal face strongly convex; processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle); lobes present as blunt flanges. Propodeal angle absent; declivitous face of propodeum smoothly convex. Erect and suberect propodeal setae greater than 10; propodeal setulae absent. Propodeal spiracle lateral and about midway between metanotal groove and declivitous face of propodeum; vestibule conspicuous through cuticle.

Petiole and postpetiole. Petiolar spiracle lateral and positioned in pedicel well anterior of petiolar node. Petiolar node conical, dorsally rounded; sculpture present; petiolar node rugose. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 1:1. Anteroventral process always absent or vestigial. Ventral lobe always absent. Height ratio of petiole to postpetiole near 1:1; height-length ratio of postpetiole near 1:1. Sculpture present in form of microreticulation. Ventral process present and distinct.

Gaster. Pilosity of first gastral tergite consisting entirely of well-spaced erect and suberect setae.

General characters. Colour of head, alitrunk, petiole, postpetiole and most of first gastral tergite red to reddish orange, rear of gaster, legs, and antennal scape brown to dark brown. Worker caste monomorphic.

Holotype worker measurements. HML 4.28; HL 1.52; HW 1.55; CeI 102; SL 1.08; SI 70; PW 0.84.

Other worker measurements. HML 4.51–5.19; HL 1.65–1.88; HW 1.65–1.85; CeI 94–102; SL 1.09–1.34; SI 67–72; PW 0.75–0.96 (21 measured).

Queen description

Head. Head square or rectangular; vertex slightly concave; frons longitudinally striate with combination of appressed setulae and erect and suberect setae. Compound eyes elliptical; (viewed from front) compound eyes set in anterior half of head capsule; (viewed laterally) compound eyes set anterior of midline of head capsule; eye large, eye width greater than 1.5× greatest width of antennal scape.

Alitrunk. Mesoscutum in profile evenly convex. Mesoscutal pilosity consisting of decumbent and subdecumbent setulae anterior and erect and suberect setae posterior; dorsal appearance of mesoscutum longitudinally striate; length-width ratio of mesoscutum and scutellum combined near 4:3. Axillae separated by distance less than half greatest width of scutellum. Propodeal sculpture present as uniform rugosity, with well-defined costulae on declivitous face of propodeum; dorsal propodeal face strongly convex. Propodeal processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle); lobes present as blunt flanges. Propodeal angle absent. Erect and suberect propodeal setae greater than 10; propodeal setulae absent. Propodeal spiracle lateral and nearer metanotal groove than declivitous face of propodeum.

Wing. Wing veins tubular and strongly sclerotised; vein m-cu present as an entire vein enclosing first discoidal cell; vein cu-a present.

Petiole and postpetiole. Petiolar spiracle lateral and positioned in pedicel well anterior of petiolar node. Petiolar node tumular and inclined anterior; sculpture present in form of microreticulation. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 1:1 to near 3:4. Anteroventral process always absent or vestigial. Height ratio of petiole to postpetiole near 1:1; height-length ratio of postpetiole near 4:3 to near 1:1. Sculpture present in form of microreticulation; ventral process present and distinct.

Gaster. Pilosity of first gastral tergite consisting entirely of erect and suberect setae.

General characters. Colour crimson to orange; katapisternum, legs and sometimes other parts of body infuscated. Brachypterous alates seen and examined. Ergatoid or worker-female intercastes not seen.

Queen measurements. HML 4.60–5.17; HL 1.50–1.67; HW 1.55–1.67; CeI 100–107; SL 1.09–1.22; SI 69–73; PW 1.14–1.29 (5 measured).

Male description

Head. Head width-mesoscutal width ratio near 1:1. Compound eyes protuberant and elliptical; (viewed laterally) compound eyes set at midline of head capsule; ocelli not turreted. Ratio of length of first funicular segment of antenna to length of second funicular segment near 1:3 to near 1:4. Maximum number of mandibular teeth and denticles: three (usually two).

Alitrunk. Mesoscutum in profile convex anterior; thereafter flattened; dorsal appearance of mesoscutum reticulate; mesoscutal pilosity consisting of numerous short setae, incurved medially. Parapsidal furrows present and distinct; notauli absent. Axillae separated by distance more than half greatest width of scutellum.

Wing. Wing veins tubular and strongly sclerotised; vein m-cu present as an entire vein enclosing first discoidal cell; vein cu-a present.

Petiole and postpetiole. Petiolar spiracle lateral and positioned in pedicel well anterior of petiolar node. Sculpture present; petiolar node rugose; ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 3:4. Anteroventral process always absent or vestigial; ventral lobe always absent. Height-length ratio of postpetiole near 4:3 to near 1:1; sculpture present; postpetiole rugose; ventral process absent or vestigial, or present and distinct.

Gaster. Pilosity of first gastral tergite consisting entirely of well-spaced erect and suberect setae.

General characters. Colour chocolate; gaster and legs orange, coxae and antennae brown.

Male measurements. HML 4.11–4.42; HL 0.98–1.09; HW 1.01–1.11; CeI 100–108; SL 0.31–0.34; SI 29–31; PW 0.98–1.24 (5 measured).

Etymology

Latin: 'striated forehead'.

Remarks

Monomorium striatifrons is a distinctive red or orange-red species. Unlike *M. rufonigrum*, the species is monomorphic, and also has a rounded propodeum with characteristic horizontal striae girdling it (see Fig. 61). The rugosity of this species also distinguishes it from the otherwise similar *M. majeri*.

Although all but one of the specimens examined were taken in Western Australia, this large '*Chelaner*' species probably has a much wider distribution throughout the Eremaean region than the sparse records suggest. My one collection of *M. striatifrons*, south of Shark Bay, Western Australia, came from a nest that had a small, simple entrance hole.

Monomorium whitei Wheeler

(Figs 22, 51, 59, 145, 156, 166)

Monomorium (Holcomyrrex) whitei Wheeler, 1915b: 808–809; pl. LXIV, fig. 2 (nest), pl. LXVI, fig. 1.

Monomorium (Holcomyrrex) armstrongi McAreevey, 1949: 10–12, Figs 30–35. **Syn. nov.**

Chelaner armstrongi (McAreevey) [comb. nov. Ettershank, 1966: 96].

Chelaner whitei (Wheeler) [comb. nov. Ettershank, 1966: 97].

Monomorium armstrongi McAreevey [comb. Bolton, 1987: 300, 301].

Monomorium whitei Wheeler [comb. Bolton, 1987: 300, 301].

*Material examined**M. armstrongi*

Holotype. Worker (major), New South Wales, Bogan R., J. Armstrong (ANIC).

Paratypes. **New South Wales:** worker (minor) on same pin as holotype (ANIC); also a pin with three major workers with same data as holotype (MV, type no. T-15242, T-15243, T-15244).

M. whitei

Syntypes. *Monomorium whitei* was described by Wheeler (1915b) from four workers taken at Flat Rock Hole, South Australia. One pin, minus the specimen, has been recovered from SAM. The specimen was apparently lost whilst being curated at the ANIC. Label data: Flat Rock Hole, Musgrave Ranges, Central Australia, Capt. S. A. White. I. 4186: 'Co-type'. The whereabouts of the other syntypes are unknown.

Other material examined. 4 workers (AMS); 108 workers, 4♀, 5♂ (ANIC); 6 workers (MV); 3 workers (QM); 29 workers, 3♀, 1♂ (SAM); 20 workers, 5♀, 6♂ (WAM) (see Fig. 22 for distribution).

Worker description

As for the worker of *M. bicornis*, but with the following apomorphies.

Head. Frons microreticulate and striolate with combination of appressed setulae and erect and suberect setae. Compound eyes set in anterior half of head capsule, or set at midpoint of each side of head capsule; (viewed laterally); eye large, eye width greater than 1.5× greatest width of antennal scape. Posteromedial clypeal margin level with posterior surface of antennal fossae. Mandibles (viewed from front) strap-like with inner and outer edges subparallel, striate, with piliferous punctures.

Alitrunk. Setulae decumbent and subdecumbent. Mesonotal suture visible externally as faint ridge. Propodeal sculpture present as uniform microreticulation, with few or no striae or costulae; dorsal propodeal face gently convex; propodeal appearance generally as for *M. bicornis* but some specimens with propodeal processes present on posterior propodeal angles as small denticles or sharp flanges; lobes present as blunt flanges. Propodeal setulae decumbent and subdecumbent.

Petiole and postpetiole. Petiolar spiracle lateral and positioned in pedicel well anterior of petiolar node. Anteroventral process present as pronounced spur, or slender

carina that tapers posteriad. Height–length ratio of postpetiole near 1:1 to near 3:4. Sculpture present in form of microreticulation only.

Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour variable: head orange to dark brown, alitrunk, petiole and postpetiole dark orange to black, gaster light orange to black, appendages orange to dark brown. Worker caste monomorphic but variable in size, with series of intercastes between largest and smallest workers (monophasic allometry).

Worker measurements. HML 3.06–3.57; HL 1.06–2.06; HW 1.06–2.23; CeI 100–114; SL 0.71–1.35; SI 59–67; PW 0.45–0.84 (32 measured).

Queen description

As for the queen of *M. bicornis*, but with the following apomorphies.

Head. Compound eyes elliptical, or elongate; much longer than wide; (viewed from front) compound eyes set at midpoint of each side of head capsule; (viewed laterally).

Alitrunk. Propodeal processes always present as small denticles or sharp flanges in this species, and propodeal angle always present.

Petiole and postpetiole. Petiolar spiracle lateral and positioned in pedicel well anterior of petiolar node. Petiolar node always rugose. Anteroventral process distinct in some individuals as slender carina that tapers posteriad. Sculpture present in form of microreticulation or rugosity; ventral process present and distinct in some specimens.

General characters. Colour either uniformly black with dark red mandibles, or head, alitrunk black, gaster, appendages, mandibles and region around mandibles tawny orange. Brachypterous alates not seen. Ergatoid or worker–female intercastes not seen.

Queen measurements. HML 5.23–6.13; HL 1.45–1.76; HW 1.73–2.02; CeI 112–124; SL 1.14–1.32; SI 59–67; PW 1.29–1.60 (10 measured).

Male description

As for the male of *M. bicornis*, but with the following apomorphies.

Head. Head width–mesoscutal width ratio near 1:1 to near 3:4. Compound eyes set posterior of the midline of head capsule.

Alitrunk. Dorsal appearance of mesoscutum striolate and microreticulate.

Wing. Vein m-cu present as an entire vein enclosing first discoidal cell in all specimens seen.

Petiole and postpetiole. Height–length ratio of postpetiole near 1:1.

General characters. Colour black.

Male measurements. HML 3.98–5.33; HL 0.88–1.32; HW 0.98–1.19; CeI 90–112; SL 0.31–0.36; SI 30–37; PW 1.19–1.45 (10 measured).

Remarks

The whereabouts of extant type specimens of *Monomorium whitei* are unknown. Wheeler's thorough description of the ant, and his accompanying diagrams, leave no doubt as to its identity (it is the largest Australian *Monomorium*). Labels identifying specimens as 'whitei' can also be found among the material from the various Australian museums. McAreavey distinguished his *M. armstrongi* from *M. whitei* on the basis of the latter's supposedly smaller size and different colouration (McAreavey 1949). I have inspected the holotype and paratypes for *M. armstrongi*, together with over 170 other workers, and consider that this ant and *M. whitei* are conspecific. The disparity in size does not hold for extended series, and neither does the colour. As an instance of this, 36 workers collected by P. J. M. Greenslade at 'Kapunda', near Nyngan (NSW) include both morphs and a number of forms that are intermediate in colour. This series also includes specimens of varying sizes. *Monomorium armstrongi*, therefore, becomes a junior synonym in this work.

M. whitei is very closely related to *M. bicornis* but has proportionately larger eyes. The former species is found mainly in arid, inland Australia, while *M. bicornis* occurs in wetter coastal areas.

M. whitei subsists largely or wholly on seeds (Davison 1982). Seeds of 20 plant species are harvested, but chenopods comprise the main part of the diet (Davison 1987). These findings are corroborated by data from specimen labels.

The *falcatum*-group

Monomorium decuria, sp. nov.

(Figs 24, 69)

Material examined

Holotype. Worker, Western Australia, Kwinana, 31.i.1987, B. E. Heterick, soil, mixed native/exotic veg., semi rural environment, 125/6MonBH49 (ANIC).

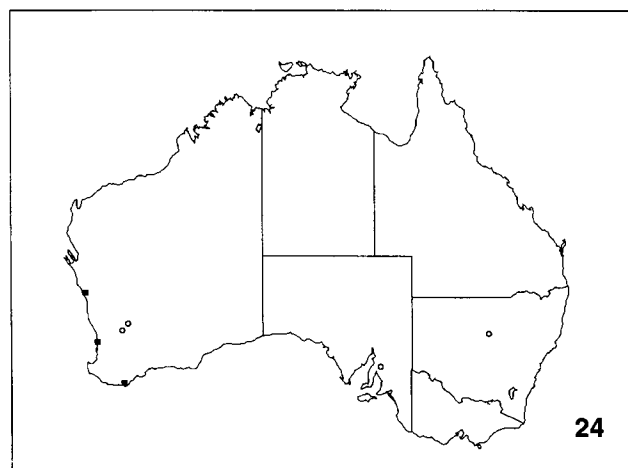
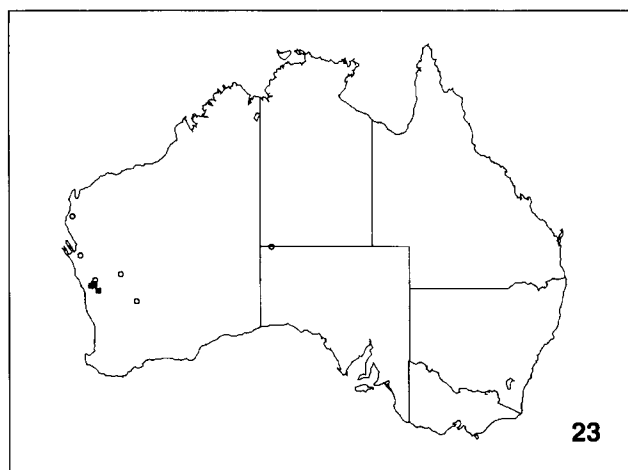
Paratypes. **Western Australia:** 2×4 workers, Geraldton, 300 miles N of Perth, 22.v.1963, C. Mercovich, 300 ft., ca 15 miles inland, savannah woodland, 10 seg. antennae, *Chelaner* (BMNH and MCZ).

Other material examined. **Western Australia:** 1 worker, King R. (JDM).

Worker description

As for the worker of *M. falcatum* (see below), but with the following apomorphies.

Head. Frons of head capsule microreticulate and striolate with combination of appressed setulae and erect and



Figs 23, 24. 23, Distribution of *M. majeri* (■) and *M. striatiformis* (○) specimens examined during this study. 24, Distribution of *M. decuria* (■) and *M. elegantulum* (○) specimens examined during this study.

suberect setae. (Viewed from front) compound eyes set at midpoint of each side of head capsule; (viewed laterally) compound eyes set posterior of midline of head capsule; eye moderate, eye width 0.5–1.5× greatest width of antennal scape. Antennal segments 10. Longest lateral anterior clypeal setae long, extending beyond dorsal margin of closed mandibles. Maximum number of mandibular teeth and denticles: five; mandibles (viewed from front) triangular and striate, with piliferous punctures; apical and basal mandibular margins meeting in tooth or denticle.

Alitrunk. Promesonotum with uniform microreticulation and dorsal foveae; evenly convex dorsally; erect and suberect promesonotal setae absent to >5; setulae appressed. Mesonotal suture absent. Metanotal groove absent. Propodeal processes present on posterior propodeal angles as small denticles or sharp flanges. Propodeal angle absent; propodeal setulae appressed.

Petiole and postpetiole. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3. Anteroventral process always present as pronounced spur. Ventral lobe present in some individuals. Height-length ratio of postpetiole near 2:1 to near 4:3. Ventral process absent or vestigial.

General characters. Colour light brown, head and gaster darker, appendages tawny yellow. Worker caste monomorphic.

Holotype worker measurements. HML 1.70; HL 0.69; HW 0.63; CeI 92; SL 0.43; SI 67; PW 0.39.

Other worker measurements. HML 1.41–1.83; HL 0.56–0.74; HW 0.52–0.72; CeI 92–97; SL 0.36–0.46; SI 65–74; PW 0.28–0.41 (9 measured).

Etymology

Latin: 'division of ten'.

Remarks

This appealing little ant is inconspicuous, and probably more abundant than the distribution records suggest. In southwestern Australia, the species occupies habitats ranging from wet sclerophyll forest to coastal *Banksia* and *Dryandra* scrubland. This is the only Australian *Monomorium* with 10-segmented antennae. Nonetheless, the form of the propodeum and of the body sculpture clearly places *M. decuria* in the same species-group as *M. elegantulum*, sp. nov., *M. falcatum* and *M. lacunosum*, sp. nov.

I observed activity at a nest in semi-rural bush and parkland in Kwinana, Western Australia, where the ants were foraging nocturnally on sand with sparse ground cover. The workers moved very slowly across the ground surface. The entrance to the nest was a minute hole, barely larger than an individual worker. No excavated soil or other material could be seen around the nest.

Monomorium elegantulum, sp. nov.

(Figs 24, 57)

Material examined

Holotype. Worker, Western Australia, Mukinbudin, 25.i.1988, M. Jacobs, soil, native veg., cara. park near town, 374/6 MonBH48 (ANIC).

Paratypes. **New South Wales:** 13 workers, Nyngan, 10.x.1946, J. Armstrong, *Chelaner* 12 seg. antennae det. R. W. Taylor 1975 (ANIC); 6 + 10 (1 head missing) workers, Bogan R., J. Armstrong, *Chelaner* 12 seg. antennae det. RWT. [R. W. Taylor] 1975. (BMNH and MCZ).

Other material examined. **South Australia:** 2 workers, Blyth (ANIC). **Western Australia:** 1 worker, N of Kellerberrin (JDM).

Worker description

As for the worker of *M. falcatum*, but with the following apomorphies.

Head. Vertex of head capsule planar; frons densely foveate and microreticulate with combination of appressed setulae and erect and suberect setae. (Viewed from front) compound eyes set at midpoint of each side of head capsule. Longest lateral anterior clypeal setae long, extending beyond dorsal margin of closed mandibles. Posteromedial clypeal margin level with posterior surface of antennal fossae. Anterior tentorial pits equidistant between mandibular insertions and antennal fossae. Maximum number of mandibular teeth and denticles: four; apical and basal mandibular margins meeting in tooth or denticle.

Alitrunk. Promesonotum with uniform microreticulation and dorsal foveae; dorsal promesonotal face convex anteriad, otherwise flattened; erect and suberect promesonotal setae >5; setulae appressed. Mesonotal suture absent. Metanotal groove absent. Propodeal angle absent; length ratio of dorsal face to declivitous face near 2:1. Propodeal setulae appressed.

Petiole and postpetiole. Petiolar node tumular and inclined posteriad; Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3 to near 1:1. Anteroventral process always present as pronounced spur. Ventral lobe present in some individuals.

General characters. Colour light orange. Worker caste monomorphic.

Holotype worker measurements. HML 1.49; HL 0.62; HW 0.57; CeI 93; SL 0.32; SI 56; PW 0.34.

Other worker measurements. HML 1.51–1.81; HL 0.61–0.72; HW 0.59–0.74; CeI 95–104; SL 0.38–0.44; SI 59–72; PW 0.32–0.42 (18 measured).

Etymology

Latin: 'having a very fine appearance'.

Remarks

Monomorium elegantulum has the widest distribution of any member of the *falcatum*-group, and can be found throughout the drier woodland areas of temperate Australia. This species resembles *M. falcatum* in many morphological aspects, but is distinguished from that species by its much smaller size. *Monomorium elegantulum* may also be distinguished from the similar-sized *M. decuria* by the possession of 12-segmented antennae.

Monomorium falcatum (McAreavey)

(Figs 25, 56, 62)

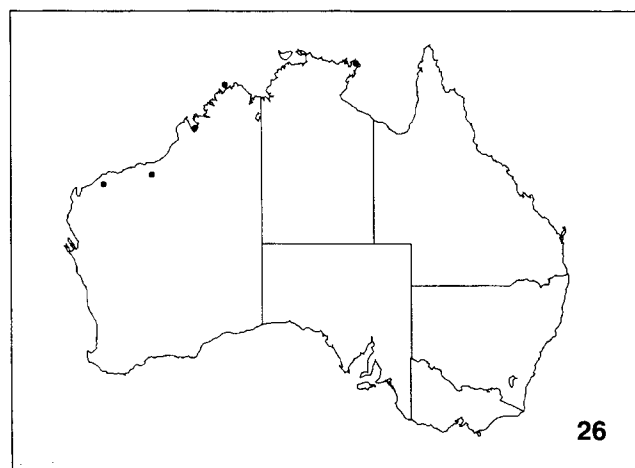
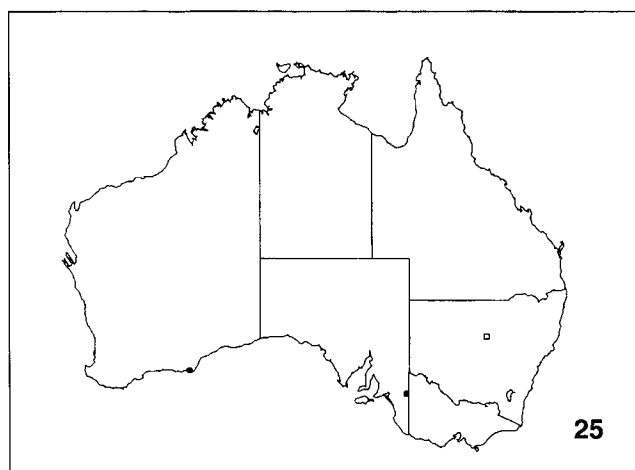
Schizopelta falcata McAreavey, 1949: 15, figs 42–47.

Chelaner falcatus (McAreavey) [comb. nov. Ettershank, 1966: 93].

Monomorium falcatum (McAreavey) [comb. nov. Bolton, 1987: 300, 301].

Material examined

Holotype. Worker, New South Wales, Bogan R., J. Armstrong (ANIC – as '*Schizopelta falcata*').



Figs 25, 26. 25, Distribution of *M. falcatum* (□) and *M. lacunosum* (●) specimens examined during this study. 26, Distribution of *M. insolens* (●) specimens examined during this study.

Paratypes. **New South Wales:** Ergatoid/intercaste and ♂ (lacking head) on same pin as holotype (ANIC); 2 workers, Bogan R. (MV – as '*Schizopelta falcata*', T-15254).

Other material examined. **New South Wales:** 5 workers, Nyngan (ANIC).

Worker description

Head. Head square or rectangular; vertex slightly concave; frons smooth and shining with combination of minute setulae in evenly spaced pits, and sparse erect and suberect setae. Compound eyes elliptical; (viewed from front) compound eyes set in anterior half of head capsule; (viewed laterally) compound eyes set anterior of midline of head capsule; eye large, eye width greater than 1.5× greatest width of antennal scape. Antennal segments 12; club three-segmented. Anteromedial clypeal margin emarginate, median clypeal carinae produced apically as pair of pronounced teeth. Longest lateral anterior clypeal setae short, not reaching dorsal margin of closed mandibles. Posteromedial clypeal margin situated between anterior and

posterior surfaces of antennal fossae. Anterior tentorial pits situated nearer antennal fossae than mandibular insertions. Frontal lobes parallel straight. Venter of head capsule without elongate, basket-shaped setae. Palp formula 2,3. Maximum number of mandibular teeth and denticles: three; mandibles (viewed from front) strap-like with inner and outer edges subparallel, striate, with piliferous punctures; basal tooth not enlarged; basal angle indistinct; apical and basal mandibular margins meeting in curve.

Alitrunk. Promesonotal sculpture present in form of microreticulation on mesopleuron; promesonotal dorsum smooth and shining, with evenly spaced foveae; dorsal promesonotal face evenly convex; erect and suberect promesonotal setae absent; setulae decumbent and subdecumbent. Mesonotal suture visible externally as faint ridge. Metanotal groove present as feebly impressed furrow between promesonotum and propodeum. Propodeal sculpture present as uniform microreticulation, with few or no striae or costulae; dorsal propodeal face sloping posteriad, with wedge-shaped flattening or shallow depression that is widest between propodeal angles; processes present on posterior propodeal angles as sharp spines; lobes present as blunt flanges. Propodeal angle present; length ratio of dorsal face to declivitous face near 2:1 to near 4:3; declivitous face of propodeum flat. Erect and suberect propodeal setae absent or very sparse; propodeal setulae absent. Propodeal spiracle lateral and about midway between metanotal groove and declivitous face of propodeum; vestibule conspicuous through cuticle.

Petiole and postpetiole. Petiolar spiracle lateral and slightly anteriad of petiolar node. Petiolar node tumular and inclined anteriad; sculpture present in form of microreticulation. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3, or near 1:1. Anteroventral process present as pronounced spur, or slender carina that tapers posteriad. Ventral lobe always absent. Height ratio of petiole to postpetiole near 4:3; height-length ratio of postpetiole near 4:3. Sculpture present in form of microreticulation. Ventral process present and distinct.

Gaster. Pilosity of first gastral tergite consisting entirely of well-spaced appressed setulae.

General characters. Colour orange: an exception is a paratype ergatoid/intercaste, which has a black head capsule with an orange strip near the occiput, black fore coxae, and infuscation of venter of alitrunk. Worker caste monomorphic.

Worker measurements. HML 2.72–2.91; HL 1.09–1.23; HW 1.07–1.13; CeI 92–97; SL 0.38–0.65; SI 52–58; PW 0.56–0.61 (5 measured).

Male description

Alitrunk. Mesoscutum in profile convex anteriad, thereafter flattened; dorsal appearance of mesoscutum

reticulate; mesoscutal pilosity consisting of long, dense setae. Parapsidal furrows present, but difficult to see because of surrounding sculpture; notauli absent. Axillae separated by distance of more than half greatest width of scutellum.

Wing. Wing veins tubular and strongly sclerotised; vein m-cu present as an entire vein enclosing first discoidal cell; vein cu-a present.

Petiole and postpetiole. Petiolar spiracle lateral and slightly anteriad of petiolar node. Sculpture present; petiolar node rugose; ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 3:4. Anteroventral process present as a blunt spur; ventral lobe absent. Height-length ratio near 1:2; sculpture present in form of microreticulation; ventral process present and distinct.

Gaster. Pilosity of first gastral segment consisting entirely of well-spaced erect and suberect setae.

General characters. Colour chocolate.

Male measurement. PW 0.69. (McAreavey (1949) mentions that the length of the intact specimen was 3.2 mm.)

Remarks

Of the Australian *Monomorium*, only *M. elegantulum* has an appearance similar to *M. falcatum*, and the latter is much smaller (HML <2 mm). *Monomorium falcatum* is currently known only from material collected by J. W. Armstrong in October 1946 (the holotype and paratypes), and again on 1.ix.1964. The collector stated on a label accompanying the second series that they came from the 'type colony'(!) Various collectors in and around Nyngan have made many subsequent collections of ants, and the absence of *M. falcatum* from such collections suggests that it is very rare and possibly highly localised. Nothing is known of its biology.

Monomorium lacunosum, sp. nov.

(Figs 25, 58)

Material examined

Holotype. Worker (top point), South Australia, 25 km SSW Pinnaroo 35°28'S, 140°47'E, 24.x.1983, J. D. Gnomon & J. C. Cradle, ANIC berlesate no. 890 mallee and heath litter (ANIC).

Paratypes. **South Australia:** 1 + 2 workers with same data as holotype (ANIC and MCZ).

Other material examined. **Western Australia:** 1 worker, Seal Cove, Cape Arid N. P. (ANAC).

Worker description

As for the worker of *M. falcatum*, but with the following apomorphies.

Head. Frons of head capsule longitudinally striate and reticulate with combination of incurved decumbent and subdecumbent setulae and erect and suberect setae.

Compound eyes circular or subcircular; (viewed laterally) compound eyes set posterior of midline of head capsule; eye moderate, eye width 0.5–1.5× greatest width of antennal scape. Anteromedial clypeal margin straight or slightly emarginate, median clypeal carinae not produced as teeth or denticles. Longest lateral anterior clypeal setae long, extending beyond dorsal margin of closed mandibles. Posteromedial clypeal margin level with posterior surface of antennal fossae. Frontal lobes parallel, sinuate. Venter of head capsule without elongate, basket-shaped setae. Palp formula 2,3. Maximum number of mandibular teeth and denticles: five; mandibles (viewed from front) triangular and smooth, with piliferous punctures; apical and basal mandibular margins meeting in tooth or denticle.

Alitrunk. Promesonotal sculpture present in form of microreticulation and rugosity over entire promesonotum; erect and suberect promesonotal setae greater than 10. Mesonotal suture absent. Metanotal groove absent. Propodeal sculpture present as uniform rugosity, with well defined costulae on declivitous face of propodeum; propodeal processes present on posterior propodeal angles as small denticles or sharp flanges; lobes present and produced apically so as to form acute angled, sharp projections. Declivitous face of propodeum longitudinally concave between its lateral margins. Erect and suberect propodeal setae greater than 10; propodeal setulae decumbent and subdecumbent.

Petiole and postpetiole. Petiolar node cuboidal; sculpture present; petiolar node rugose. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3 to near 1:1. Anteroventral process always present as pronounced spur. Height ratio of petiole to postpetiole near 1:1 to near 4:3; height-length ratio of postpetiole near 2:1. Sculpture present; postpetiole rugose.

Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour tawny yellow to yellow-orange; or, alitrunk, petiole, postpetiole, and appendages russet, head and gaster chocolate. Worker caste monomorphic.

Holotype worker measurements. HML 1.66; HL 0.60; HW 0.48; CeI 81; SL 0.37; SI 76; PW 0.39.

Worker measurements. HML 1.62–1.72; HL 0.56–0.60; HW 0.47–0.49; CeI 80–88; SL 0.34–0.38; SI 70–79; PW 0.37–0.39 (4 measured).

Etymology

Latin: 'pitted'.

Remarks

The Western Australian specimen of *Monomorium lacunosum* is distinct from the Pinnaroo material, being much darker, and with reduced propodeal denticles. Nonetheless, this worker shares several characters that are considered diagnos-

tic for the species: 1, overall sculpture; 2, conformation of the clypeus; 3, shape of the anterior promesonotum and nodes; 4, presence of erect and suberect setae on the alitrunk; 5, bevelled appearance of the propodeal declivity; and 6, acutely angled metapleural lobes. *Monomorium lacunosum* differs from other members of the *falcatum*-group in terms of the pilosity and sculpture of its alitrunk.

Like other members of the *M. falcatum*-group, *M. lacunosum* is known from a limited number of specimens (here, five workers), but this may give a misleading picture of its actual abundance. The region around the Great Australian Bight has sparse human settlement, and the ant fauna of the Australian mainland between the coastal towns of Esperance (Western Australia) and Ceduna (South Australia) is almost unknown.

The *insolens*-group

Monomorium insolens Wheeler

(Figs 26, 67, 68, 74, 75, 161, 169)

Monomorium (Notomyrmex) insolens Wheeler, 1934: 145, 146.

Chelaner insolens (Wheeler) [comb. nov. Ettershank, 1966: 97].

Monomorium insolens Wheeler [comb. Bolton, 1987: 300, 301].

Material examined

Lectotype. One worker, Western Australia, Derby, W. D. Dodd (MV-‘Cotype 20864’; ‘Paratype worker T-15057’), here designated. [A syntype worker has been chosen to become the lectotype, so as to fix the species name for the typical form of *M. insolens*.]

Paralectotypes. **Western Australia:** 5 workers, 1 ♂, same data as lectotype (MCZ); 1 worker same data as lectotype (MV); here designated.

Other material examined. **Northern Territory:** 2 workers Gove (ANIC). **Western Australia:** 1 ♂ Bamboo Ck 20°56’S, 120°13’E, 11.iv.1977 (WAM); 1 worker Cape Bougainville (JDM); 4 workers Kununurra district (JDM); 1 worker Pannawonica (JDM).

Worker description

Head. Head square or rectangular; vertex slightly concave; frons smooth and shining with combination of appressed setulae and erect and suberect setae. Compound eyes elliptical; (viewed from front) compound eyes set in anterior half of head capsule; (viewed laterally) compound eyes set posterior of midline of head capsule, or set at midline of head capsule; eye moderate, eye width 0.5–1.5× greatest width of antennal scape to large, eye width greater than 1.5× greatest width of antennal scape. Antennal segments 12; club three-segmented. Anteromedial clypeal margin emarginate, median clypeal carinae produced as pair of bluntly rounded denticles. Longest lateral anterior clypeal setae long, extending beyond dorsal margin of closed mandibles. Posteromedial clypeal margin level with posterior surface of antennal fossae. Anterior tentorial pits

situated nearer antennal fossae than mandibular insertions. Frontal lobes parallel straight. Venter of head capsule without elongate, basket-shaped setae. Palp formula 2,3. Maximum number of mandibular teeth and denticles: five; mandibles (viewed from front) triangular and smooth, with piliferous punctures; basal tooth not enlarged; basal angle indistinct; apical and basal mandibular margins meeting in tooth or denticle.

Alitrunk. Promesonotal sculpture absent with promesonotum smooth and shining, or promesonotum mainly smooth and shining with limited microreticulation and striolae on and around katapisternum; dorsal promesonotal face convex anteriad, otherwise flattened to evenly flattened; erect and suberect promesonotal setae greater than 10; setulae appressed. Mesonotal suture absent. Metanotal groove absent. Propodeal sculpture absent; propodeum smooth and shining, or present as faint microreticulation with few striae, mainly on lower lateral surface; dorsal propodeal face strongly convex, or sloping posteriad, with wedge-shaped flattening or shallow depression that is widest between propodeal angles; processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle); lobes present as blunt flanges. Propodeal angle absent; declivitous face of propodeum smoothly convex to flat. Erect and suberect propodeal setae 5–10; propodeal setulae decumbent and subdecumbent. Propodeal spiracle lateral and nearer declivitous face of propodeum than metanotal groove; vestibule conspicuous through cuticle.

Petiole and postpetiole. Petiolar spiracle lateral and slightly anteriad of petiolar node to lateral and positioned in pedicel well anteriad of petiolar node. Petiolar node variable: from cuboidal and inclined posteriad to narrow and elliptical; sculpture absent, petiolar node smooth and shining, or sculpture present in form of microreticulation. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 1:1 to near 3:4. Anteroventral process always absent or vestigial. Ventral lobe always absent. Height ratio of petiole to postpetiole near 3:4; height–length ratio of postpetiole near 4:3. Sculpture present in form of microreticulation. Ventral process present and distinct.

Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour of head, alitrunk, petiole and postpetiole dark orange to shining russet (head may be lighter than alitrunk), gaster and appendages amber. Worker caste monomorphic but variable in size, with series of intercastes between largest and smallest workers (monophasic allometry).

Worker measurements. HML 2.05–3.55; HL 0.72–1.18; HW 0.59–1.04; CeI 78–91; SL 0.52–0.98; SI 85–102; PW 0.41–0.81 (16 measured).

Lectotype measurements. HML 2.46; HL 0.85; HW 0.67; Cel 78; SL 0.67; SI 0.67; SI 100; PW 0.48.

Male description

Head. Compound eyes protuberant and elliptical; (viewed laterally) compound eyes set posterior of the midline of head capsule; ocelli conspicuous and turreted. Ratio of length of first funicular segment of antenna to length of second funicular segment near 1:3. Number of mandibular teeth and denticles: five.

Alitrunk. Mesoscutum in profile evenly flattened; dorsal appearance of mesoscutum smooth and shining; mesoscutal pilosity consisting of long, dense setae. Parapsidal furrows vestigial; notauli absent. Axillae separated by distance more than half greatest width of scutellum.

Wing. Wing veins tubular and strongly sclerotised; vein m-cu present as an entire vein enclosing first discoidal cell; vein cu-a present.

Petiole and postpetiole. Petiolar spiracle lateral and slightly anterior of petiolar node. Sculpture absent, petiolar node smooth and shining; ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 3:4. Anteroventral process always absent or vestigial; ventral lobe always absent. Height-length ratio of postpetiole near 2:1; sculpture absent on dorsum, at least: postpetiole smooth and shining; ventral process present and distinct.

Gaster. Pilosity of first gastral tergite consisting entirely of well-spaced erect and suberect setae.

General characters. Colour orange.

Male measurements. HML 3.05; HL 0.78; HW 0.78; Cel 100; SL 0.31; SI 40; PW ? (promesonotum obscured) (1 measured).

Remarks

Monomorium insolescens has a highly variable morphology, but as here defined almost certainly includes a complex of species. Compared with the type workers, several specimens are considerably larger and show distinct clypeal characters, a flattened and almost carinate anterior promesonotum, and an elliptical dorsum to the node. Additional variants are held in the A. Andersen collection. However, the group can be distinguished from all other *Monomorium* by the highly developed anteroventral postpetiolar process. Furthermore, larger specimens have a distinctive indentation on the ventral face of the petiole near its junction with the postpetiole.

The male from Bamboo Ck is bright orange-red with thick antennae, contrasting with the smaller brown paralectotype male. Nonetheless, the structure of the alitrunk and the petiole clearly place the specimen within the *insolescens*-group.

Since the taxon is known from so few specimens, it is difficult to determine the species status of all material

examined. The erection of a lectotype fixes the species name for the smaller specimens with a rounded promesonotum and cuboidal (rather than elliptical) petiolar node.

Little has been published on the biology of *M. insolescens*, but Andersen (1991a: 448) mentions that it is almost exclusively graminivorous.

The *kilianii*-group

Monomorium crinitum, sp. nov.

(Figs 27, 87, 89)

Material examined

Holotype. Worker, New South Wales, Mt Conobolas [= Canobolas] near Orange, 4.iii.1969, R.W. T[yaylor] & R. J. Bartell, c. 4200 ft, nest under stones, dry sclero., R. W. Taylor 69.62, ANIC ants vial 6.49 (ANIC).

Paratypes. **New South Wales:** 1 ♀ and 6 workers, with same data as holotype (ANIC). **Australian Capital Territory:** 3×3 workers, Mt Aggie, 5.xi.1966, R. W. T[yaylor], C. 4700 ft., wet sclero. (1 pin BMNH, 2 pins MCZ). **South Australia:** 1 worker, 3 miles E of Norwood, Adelaide Hills, 500 ft, valley, dry sclerophyll, in gallery of *Bothroponera* (BMNH).

Other material examined. **New South Wales:** 1 worker, The Gib, Bowral (ANIC). **Tasmania:** 2 workers, Trevallyn Dam 41°26'S, 147°06'E (QVMT). **Western Australia:** 1 ♀, 1 ♂, 2 workers, Mundaring (MV).

Worker description

As for the worker of *M. kilianii* (below), but with the following apomorphies.

Head. Head square or rectangular; (viewed laterally) compound eyes set at midline of head capsule. Anteromedial clypeal margin broadly and shallowly emarginate, median clypeal carinae absent. Longest lateral anterior clypeal setae moderate, reaching dorsal margin of closed mandibles. Posteromedial clypeal margin level with posterior surface of antennal fossae. Palp formula 2,2. Maximum number of mandibular teeth and denticles: five; mandibles (viewed from front) triangular and smooth, with piliferous punctures; basal tooth usually enlarged.

Alitrunk. Promesonotal sculpture present in form of microreticulation, striolae and striae on the mesopleuron, and striolae on posterodorsal promesonotal surface; erect and suberect promesonotal setae absent. Propodeal sculpture present as uniform rugosity, with well defined costulae on declivitous face of propodeum; propodeal processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle), or absent (propodeum angulate in profile). Propodeal angle absent, or present; declivitous face of propodeum longitudinally concave between its lateral margins. Erect and suberect propodeal setae greater than 10; propodeal setulae decumbent and subdecumbent.

Petiole and postpetiole. Petiolar spiracle lateral and positioned in pedicel well anterior of petiolar node. Petiolar

node conical, dorsally rounded; sculpture absent, petiolar node smooth and shining, or present in form of microreticulation. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 1:1. Anteroventral process distinct in some individuals as slender carina that tapers posteriad. Height-length ratio of postpetiole near 1:1 to near 3:4.

Gaster. Pilosity of first gastral tergite consisting mainly of decumbent and subdecumbent setulae.

General characters. Colour shining orange or yellow-orange, head, gaster and legs may be lighter than alitrunk. Worker caste monomorphic.

Holotype worker measurements. HML 2.16; HL 0.83; HW 0.67; CeI 81; SL 0.60; SI 90; PW 0.39.

Other worker measurements. HML 1.93–2.53; HL 0.69–0.91; HW 0.59–0.75; CeI 78–87; SL 0.47–0.61; SI 79–89; PW 0.36–0.48 (17 measured).

Queen description

Head. Head square or rectangular; vertex convex; frons striolate with decumbent and subdecumbent setulae of variable lengths. (Viewed laterally) compound eyes set anterior of midline of head capsule.

Alitrunk. Mesoscutum in profile evenly convex. Dorsal appearance of mesoscutum longitudinally striate. Propodeal sculpture present as uniform microreticulation, with few or no striae or costulae. Propodeal processes absent (propodeum angulate in profile). Erect and suberect propodeal setae greater than 10. Propodeal spiracle lateral and about midway between metanotal groove and declivitous face of propodeum.

Petiole and postpetiole. Petiolar node tumular and inclined anteriad; sculpture present; petiolar node rugose. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3. Anteroventral process a slender carina. Height ratio of petiole to postpetiole near 4:3; height-length ratio of postpetiole near 4:3. Sculpture present; postpetiole rugose; ventral process absent or vestigial.

Gaster. Pilosity of first gastral tergite consisting mainly of decumbent and subdecumbent setulae.

General characters. Colour orange. Brachypterous alates not seen. Ergatoid or worker-female intercastes not seen.

Queen measurements. HML 2.17–2.54; HL 0.74–0.87; HW 0.67–0.68; CeI 87–91; SL 0.54–0.60; SI 79; PW 0.62–0.62 (2 measured).

Male description

Head. Ratio of length of first funicular segment of antenna to length of second funicular segment near 1:1. Maximum number of mandibular teeth and denticles: three.

Alitrunk. Dorsal appearance of mesoscutum finely microreticulate; notauli absent. Axillae separated by distance more than half greatest width of scutellum.

Petiole and postpetiole. Petiolar spiracle lateral and in anterior sector of petiolar node. Sculpture present in form of microreticulation; ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 1:1. Ventral lobe always absent. Height-length ratio of postpetiole near 1:1; sculpture present in form of microreticulation.

Gaster. Pilosity of first gastral tergite consisting mainly of decumbent and subdecumbent setulae.

General characters. Colour chocolate.

Male measurements. HML 1.95; HL 0.55; HW 0.54; CeI 98; SL 0.17; SI 32; PW 0.60 (1 measured).

Etymology

Latin: 'long-haired'.

Remarks

Monomorium crinitum is one of the more widespread of the *kilianii*-group, most members of which are confined to the humid east coast of Australia. The worker is distinctive, with rather small eyes compared with other, similar-sized 'Chelaner' and long, fine setulae. In some individuals the mesonotal suture is evident as a raised ridge.

Several workers have been collected from the colonies of other ant species, namely *Pachycondyla* (*Bothroponera*) and *Myrmecia*, but the biology of *M. crinitum* is unknown. The reduced number of ommatidia suggests to me that *M. crinitum* is largely fossorial.

Monomorium kilianii Forel

(Figs 28, 90, 171, 182–184)

Monomorium kilianii Forel, 1902: 441, 442.

Monomorium kilianii var. *obscurum* Viehmeyer, 1925: 27, 28.

Syn. nov.

Chelaner kiliani (Forel) [comb. nov. Ettershank, 1966: 97].

Chelaner kiliani obscurum (Viehmeyer) [comb. nov. Ettershank, 1966: 97].

Monomorium kiliani Forel [comb. Bolton, 1987: 300, 301].

Monomorium kiliani obscurum Viehmeyer [comb. Bolton, 1987: 300, 301].

Material examined

M. kilianii

Syntype. Worker, Austr. [published locality: New South Wales, Bong Bong], [W. W.] Froggatt (ANIC – 'Syntype. not to be designated lectotype').

M. kilianii obscurum

Syntype. Worker, New South Wales, Liverpool, [collector not specified] (ZMHB) – cited as '*Monomorium kiliani obscurum*' in publication, but as '*Monomorium kiliani obscurum*' by the author on a hand-written label.

Other material examined. 121 workers, 6♀, 2♂ (ANIC); 14 workers, 1♀ (MV); 5 workers (QVMT); 142 workers, 2♀ (SAM) (see Fig. 28 for distribution).

Worker description

Head. Head rounded; vertex planar, or convex; frons smooth and shining with combination of incurved decumbent and subdecumbent setulae and erect and suberect setae. Compound eyes elliptical; (viewed from front) compound eyes set in anterior half of head capsule; (viewed laterally) compound eyes set posterior of midline of head capsule, or set at midline of head capsule; eye moderate, eye width 0.5–1.5× greatest width of antennal scape. Antennal segments 12; club three-segmented. Anteromedial clypeal margin convex, straight or slightly emarginate, median clypeal carinae indistinct. Longest lateral anterior clypeal setae long, extending beyond dorsal margin of closed mandibles. Posteromedial clypeal margin extending slightly posteriad of posterior surface of antennal fossae. Anterior tentorial pits situated nearer antennal fossae than mandibular insertions. Frontal lobes parallel straight. Venter of head capsule without elongate, basket-shaped setae. Palp formula 2,3. Maximum number of mandibular teeth and denticles: six; mandibles (viewed from front) triangular and striate, with piliferous punctures (striae partly effaced in pale individuals); basal tooth not enlarged; basal angle indistinct; apical and basal mandibular margins meeting in tooth or denticle.

Alitrunk. Promesonotal sculpture present in form of microreticulation and striolae on and around katapisternum, otherwise promesonotum smooth and shining; dorsal promesonotal face evenly convex; erect and suberect promesonotal setae greater than 10; setulae decumbent and subdecumbent. Mesonotal suture absent, or visible externally as faint ridge. Metanotal groove present as distinct and deeply impressed trough between promesonotum and propodeum. Propodeal sculpture present as faint microreticulation with few striae, mainly on lower lateral surface; dorsal propodeal face sloping posteriad, with wedge-shaped flattening or shallow depression that is widest between propodeal angles; processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle); lobes present as blunt flanges. Propodeal angle absent; declivitous face of propodeum flat. Erect and suberect propodeal setae 5–10; propodeal setulae appressed. Propodeal spiracle lateral and about midway between metanotal groove and declivitous face of propodeum; vestibule conspicuous through cuticle.

Petiole and postpetiole. Petiolar spiracle lateral and slightly anterior of petiolar node. Petiolar node cuneate, dorsally rounded, or tumular and inclined posteriad; sculpture absent, petiolar node smooth and shining. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3 to near 1:1. Anteroventral

process always absent or vestigial. Ventral lobe always absent. Height ratio of petiole to postpetiole near 4:3; height-length ratio of postpetiole near 4:3 to near 1:1. Sculpture absent on dorsum, at least: postpetiole smooth and shining. Ventral process absent or vestigial.

Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Workers most commonly with head chocolate, promesonotum tan, remaining body parts brown; other individuals more uniformly brown or yellow; all individuals with tawny yellow mandibles. Worker caste monomorphic.

Worker measurements. HML 1.83–2.84; HL 0.64–0.94; HW 0.58–0.88; CeI 81–92; SL 0.48–0.75; SI 79–96; PW 0.35–0.59 (46 measured).

Queen description

Head. Head square or rectangular, or cordate; vertex planar; frons striolate between frontal carinae, otherwise smooth and shining with a combination of decumbent and subdecumbent setulae and erect and suberect setae. Compound eyes elliptical; (viewed from front) compound eyes set in anterior half of head capsule; (viewed laterally) compound eyes set at midline of head capsule; eye large, eye width greater than 1.5× greatest width of antennal scape.

Alitrunk. Mesoscutum in profile convex anteriorly; thereafter flattened. Mesoscutal pilosity consisting of decumbent and subdecumbent setulae anteriorly and erect and suberect setae posteriorly; dorsal appearance of mesoscutum smooth and shining; length-width ratio of mesoscutum and scutellum combined near 4:3. Axillae separated by distance less than half greatest width of scutellum. Propodeal sculpture present as uniform rugosity, with well defined costulae on declivitous face of propodeum; dorsal propodeal face flattened. Propodeal processes present on posterior propodeal angles as small denticles or sharp flanges; lobes present as blunt flanges. Propodeal angle present. Erect and suberect propodeal setae 5–10; propodeal setulae decumbent and subdecumbent. Propodeal spiracle lateral and nearer metanotal groove than declivitous face of propodeum.

Wing. Wing veins tubular and strongly sclerotised; vein m-cu present as an entire vein enclosing first discoidal cell; vein cu-a present.

Petiole and postpetiole. Petiolar spiracle lateral and positioned in pedicel well anterior of petiolar node. Petiolar node cuneate, dorsally rounded; sculpture present in form of microreticulation. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3 to near 1:1. Anteroventral process distinct in some individuals as slender carina that tapers posteriad. Height ratio of petiole to postpetiole near 1:1 to near 4:3; height-length ratio of postpetiole near 2:1 to near 4:3. Sculpture

absent on dorsum, at least: postpetiole smooth and shining; ventral process absent or vestigial.

Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour brown to tawny orange, gaster amber. Brachypterous alates not seen. Ergatoid or worker-female intercastes not seen.

Queen measurements. HML 3.88–4.63; HL 1.03–1.24; HW 1.01–1.24; CeI 92–105; SL 0.78–0.98; SI 76–84; PW 1.11–1.40 (8 measured).

Male description

Head. Head width–mesoscutal width ratio near 1:1. Compound eyes protuberant and elliptical; (viewed laterally) compound eyes set at midline of head capsule; ocelli not turreted. Ratio of length of first funicular segment of antenna to length of second funicular segment near 1:2 to near 1:3. Maximum number of mandibular teeth and denticles: four.

Alitrunk. Mesoscutum in profile evenly convex; dorsal appearance of mesoscutum striolate and microreticulate; mesoscutal pilosity consisting of numerous short setae, incurved medially. Parapsidal furrows vestigial; notauli present. Axillae separated by distance of about half greatest width of scutellum.

Wing. Wing veins tubular and strongly sclerotised; vein m-cu present as an entire vein enclosing first discoidal cell; vein cu-a present.

Petiole and postpetiole. Petiolar spiracle lateral and slightly anterior of petiolar node. Sculpture absent, petiolar node smooth and shining; ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 3:4. Anteroventral process always absent or vestigial; ventral lobe always absent. Height–length ratio of postpetiole near 2:1; sculpture absent on dorsum, at least: postpetiole smooth and shining, or present in form of microreticulation; ventral process absent or vestigial.

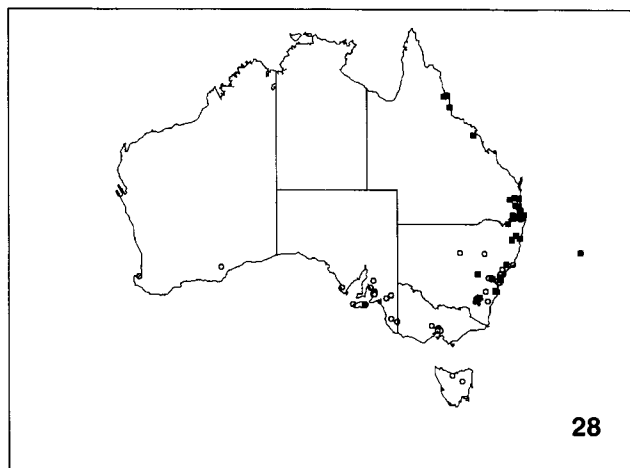
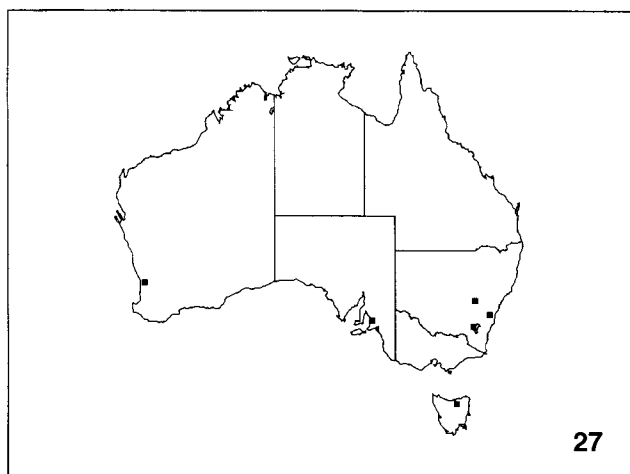
Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour chocolate.

Male measurements. HML 2.59–2.79; HL 0.62–0.72; HW 0.62–0.72; CeI 100; SL 0.21–0.23; SI 32–33; PW 0.67–0.75 (2 measured).

Remarks

Monomorium bearing the species name '*kiliani*' pose a nomenclatural problem. Forel's hand-written labels on the syntypes for *Monomorium kiliani* and *Monomorium kiliani tambourinense* clearly read '*kilianii*'. However, '*Monomorium kiliani*' appears in the description in Forel's article 'Fourmis Nouvelle D'Australie' (Forel 1902), though '*Monomorium kilianii*' is found in the list of ants at the end of the same article. Conversely, '*kilianii*' is the published



Figs 27, 28. 27, Distribution of *M. crinitum* (■) specimens examined during this study. 28, Distribution of *M. kilianii* (○) and *M. tambourinense* (■) specimens examined during this study.

species epithet in the description of *Monomorium kiliani tambourinense*.

Forel nowhere mentions the origin of the name, though it is a proper noun. (This is indicated by Forel's use of capitalisation for the species epithet: ordinary nouns commence with a lower case letter in his works.) The name may be in honour of a colleague or a collector. Forel made major contributions in disciplines other than entomology, and contemporaneous European scientists who bore the surnames 'Kilian' and 'Kiliani' can be found in these fields (e.g. the noted geologist and palaeontologist Charles C. W. Kilian, and the biochemist Heinrich Kiliani). Since '*kilianii*' appears on at least two type-labels, and is also published in two articles, the use of '*kiliani*' on just the one occasion suggests a typographical error.

I therefore propose that, under Article 32.4 of the Code (ICZN 1999), the species epithet '*kiliani*' be emended to read '*kilianii*' as the correct spelling in the type names *Monomorium kilianii* and *Monomorium kilianii*

tambourinense. The type name '*Monomorium kilianii obscurellum*' also requires to be spelt in this way, as the original spelling has no separate availability in the original form.

Monomorium kilianii has a uniform morphology throughout its range, though the cuticle may be lighter or darker in some specimens. *Monomorium kilianii obscurellum* simply represents one of the darker forms, and is otherwise identical with the typical morph. *Monomorium tambourinense*, however, represents a distinct species that can be distinguished from *M. kilianii* by the features noted in the worker key. Moreover, the head capsule is generally darker than the promesonotum when *M. kilianii* is viewed from the front, whereas the head capsule of *M. tambourinense* is lighter in colour or the same colour as the promesonotum, when viewed similarly.

Monomorium kilianii includes a high proportion of vegetable material in its diet (Andersen 1991a: 498, 499) and may even constitute a minor pest in orchards. Label data on specimens from Lucindale, South Australia, indicate that the ants were attacking young buds on apple trees, causing deformity in the growing fruit. The ants also attacked fallen fruit.

***Monomorium petiolatum*, sp. nov.**

(Figs 29, 80)

Material examined

Holotype. Worker, Queensland, Mt Tyson 2 km SW Tully 17°55'S, 145°54'E, 7.v.1983, D. K. Yeates, QM berlesate no. 588, rainforest, 650m, sieved litter (ANIC).

Paratypes. **Queensland:** 3×3 workers, Table Mtn., Cape Tribulation 16°09'S, 145°26'E, 24.iv.1983, G. B. Monteith & D. Cook, QM berlesate no. 542, rainforest, 320m, sieved litter, ANIC ants vial no. 40.211 (ANIC, BMNH, MCZ); 3×2 workers, same collection data as preceding paratypes, QM berlesate no. 540 (ANIC, BMNH, MCZ); 3 workers, Queensland, banks of Daintree R., 8.viii.1975, B. B. Lowery, RF, in rotten wood, *Chelaner* (ANIC).

Other material examined. **Queensland:** 3 workers, 8 km SW Innisfail (ANIC); 3 workers, Pingin Hill (ANIC); 1 worker, Windsor Tableland (ANIC).

Worker description

As for the worker of *M. kilianii*, but with the following apomorphies.

Head. Head square or rectangular; vertex convex. (Viewed laterally) compound eyes set at midline of head capsule. Anteromedial clypeal margin straight or slightly emarginate, median clypeal carinae not produced as teeth or denticles. Posteromedial clypeal margin level with posterior surface of antennal fossae. Anterior tentorial pits equidistant between mandibular insertions and antennal fossae. Palp formula 2,2. Maximum number of mandibular teeth and denticles: four; mandibles (viewed from front) triangular and smooth, with piliferous punctures.

Alitrunk. Promesonotal setulae appressed. Mesonotal suture absent. Metanotal groove present as feebly impressed furrow between promesonotum and propodeum. Dorsal propodeal face gently convex, or sloping posteriad, with wedge-shaped flattening or shallow depression that is widest between propodeal angles. Propodeal setulae absent.

Petiole and postpetiole. Petiolar spiracle lateral and positioned in pedicel well anterior of petiolar node. Petiolar node conical, dorsally rounded. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 1:1. Height ratio of petiole to postpetiole near 1:1 to near 4:3; height-length ratio of postpetiole near 3:4 to near 1:2.

Gaster. Pilosity of first gastral tergite consisting entirely of well-spaced erect and suberect setae.

General characters. Colour shining orange; head, gaster, and legs often lighter in colour. Worker caste monomorphic.

Holotype worker measurements. HML 2.02; HL 0.62; HW 0.51; CeI 81; SL 0.57; SI 114; PW 0.37.

Other worker measurements. HML 2.04–2.29; HL 0.59–0.65; HW 0.50–0.57; CeI 80–88; SL 0.56–0.59; SI 104–111; PW 0.30–0.40 (13 measured).

Etymology

Latin: 'little stalk' (referring to the petiolar peduncle).

Remarks

The above species has a remarkably long petiolar peduncle, and this feature, combined with the glossy, shining cuticle, gives the ant the appearance of a glasswork creation when viewed under a microscope. The long peduncle also distinguishes it from other members of the *kilianii*-group, except for *M. shattucki* (which, however, has a conspicuous petiolar node). *Monomorium petiolatum* is a cryptic forager in rainforest ground litter.

***Monomorium shattucki*, sp. nov.**

(Figs 29, 79)

Material examined

Holotype. Worker, Queensland, 2 km W of Cape Tribulation (site 4) 16°05'S, 145°28'E, 21.iv.1983, G. B. Monteith & D. K. Yeates, berlesate no. 528, rainforest, 200 m, sieved litter (ANIC).

Paratype. **Queensland:** 7 workers and 2 ergatoids, same data as holotype (1 pin each to ANIC, BMNH and MCZ).

Worker description

As for the worker of *M. kilianii*, but with the following apomorphies.

Head. Head rounded; vertex slightly concave. Anteromedial clypeal margin straight or slightly emarginate, median clypeal carinae not produced as teeth or denticles.

Posteromedial clypeal margin level with posterior surface of antennal fossae. Palp formula 2,2. Maximum number of mandibular teeth and denticles: four; mandibles (viewed from front) triangular and smooth, with piliferous punctures.

Alitrunk. Mesonotal suture absent. Metanotal groove present as feebly impressed furrow between promesonotum and propodeum. Propodeal sculpture present as uniform rugosity, with well defined costulae on declivitous face of propodeum. Propodeal processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle), or absent (propodeum angulate in profile). Propodeal angle absent, or present; declivitous face of propodeum longitudinally concave between its lateral margins. Erect and suberect propodeal setae >5; propodeal setulae absent.

Petiole and postpetiole. Petiolar spiracle lateral and slightly anterior of petiolar node. Petiolar node conical, dorsally rounded. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 1:1 to near 3:4. Height ratio of petiole to postpetiole near 1:1 to near 4:3.

Gaster. Pilosity of first gastral tergite consisting entirely of well-spaced erect and suberect setae.

General characters. Colour shining yellow-orange. Worker caste monomorphic.

Holotype worker measurements. HML 2.15; HL 0.68; HW 0.59; CeI 86; SL 0.61; SI 104; PW 0.41.

Other worker measurements. HML 2.09–2.39; HL 0.66–0.74; HW 0.56–0.64; CeI 83–88; SL 0.52–0.64; SI 96–106; PW 0.40–0.49 (12 measured).

Etymology

Named in honour of Dr Steve Shattuck, CSIRO, Canberra.

Remarks

As with several other Australian rainforest *Monomorium*, this species appears to have a restricted distribution, and is known from one collection from Cape Tribulation. *Monomorium shattucki* is very similar to the more widespread *M. petiolatum*, but differs in the shape of the nodes, the length of the petiolar peduncle and the position of the petiolar spiracle.

Monomorium tambourinense Forel

(Figs 28, 92, 99, 170)

Monomorium (Notomyrmex) kilianii var. *tambourinensis* Forel, 1915: 71.

Monomorium (Notomyrmex) howense Wheeler, 1927: 138–139, fig. 5 a,b. **Syn. nov.**

Chelaner kiliani tambourinensis (Forel) [comb. nov. Ettershank, 1966: 97].

Chelaner howensis (Wheeler) [comb. nov. Ettershank, 1966: 97].

Monomorium kiliani tambourinense Forel [comb. Bolton, 1987: 300, 301].

Monomorium howense Wheeler [comb. Bolton, 1987: 300, 301].

Material examined

M. howense

Syntypes. Two ♀, 6 workers and 1 intercaste, Lord Howe Island, Wm. M. Wheeler (MCZ – ‘Cotype’ 22849).

M. kilianii tambourinense

Syntype. Worker, Queensland, Mt Tambourine, x.1913, [E. G.] Mjöberg (ANIC – ‘Syntype ex Geneva Mus. not to be designated lectotype’).

Other material examined. 139 workers, 17 ♀, 2 ergatoids (ANIC); 2 workers, 1 ♀ (QM); 11 workers, 2 ergatoids (SAM) (see Fig. 28 for distribution).

Worker description

As for the worker of *M. kilianii*, but with the following apomorphies.

Head. Head square or rectangular; vertex slightly concave to planar. (Viewed laterally) compound eyes set at midline of head capsule. Anteromedial clypeal margin straight or slightly emarginate, median clypeal carinae not produced as teeth or denticles. Posteromedial clypeal margin level with posterior surface of antennal fossae. Palp formula 2,2. Maximum number of mandibular teeth and denticles: five; mandibles (viewed from front) triangular and smooth, with piliferous punctures.

Alitrunk. Mesonotal suture absent. Propodeal sculpture present as faint microreticulation with few striae, mainly on lower lateral surface, or present as uniform rugosity, with well defined costulae on declivitous face of propodeum. Propodeal angle absent; declivitous face of propodeum longitudinally concave between its lateral margins.

Petiole and postpetiole. Petiolar node conical, dorsally rounded, or tumular and inclined posteriad; sculpture absent, petiolar node smooth and shining. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 1:1, or near 3:4. Height–length ratio of postpetiole near 4:3 to near 3:4.

General characters. Colour very variable: two distinctive colour morphs: 1. head, alitrunk, petiole and postpetiole shining russet, gaster bright tawny yellow to russet, often with one or more brown bands, appendages a creamy yellow to amber; 2. head tawny yellow, alitrunk, petiole and postpetiole yellow, reddish-orange or fulvous, gaster as for 1., legs tawny yellow; other series yellowish, orange or dull brown with varying degrees of infuscation, particularly of propodeum. Worker caste monomorphic.

Worker measurements. HML 1.41–2.48; HL 0.50–0.81; HW 0.40–0.72; CeI 76–90; SL 0.36–0.67; SI 86–102; PW 0.28–0.50 (54 measured).

Queen description

As for the queen of *M. kilianii*, but with the following apomorphies.

Head. Head square or rectangular; vertex planar; frons smooth and shining with combination of incurved decumbent and subdecumbent setulae and erect and suberect setae.

Alitrunk. Mesoscutum in profile evenly convex, or convex anteriad; thereafter flattened. Mesoscutal pilosity consisting of dense incurved setulae and setae. Propodeal processes absent (propodeum angulate in profile). Propodeal spiracle lateral and about midway between metanotal groove and declivitous face of propodeum.

Petiole and postpetiole. Petiolar node cuneate, dorsally rounded; sculpture absent, petiolar node smooth and shining. Height ratio of petiole to postpetiole near 1:1, or near 4:3; height-length ratio of postpetiole near 2:1, or near 4:3.

General characters. Colour variable: often tawny yellow or shining russet, alone or in combination. If alitrunk infuscated, head and gaster usually of lighter colour, gaster sometimes with transverse brown banding. Brachypterous alates not seen. Ergatoid or worker-female intercastes seen and examined.

Queen measurements. HML 2.00–2.77; HL 0.62–0.82; HW 0.55–0.72; CeI 86–93; SL 0.45–0.64; SI 78–79; PW 0.48–0.71 (12 measured).

Remarks

Monomorium tambourinense can be distinguished from the similar *M. kilianii* on the basis of the characters mentioned in the key to *Monomorium* species based on workers. This species also resembles *M. leae*, from which it differs chiefly in the length of the petiolar peduncle and the shape of the postpetiole. *Monomorium tambourinense* is very variable in colour, but is more uniform in morphology than either *M. leae* or *M. rubriceps*, the other widespread east coast *Monomorium*. The type of *Monomorium howense* represents a pale variety of *M. tambourinense*, that can also be found on the mainland. Almost identical specimens from Mt Canobolas and Ebor (New South Wales) have been noted. The only difference between most light-coloured mainland worker material and the Lord Howe Island population is the absence of transverse brown bands on the gasters of the latter. However, Wheeler (1927) noted that queens and intercastes occasionally did have the bands or other infuscation. The colour morph *M. howense* may have been inadvertently transported to Lord Howe Island from the Australian mainland in the early days of European settlement.

Monomorium howense has a yellow or orange head and gaster, and reddish-orange alitrunk, while the type of *M. kilianii tambourinense* is brown with a yellow gaster and pale appendages. The *M. tambourinense* colour morph is more common in northern New South Wales and southern Queensland, though it occurs elsewhere. Other colour patterns forming a continuum between these two extremes are common, and a pale yellow morph occurs on the

Bellenden Ker range, thus there is no justification for *M. howense* and *M. tambourinense* to be considered as anything other than colour varieties of a widespread species. Consequently, *M. howense* is here synonymised under the senior name *M. tambourinense*.

This species is a cryptic forager in cool temperate and tropical montane forests. Habitats include moss, rotten logs and leaf litter. Specimens taken from Lord Howe Island in 1972 were found nesting in subfossil bird bones.

The longinode-group

Monomorium bifidum, sp. nov.

(Figs 30, 63, 70)

Material examined

Holotype. Worker, Northern Territory, 30 km SE Katherine, 7–11.iv.1978, P. J. M. Greenslade (ANIC).

Paratypes. **Northern Territory:** 7 workers, 22 km SE Katherine, 8.iv.1978, P. J. M. Greenslade (ANIC); 1 worker, 24 km SE Katherine, 8.iv.1978, P. J. M. Greenslade (MCZ); 1 worker, 27 km SE Katherine, 8.iv.1978, P. J. M. Greenslade (ANIC); 2 workers, Manbulloo, SW Katherine, 25.x.1977, P. J. M. Greenslade (BMNH).

Other material examined. **Northern Territory:** 3 workers, 18 km N Jabiru 12°30'S, 132°51'E (ANIC). **Queensland:** 6 workers, near Dimbulah 145°04'S, 17°04'E (ANIC). **Western Australia:** 1 worker, Kimberley R. S. (WAM); 1 worker, Kununurra region (JDM).

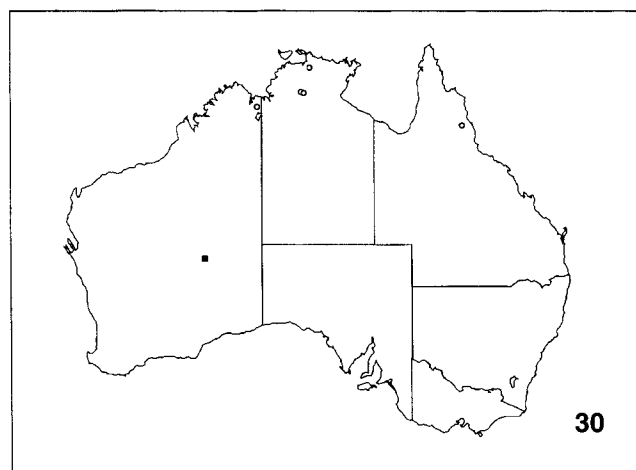
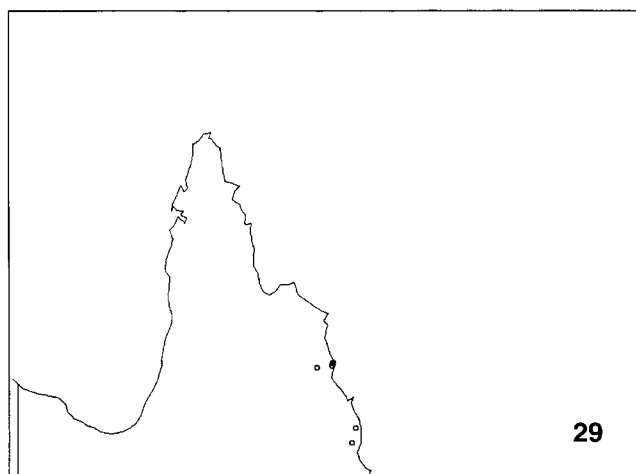
Worker description

As for the worker of *M. longinode* (see below), but with the following apomorphies.

Head. Frons of head capsule longitudinally striate with combination of appressed setulae and erect and suberect setae. (Viewed from front) compound eyes set in anterior half of head capsule. Antennal club gradually tapering and barely discernible. Anteromedial clypeal margin emarginate, median clypeal carinae produced apically as pair of pronounced teeth. Posteromedial clypeal margin situated between anterior and posterior surfaces of antennal fossae. Frontal lobes parallel straight. Maximum number of mandibular teeth and denticles: two.

Alitrunk. Dorsal promesonotal face evenly convex; erect and suberect promesonotal setae 5–10. Mesonotal suture visible externally as faint ridge. Dorsal propodeal face gently convex; processes present on posterior propodeal angles in form of minute lamellae. Erect and suberect propodeal setae absent or very sparse; propodeal setulae appressed.

Petiole and postpetiole. Petiolar node cuboidal; sculpture present in form of microreticulation. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 1:1. Height ratio of petiole to postpetiole near 3:4 to near 1:1; height-length ratio of postpetiole near 4:3 to near 1:1. Sculpture present in form of microreticulation.



Figs 29, 30. 29, Distribution of *M. petiolatum* (○) and *M. shattucki* (■) specimens examined during this study. 30, Distribution of *M. bifidum* (○) and *M. capito* (■) specimens examined during this study.

General characters. Colour a uniform russet, or reddish with a black gaster. Worker caste monomorphic.

Holotype worker measurements. HML 3.43; HL 1.40; HW 1.31; CeI 93; SL 0.83; SI 63; PW 0.68.

Other worker measurements. HML 3.39–3.85; HL 1.38–1.57; HW 1.35–1.48; CeI 90–96; SL 0.75–0.90; SI 60–63; PW 0.61–0.69 (7 measured).

Etymology

Latin: 'cleft', with reference to the mandibles.

Remarks

Monomorium bifidum is the only known *Monomorium* with two mandibular teeth. The bottom tooth is larger than the top tooth, and both are broad and flattened with a scissor-like edge. This feature, together with the stoutly produced clypeal denticles, suggests that the ant may be a graminivore, but nothing is known of its biology. A label with the Jabiru

specimens states that they were found foraging on the ground in *Eucalyptus* forest.

This species varies little across its range, but the Dimbulah specimens have reddish gasters, while workers from Western Australia and most of those from the Northern Territory have black gasters. The Jabiru specimens, however, fall between these two extremes. (Similar variation in the colour of the worker gaster has already been described for *M. bicornis*.)

Monomorium capito, sp. nov.

(Figs 30, 64)

Material examined

Holotype. Worker, Western Australia, 182 km NE by E of Cosmo Newberry, 14.ix.1977, J. E. Feehan (ANIC).

Worker description

As for the worker of *M. longinode*, sp. nov., but with the following apomorphies.

Head. Vertex of head capsule strongly concave; frons longitudinally striate with combination of appressed setulae and erect and suberect setae. (Viewed laterally) compound eyes set anterior of midline of head capsule; eye large, eye width greater than 1.5× greatest width of antennal scape. Antennal club gradually tapering and barely discernible. Anteromedial clypeal margin emarginate, median clypeal carinae produced apically as pair of pronounced teeth. Longest lateral anterior clypeal setae short, not reaching dorsal margin of closed mandibles. Venter of head capsule with elongate, basket-shaped setae. Palp formula unknown. Maximum number of mandibular teeth and denticles: three.

Alitrunk. Dorsal promesonotal face evenly convex; erect and suberect promesonotal setae >5. Dorsal propodeal face strongly convex; processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle. Erect and suberect propodeal setae absent or very sparse; propodeal setulae appressed. Propodeal spiracle lateral and nearer declivitous face of propodeum than metanotal groove.

Petiole and postpetiole. Petiolar spiracle ventral and slightly anterior of petiolar node. Petiolar sculpture present in form of microreticulation. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 3:4. Anteroventral process vestigial in specimen seen. Height ratio of petiole to postpetiole near 3:4. Sculpture present in form of microreticulation. Ventral process absent or vestigial.

General characters. Colour crimson; legs brown.

Holotype worker measurements. HML 3.60; HL 1.38; HW 1.33; CeI 97; SL 0.91; SI 66; PW 0.64.

Etymology

Latin: 'big head'.

Remarks

Monomorium capito has three teeth, as opposed to two in *M. bifidum*, and four or five in the smaller-headed *M. flavonigrum* and *M. longinode*. The one known specimen of this interesting ant comes from a remote area of Western Australia, where very little collecting has been done.

Monomorium flavonigrum, sp. nov.

(Figs 31, 65, 71)

Material examined

Holotype. Worker (top rectangle), Western Australia, Woongondy [= Wongoody], 19.v.1963, C. Mercovich (ANIC).

Paratypes. **Western Australia**: 2 workers and 1 ergatoid with same data as holotype (ANIC); 8 workers, Tardun, 90 miles E of Geraldton (via Mullewa), 10.i.1963, C. Mercovich, 400 ft, semi-arid mallee (MCZ); 2 workers, Tardun, 10.i.1963, C. Mercovich (BMNH)

Worker description

As for the worker of *M. longinode*, sp. nov., but with the following apomorphies.

Head. Head trapezoid, narrowest towards vertex; frons longitudinally striate with combination of appressed setulae and erect and suberect setae. (Viewed laterally) compound eyes set anterior of midline of head capsule;

Alitrunk. Promesonotal sculpture present in form of microreticulation, striolae and striae on the mesopleuron, and striolae on posterodorsal promesonotal surface; dorsal promesonotal face evenly convex; erect and suberect promesonotal setae 5–10. Propodeal sculpture present as uniform microreticulation, with few or no striae or costulae; dorsal propodeal face gently convex; processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle). Propodeal angle present; declivitous face of propodeum flat. Erect and suberect propodeal setae absent or very sparse; propodeal setulae absent. Propodeal spiracle lateral and nearer declivitous face of propodeum than metanotal groove.

Petiole and postpetiole. Petiolar spiracle ventral and slightly anteriad of petiolar node. Petiolar sculpture present in form of microreticulation. Anteroventral process always absent or vestigial. Height ratio of petiole to postpetiole near 3:4 to near 1:1; height–length ratio of postpetiole near 4:3 to near 1:1. Sculpture present in form of microreticulation.

Gaster. Pilosity of first gastral tergite consisting entirely of well-spaced appressed setulae.

General characters. Colour of head orange, alitrunk petiole and postpetiole dark brown to black, gaster bright gamboge yellow, legs brown. Worker caste monomorphic.

Holotype worker measurements. HML 2.83; HL 0.97; HW 0.87; CeI 90; SL 0.83; SI 95; PW 0.60.

Worker measurements. HML 2.55–2.82; HL 0.90–1.00; HW 0.91–0.96; CeI 89–100; SL 0.75–0.86; SI 85–92; PW 0.48–0.58; (12 measured).

Ergatoid description

As for the worker, but differing in the following particulars:

Head. Head square or rectangular. (Viewed from front) compound eyes set in anterior half of head capsule; (viewed laterally) compound eyes set at midline of head capsule.

Alitrunk. Mesoscutum in profile evenly convex. Mesoscutal pilosity consisting of dense incurved setulae and setae; dorsal appearance of mesoscutum finely microreticulate. Propodeal sculpture present as uniform rugosity, with well defined costulae on declivitous face of propodeum; dorsal propodeal face flattened. Propodeal angle absent. Erect and suberect propodeal setae 5–10; propodeal setulae decumbent and subdecumbent.

Petiole and postpetiole. Petiolar spiracle lateral and slightly anteriad of petiolar node. Petiolar node cuboidal. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 2:1. Anteroventral process of petiole a pronounced spur. Height ratio of petiole to postpetiole near 1:1; height–length ratio of postpetiole near 2:1. Sculpture absent on dorsum, at least: postpetiole mainly smooth and shining, faintly shagreenate on sides.

Gaster. Pilosity of first gastral tergite consisting entirely of erect and suberect setae.

General characters. Colour of head and gaster orange; alitrunk, petiole and postpetiole brown. Brachypterous alates not seen for this species.

Ergatoid measurements. HML 3.39; HL 1.03; HW 1.09; CeI 105; SL 0.88; SI 81; PW 0.88 (1 measured).

Etymology

Latin: 'yellow-and-black'.

Remarks

Features of colour (bicoloured yellow and dark brown as opposed to a combination of various shades of red and brown) and head shape (trapezoid versus square or rectangular) most clearly separate *M. flavonigrum* from *M. longinode*. Unlike the closely related *M. longinode*, *M. flavonigrum* seems to have a restricted distribution in the Murchison district, Western Australia, with just two collections taken east of Geraldton at the time of this study. Since then additional worker material has been collected from nests on the Canna townsite, 15 km S of Tardun. The latter specimens are housed in the JDM Ant Collection.

Monomorium longinode, sp. nov.

(Figs 31, 72, 185–187)

Material examined

Holotype. Worker, Western Australia, Morangup Rd. (near Toodyay), 3.i.1987, B. E. Heterick, soil, native veg., rural environ., 113/6MonBH33A (ANIC).

Paratypes. **Western Australia**: 1 worker (vi.1972), 4 workers (vi.1977), Perth, John Forrest Natl Pk, Darling Range, G. H. Lowe, 94/1665, 96/1646, 96/1647, 96/1648, and 96/1649 (WAM); 2 workers, Cannington, 9.vii.1953, R. P. McMillan, 53–1645 (WAM); 1 worker, near Perth, 1978, M. Rossbach, A1379 C34, JDM no. 502 (BMNH); 5 workers, Kings Park, Perth, 19.xii.1969, B. B. Lowery (MCZ).

Other material examined. **Western Australia**: 4 workers, Bushmead (WAM); 1 worker, Canningvale (JDM); 21 workers, Carlisle (WAM); 5 workers, Esperance (ANIC); 3 workers, Lake Cronin 32°23'S, 119° (WAM); 4 workers, Merivale Downs, E of Esperance (ANIC); 1 worker, Mount Barker (WAM); 1 ♂, 5 workers, 2 miles W of Mt Ragged (ANIC); 6 workers, 3 miles S by W Mt Ragged (ANIC); 3 workers, 20 miles SW Mt Ragged 33°39'S, 123°13'E (ANIC); 1 worker, Mundaring, date unknown, J. Clark (ANIC); 5 workers, Mundaring, date unknown (MV); 6 workers, near Perth (JDM); 3 workers, Thomas R. W of mouth 33°51'S, 123°01'E (ANIC).

Worker description

Head. Head square or rectangular; vertex slightly concave; frons longitudinally striate and reticulate with combination of incurved decumbent and subdecumbent setulae and erect and suberect setae. Compound eyes elliptical; (viewed from front) compound eyes set at midpoint of each side of head capsule; (viewed laterally) compound eyes set at midline of head capsule; eye moderate, eye width 0.5–1.5× greatest width of antennal scape. Antennal segments 12; club three-segmented. Anteromedial clypeal margin emarginate, median clypeal carinae produced as pair of bluntly rounded denticles. Longest lateral anterior clypeal setae long, extending beyond dorsal margin of closed mandibles. Posteromedial clypeal margin level with posterior surface of antennal fossae. Anterior tentorial pits situated nearer antennal fossae than mandibular insertions. Frontal lobes parallel, sinuate. Venter of head capsule with elongate, basket-shaped setae in at least some individuals. Palp formula 2,3. Maximum number of mandibular teeth and denticles: five; mandibles (viewed from front) strap-like with inner and outer edges subparallel, striate, with piliferous punctures; basal tooth not enlarged; basal angle indistinct; apical and basal mandibular margins meeting in tooth or denticle.

Alitrunk. Promesonotal sculpture present in form of microreticulation and rugosity over entire promesonotum; dorsal promesonotal face convex anteriad, otherwise flattened; erect and suberect promesonotal setae greater than 10; setulae appressed. Mesonotal suture absent. Metanotal groove present as feebly impressed furrow between promesonotum and propodeum. Propodeal sculpture present as uniform rugosity, with well defined costulae on

declivitous face of propodeum; dorsal propodeal face strongly convex to gently convex; processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle); lobes present as blunt flanges. Propodeal angle absent; declivitous face of propodeum smoothly convex. Erect and suberect propodeal setae greater than 10; propodeal setulae decumbent and subdecumbent. Propodeal spiracle lateral and about midway between metanotal groove and declivitous face of propodeum; vestibule conspicuous through cuticle.

Petiole and postpetiole. Petiolar spiracle lateral and slightly anteriad of petiolar node. Petiolar node elongate and barrel-shaped; sculpture present; petiolar node rugose. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 1:1 to near 3:4. Anteroventral process distinct in some individuals as slender carina that tapers posteriad. Ventral lobe always absent. Height ratio of petiole to postpetiole near 1:1 to near 4:3; height-length ratio of postpetiole near 1:1. Sculpture present in form of microreticulation, or present; postpetiole rugose. Ventral process present and distinct.

Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour of head amber to red, and variously infuscated with brown or black in many individuals, alitrunk, petiole and postpetiole dark crimson to amber (may be infuscated dorsally with a blackish tinge), sometimes darker in colour than head, gaster and legs amber to black. Worker caste monomorphic.

Holotype worker measurements. HML 3.16; HL 1.06; HW 0.99; CeI 93; SL 0.85; SI 86; PW 0.63.

Other worker measurements. HML 2.89–3.50; HL 0.96–1.09; HW 0.90–1.07; CeI 90–103; SL 0.79–0.93; SI 77–89; PW 0.51–0.65 (25 measured).

Male description

Head. Head width–mesoscutal width ratio near 4:3. Compound eyes protuberant and elliptical; (viewed laterally) compound eyes set anterior of midline of head capsule; ocelli conspicuous and turreted. Ratio of length of first funicular segment of antenna to length of second funicular segment near 1:2. Maximum number of mandibular teeth and denticles: three.

Alitrunk. Mesoscutum in profile evenly convex; dorsal appearance of mesoscutum finely microreticulate; mesoscutal pilosity consisting of numerous short setae, incurved medially. Parapsidal furrows present and distinct; notauli absent. Axillae separated by distance more than half greatest width of scutellum.

Wing. Wing veins tubular and strongly sclerotised; vein m-cu absent; vein cu-a present.

Petiole and postpetiole. Petiolar spiracle lateral and slightly anteriad of petiolar node. Sculpture present in form

of microreticulation; ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 3:4. Anteroventral process absent. Ventral lobe absent. Height-length ratio of postpetiole near 1:1; sculpture present in form of microreticulation; ventral process absent or vestigial.

Gaster. Pilosity of first gastral tergite consisting entirely of well-spaced appressed setulae.

General characters. Colour dark brown; gaster and legs lighter than rest of body.

Male measurements. HML 3.23; HL 0.78; HW 0.73; CeI 95; SL 0.31; SI 42; PW 1.03 (1 measured).

Etymology

Latin: 'long node'.

Remarks

Monomorium longinode is separable from the closely related *M. flavonigrum* by the features listed under 'Remarks' for that species. *Monomorium longinode* is probably the most frequently encountered of the large 'Chelaner' species occurring in southwestern Australia, and is not uncommon in relict bush-land in the Perth metropolitan area. Label data and my own collecting experience indicate that this species prefers to nest in sandy soil.

The length of the petiolar node can vary between populations (see 'Worker description'). Many worker specimens also possess a propodeal hump that is lacking in workers in the immediate vicinity of Perth. Colour is another variable feature. Specimens from localities near the south coast of Western Australia tend to be dull orange or tawny brown with heavy infuscation of the head and alitrunk. In some cases the frons is nearly black. This feature is lacking in most populations near Perth, though a series from Bushmead reveals some vestigial infuscation near the occiput. Many workers from nests in the Perth area have a crimson alitrunk and nodes, an orange head, and black, shining gaster. No collections from the area stretching from Perth to Bunbury have been seen, and these are needed to gain a better picture of the above variation.

The *monomorium*-group Bolton

Monomorium aithoderum, sp. nov.

(Figs 32, 131)

Material examined

Holotype. Worker (top point), South Australia, Eyre Hwy., 38 km W Kimba, 14.xii.1995, B. E. Heterick (ANIC).

Paratypes. **South Australia:** 3 workers with same data as the holotype (ANIC). **Western Australia:** 4 workers (1 head missing), 2 miles N of Borden, 9.xi.1947, T. Greaves, 8455, only specimens

(ANIC); 1 worker, 11 miles WNW of Esperance, 11.xi.1947, T. Greaves, 8730, only specimens (BMNH); 1 worker, Kenwick, 14 km SE of Perth, 10.ix.1980, J. Lewis, on *Conostylis*, 94/11682 (WAM); 4×1 workers, Tutanning, 1980, A. Perth, JDM 541 (3 pins to MCZ, 1 pin to JDM).

Other material examined. **Western Australia:** 1 worker, Bungulla (JDM); 1 worker, Darlington (Perth) (WAM); 1 worker, Lake Leschenaultia (JDM).

Worker description

As for the worker of *M. sydneyense* (see below), but with the following apomorphies.

Head. (Viewed from front) compound eyes set at midpoint of each side of head capsule; (viewed laterally) compound eyes set posterior of midline of head capsule; eye moderate, eye width 0.5–1.5× greatest width of antennal scape. Anteromedial clypeal margin emarginate, median clypeal carinae produced apically as pair of pronounced teeth. Mandibles (viewed from front) strap-like with inner and outer edges subparallel, striate, with piliferous punctures; basal tooth not enlarged.

Alitrunk. Promesonotal sculpture present in form of microreticulation, striolae and striae on the mesopleuron, and striolae on posterodorsal promesonotal surface; dorsal promesonotal face evenly convex; erect and suberect promesonotal setae absent, or greater than 10. Metanotal groove present as feebly impressed furrow between promesonotum and propodeum, or present as distinct and deeply impressed trough between promesonotum and propodeum. Propodeal sculpture present as uniform microreticulation, with few or no striae or costulae. Declivitous face of propodeum longitudinally concave between its lateral margins. Erect and suberect propodeal setae absent or very sparse, or 5–10 setae present; propodeal setulae appressed.

Petiole and postpetiole. Petiolar node cuneate, dorsally rounded; sculpture absent, petiolar node smooth and shining to present in form of microreticulation. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3. Height ratio of petiole to postpetiole near 4:3. Sculpture absent on dorsum, at least: postpetiole smooth and shining.

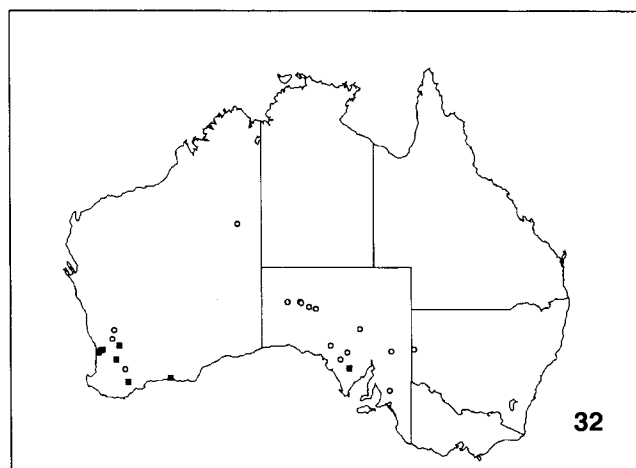
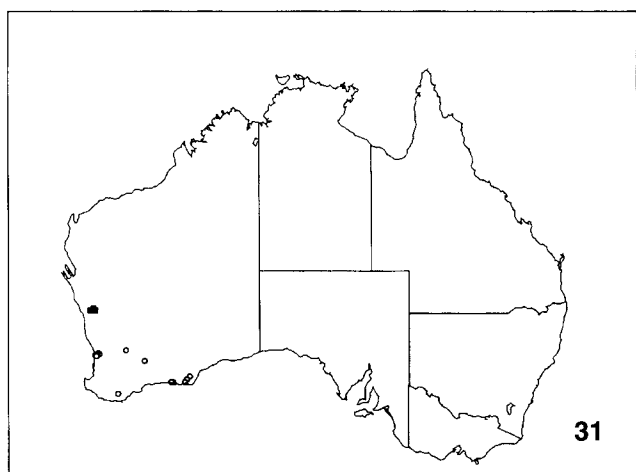
General characters. Colour tawny orange (head may be darker than alitrunk when viewed from front), mandibles conspicuously yellow in some specimens, gaster and legs light brown to brown. Worker caste monomorphic.

Holotype worker measurements. HML 1.20; HL 0.48; HW 0.41; CeI 84; SL 0.36; SI 89; PW 0.26.

Other worker measurements. HML 1.07–1.52; HL 0.46–0.57; HW 0.40–0.48; CeI 78–91; SL 0.34–0.40; SI 80–89; PW 0.23–0.30 (16 workers).

Etymology

Greek: 'burnt, fiery red colour' + 'skin or hide'.



Figs 31, 32. 31, Distribution of *M. flavonigrum* (■) and *M. longinode* (○) specimens examined during this study. 32, Distribution of *M. aithoderum* (■) and *M. stictonotum* (○) specimens examined during this study.

Remarks

Monomorium aithoderum is a small, inconspicuous species. Nearly all specimens have come from Western Australia, but the ant may have a much broader range, as the recent collection of material in the Eyre Peninsula demonstrates. This ant is not easily separated from other tiny *Monomorium* with a reticulate propodeum, but it is never yellow (unlike *M. micula* and many *M. sydneyense* specimens), has a more elongate promesonotum and a more compressed propodeum than brown samples of *M. sydneyense*, and has an oval eye (unlike *M. stictonotum* and *M. nanum*). Nothing is known of *M. aithoderum*'s biology. One worker was collected on *Conostylis* ('trigger plant').

Monomorium anderseni, sp. nov.

(Figs 33, 120, 125)

Material examined

Holotype. Worker, Northern Territory, Manbulloo, SW Katherine, 25.x.1977, P. J. M. Greenslade (ANIC).

Paratypes. **Northern Territory:** (All type specimens collected by P. J. M. Greenslade) 3 workers, locality as for holotype, 21–25.x.1977 (ANIC); 3 workers, locality as for holotype, 24.x.1977 (ANIC); 5 workers, locality as for holotype, 7–11.iv.1978 (BMNH); 1 worker, 10 km SW of Katherine, 20.x.1977 (BMNH); 1 worker, 17 km SW of Katherine, 21.x.1977 (MCZ); 3 workers, 22 km SW of Katherine, 9.iv.1978 (MCZ); 2 workers, 23 km SW Katherine, 9.iv.1978 (MCZ).

Other material examined. **Northern Territory:** 1 worker, 7.5 km SW Katherine (ANIC); 1 worker, 20 km SE Katherine (ANIC); 2 workers, 27 km SE Katherine (ANIC); 1 worker, 35 km NW (ANIC); 2 workers, 37 km SE Katherine, 23.x.1977 (ANIC); 2 workers, 38 km SE Katherine (ANIC); 5 workers, 45 km SW Katherine (ANIC); 3 workers, Mulga Camp (ANIC). **Western Australia:** 6 workers, Mary R. (ANIC); 6 workers, Derby (SAM); 4 workers, Kununurra region (JDM).

Worker description

As for the worker of *M. fieldi* (see below), but with the following apomorphies.

Head. Eye large, eye width greater than $1.5\times$ greatest width of antennal scape. Anteromedial clypeal margin emarginate, median clypeal carinae produced as pair of bluntly rounded denticles. Posteromedial clypeal margin extending slightly posteriad of posterior surface of antennal fossae. Frontal lobes parallel, sinuate. Venter of head capsule without elongate, basket-shaped setae.

Alitrunk. Promesonotal sculpture present in form of microreticulation and striolae on and around katapisternum, otherwise promesonotum smooth and shining; dorsal promesonotal face evenly convex, or convex anteriorly, otherwise flattened. Propodeal sculpture present as faint microreticulation with few striae, mainly on lower lateral surface on individuals seen; dorsal propodeal face gently convex; lobes present as blunt flanges. Declivitous face of propodeum smoothly convex. Erect and suberect propodeal setae >5 . Propodeal spiracle lateral and about midway between metanotal groove and declivitous face of propodeum.

Petiole and postpetiole. Petiolar node cuneate, dorsally rounded; sculpture absent, petiolar node smooth and shining. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3. Height ratio of petiole to postpetiole near 1:1 to near 4:3; height-length ratio of postpetiole near 2:1.

General characters. Colour bright gamboge yellow. Worker caste monomorphic.

Holotype worker measurements. HML 1.46; HL 0.54; HW 0.46; CeI 85; SL 0.41; SI 90; PW 0.30.

Other worker measurements. HML 1.24–1.50; HL 0.50–0.58; HW 0.41–0.43; CeI 75–85; SL 0.36–0.41; SI 87–97; PW 0.24–0.30 (22 measured).

Etymology

Named in honour of Dr Alan Andersen, CSIRO, Darwin.

Remarks

Monomorium anderseni is one of several *M. laeve*-like species that have a distribution wholly or largely confined to tropical Australia. This species can be distinguished from *M. laeve* by the flattened, squamiform development of the nodes. Many workers also have a large propodeal spiracle, compared with a small spiracle in *M. laeve*. *Monomorium anderseni* can be separated from *M. disetigerum*, sp. nov. and *M. micula*, sp. nov. by the presence of erect and suberect setae on the frons, and more than one pair of erect setae on the alitrunk, and from *M. silaceum*, sp. nov. by the narrower head capsule (CeI ≤ 85 , compared with CeI ≥ 86).

Monomorium arenarium, sp. nov.

(Figs 34, 135, 144, 152, 177)

Material examined

Holotype. Worker, South Australia, Belair, 13–17.i.1972, P. J. M. Greenslade, trap 3 (ANIC).

Paratypes. **South Australia**: 1 Worker, Belair, iv.1971, traps (ANIC); 2♀, Black Oak Ck., Koonamore, 15.iv.1973, P. J. M. Greenslade (ANIC); 1♀, Koonamore, iv.1973, P. J. M. Greenslade, pitfall traps (BMNH); 1♀, 2 workers, Natl Pk, Lofty Ra., 23.iii.1969, dry sclerophyll, ridge 1800 ft, nest in hard soil, ANIC ants vial 66–74 (BMNH). **Tasmania**: 3 workers, Greens Beach, 22.xii.1990, B. B. Lowery, dry sclerophyll, under rock, reg. n. 12:5601, rare (QVMT). **Western Australia**: 4 workers, Esperance, 2.i.1970, B. B. Lowery, coastal sand heath, nest in sand near road, 7 pm, long trail between craters (MCZ); 1 worker, Nornalup, 18.xii.1969, B. B. Lowery, wet sclero., in soil (MCZ); 1 worker, Swanbourne, 19.vii.1987, B. E. Heterick, soil, mixed native/exotic veg., vegetated coastal dune, 266/6MonBH46 (JDM).

Worker description

As for the worker of *M. fieldi*, but with the following apomorphies.

Head. Frons of head capsule smooth and shining with evenly spaced, appressed setulae, or smooth and shining with incurved decumbent and subdecumbent setulae. (Viewed from front) compound eyes set in anterior half of head capsule. Venter of head capsule without elongate, basket-shaped setae. Maximum number of mandibular teeth and denticles: three.

Alitrunk. Dorsal promesonotal face convex anteriorly, otherwise flattened; erect and suberect promesonotal setae absent. Propodeal sculpture present as faint microreticulation with few striae, mainly on lower lateral surface; dorsal propodeal face sloping posteriorly, with wedge-shaped flattening or shallow depression that is widest between propodeal angles; processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle), or present on posterior propodeal angles in form of

minute lamellae; lobes present as blunt flanges. Declivitous face of propodeum flat. Erect and suberect propodeal setae absent or very sparse. Propodeal spiracle lateral and about midway between metanotal groove and declivitous face of propodeum.

Petiole and postpetiole. Petiolar node conical, dorsally rounded; sculpture absent, petiolar node smooth and shining. Anteroventral process present as pronounced spur, or slender carina that tapers posteriorly. Ventral lobe present in some individuals. Height ratio of petiole to postpetiole near 4:3. Ventral process present and distinct.

Gaster. Pilosity of first gastral tergite consisting mainly of decumbent and subdecumbent setulae.

General characters. Colour orange, or light tawny yellow. Worker caste monomorphic.

Holotype worker measurements. HML 1.30; HL 0.45; HW 0.41; CeI 92; SL 0.41; SI 81; PW 0.25.

Worker measurements. HML 1.25–1.49; HL 0.46–0.55; HW 0.36–0.47; CeI 79–90; SL 0.30–0.42; SI 68–90; PW 0.24–0.28 (19 measured, including alcohol specimens from Swanbourne).

Queen description

Head. Head trapezoid, narrowest at the vertex; frons smooth and shining with incurved decumbent and subdecumbent setulae.

Alitrunk. Propodeal sculpture absent; propodeum smooth and shining; dorsal propodeal face gently convex. Metapleural lobes present as blunt flanges. Propodeal spiracle lateral and about midway between metanotal groove and declivitous face of propodeum.

Petiole and postpetiole. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 1:1 to near 3:4. Anteroventral process present as a broad flange along the underside of the petiole. Height ratio of petiole to postpetiole near 1:1 to near 4:3; height–length ratio of postpetiole near 3:1 to near 2:1. Ventral process present and distinct.

Gaster. Pilosity of first gastral tergite consisting mainly of decumbent and subdecumbent setulae.

General characters. Colour amber, often darker on dorsal surfaces. Brachypterous alates not seen. Ergatoid or worker–female intercastes not seen.

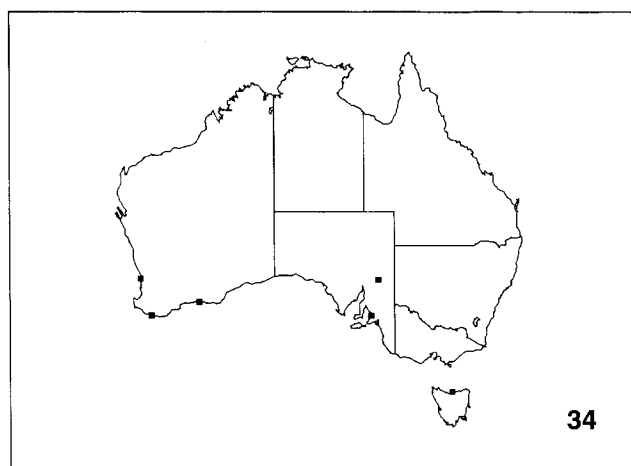
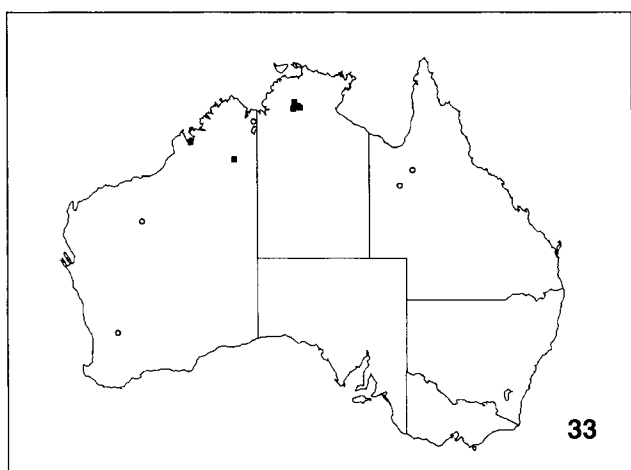
Queen measurements. HML 1.98–2.37; HL 0.62–0.68; HW 0.57–0.60; CeI 86–93; SL 0.48–0.53; SI 84–88; PW 0.44–0.53 (4 measured).

Etymology

Latin: ‘of sand/sandy’.

Remarks

This distinctive little *Monomorium* has a wide distribution, with an apparent predilection for sandy coastal soil and dry sclerophyll woodland. However, several collections have



Figs 33, 34. 33, Distribution of *M. anderseni* (■) and *M. silaceum* (○) specimens examined during this study. 34, Distribution of *M. arenarium* (■) specimens examined during this study.

been made away from the coast. The oblique, sloping propodeum is sufficient to distinguish it from other small, yellow *Monomorium*. The queen also is distinctive, the oblique propodeal declivity being unlike that of other small Australian *Monomorium* queens.

***Monomorium carinatum*, sp. nov.**

(Figs 35, 136, 143)

Material examined

Holotype. Worker (top point), Northern Territory, 5 km NE of Barrow Ck 21°29'S, 133°55'E, 10.x.1981, D. Davidson & S. Morton, 126a (ANIC).

Paratypes. **Northern Territory:** (All specimens collected by D. Davidson & S. Morton in the Northern Territory.) 2 + 3 workers with same data as the holotype (ANIC); 3 workers (126b), 3 + 2 workers (126c, 2 heads and two gasters missing) same data as the holotype (BMNH); 3 workers (141a), 3 + 2 workers (141b), 2×3 workers (141c), 11 km N of Tennant Ck 19°32'S, 134°13'E, 11.x.1981 (MCZ).

Other material examined. **Northern Territory:** 3 workers, 11 km N Tennant Ck 19°32'S, 134°13'E. **Western Australia:** 1 worker, Argyle Diamond Mine via Kununurra (JDM); 1 worker, Gantheaume Point, Broome (JDM); 4 workers, Ophthalmia Dam (JDM).

Worker description

As for the worker of *M. sydneyense*, but with the following apomorphies.

Head. Frons of head capsule smooth and shining with evenly spaced, appressed setulae, or longitudinally striate with well-spaced, appressed setulae. (Viewed laterally) compound eyes set at midline of head capsule; eye large, eye width greater than 1.5× greatest width of antennal scape. Anteromedial clypeal margin straight or slightly emarginate, median clypeal carinae not produced as teeth or denticles. Maximum number of mandibular teeth and denticles: three; mandibles (viewed from front) strap-like with inner and outer edges subparallel, striate, with piliferous punctures.

Alitrunk. Promesonotal sculpture present in form of uniform microreticulation with few mesopleural striolae; dorsal promesonotal face convex anteriorly, otherwise flattened; erect and suberect promesonotal setae absent. Propodeal sculpture present as uniform microreticulation, with few or no striae or costulae; propodeal processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle); lobes present as blunt flanges. Declivitous face of propodeum longitudinally concave between its lateral margins. Erect and suberect propodeal setae absent or very sparse; propodeal setulae absent. Propodeal spiracle lateral and about midway between metanotal groove and declivitous face of propodeum.

Petiole and postpetiole. Petiolar spiracle lateral and slightly anteriorly of petiolar node. Petiolar node cuneate, dorsally rounded to cuneate, sharply tapered; sculpture present in form of microreticulation. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3. Anteroventral process always present as pronounced spur. Height ratio of petiole to postpetiole near 4:3. Sculpture present in form of microreticulation.

General characters. Colour either russet or brown with posterior promesonotum, propodeum, anterior sector of petiole, and apex of gaster more darkly infuscated, legs amber or uniformly fulvous. Worker caste monomorphic.

Holotype worker measurements. HML 1.47; HL 0.53; HW 0.43; CeI 80; SL 0.38; SI 89; PW 0.30.

Worker measurements. HML 1.25–1.56; HL 0.48–0.55; HW 0.36–0.46; CeI 76–86; SL 0.34–0.40; SI 84–94; PW 0.24–0.32 (26 measured).

Etymology

Latin: 'keeled'.

Remarks

Monomorium carinatum belongs to the *M. sydneyense* complex, and closely resembles northern populations of that

species. Some *M. carinatum* workers without strongly defined propodeal carinae may be confused with *M. sydneyense*, but can be distinguished by the laterally compressed propodeum, flattened trapezoidal promesonotum (viewed dorsally) and relatively larger eye. This species appears to be nocturnal: I have seen terrestrial foraging activity by workers near Newman, Western Australia.

Monomorium castaneum, sp. nov.

(Fig. 36)

Material examined

Holotype. Worker, Queensland, 8 km W of Warwick, 13.v.1974, P. J. M. Greenslade (ANIC).

Paratypes. **New South Wales**: 2 queens, 6 workers (1 with head missing), Trundle, 13.i.1964, B. Lowery, M. L. (ANIC). **South Australia**: 1 worker, 7 km NW of Morgan, 15–17.xii.1976, P. J. M. Greenslade, Traps J (ANIC).

Worker description

As for the worker of *M. fieldi*, but with the following apomorphies.

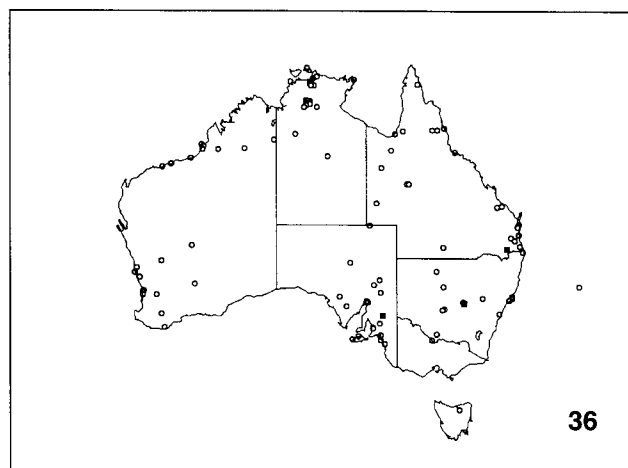
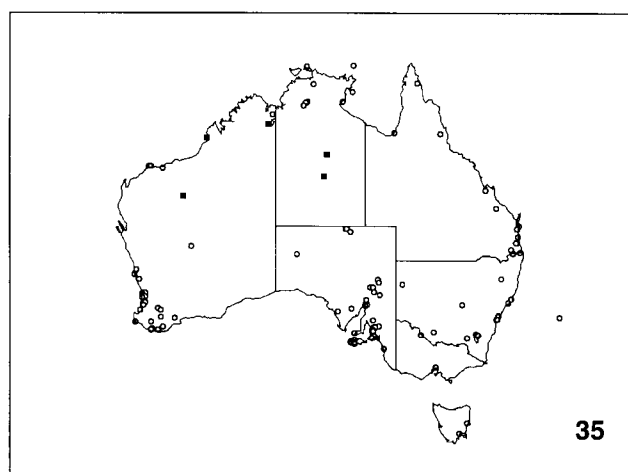
Head. Frons of head capsule smooth and shining with evenly spaced, appressed setulae, or longitudinally striate with well-spaced, appressed setulae. Compound eyes reniform, with posterior surface of eye emarginate; (viewed from front) compound eyes set in anterior half of head capsule; (viewed laterally) compound eyes set posterior of midline of head capsule; eye large, eye width greater than 1.5× greatest width of antennal scape. Venter of head capsule without elongate, basket-shaped setae

Alitrunk. Promesonotal sculpture present in form of microreticulation and striae on and around katepisternum, otherwise promesonotum smooth and shining; setulae appressed. Propodeal sculpture present as faint microreticulation with few striae, mainly on lower lateral surface; dorsal propodeal face strongly convex. Declivitous face of propodeum smoothly convex. Erect and suberect propodeal setae >5. Propodeal spiracle lateral and nearer metanotal groove than declivitous face of propodeum.

Petiole and postpetiole. Petiolar node conical, dorsally rounded, or conical, sharply tapered; sculpture absent, petiolar node smooth and shining. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3. Ventral lobe present in some individuals. Height ratio of petiole to postpetiole near 4:3; height–length ratio of postpetiole near 2:1.

General characters. Colour alitrunk, petiole and postpetiole tawny orange, head, gaster, and appendages brown. Worker caste monomorphic.

Holotype worker measurements. HML 1.10; HL 0.41; HW 0.37; CeI 89; SL 0.33; SI 89; PW 0.22.



Figs 35, 36. 35, Distribution of *M. carinatum* (■) and *M. sydneyense* (○) specimens examined during this study. 36, Distribution of *M. fieldi* (○) and *M. castaneum* (■) specimens examined during this study.

Worker measurements. HML 1.06–1.13; HL 0.41–0.43; HW 0.34–0.37; CeI 83–89; SL 0.30–0.36; SI 87–93; PW 0.20–0.21 (5 measured).

Queen description

As for the queen of *M. fieldi*, but with the following apomorphies.

Alitrunk. Mesoscutum in profile convex anteriorly; thereafter flattened. Mesoscutal pilosity consisting of dense incurved setulae and setae; dorsal appearance of mesoscutum smooth and shining; length–width ratio of mesoscutum and scutellum combined near 2:1. Axillae separated by distance less than half greatest width of scutellum. Propodeal sculpture present as uniform microreticulation, with few or no striae or costulae; dorsal propodeal face flattened. Metapleural lobes present as blunt flanges. Erect and suberect propodeal setae 5–10. Propodeal

spiracle lateral and nearer metanotal groove than declivitous face of propodeum.

Petiole and postpetiole. Petiolar spiracle lateral and in anterior sector of petiolar node. Petiolar node conical, dorsally rounded; sculpture present in form of microreticulation. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 1:1.

General characters. Colour of gaster chocolate; other body parts tan. Brachypterous alates seen and examined. Ergatoid or worker-female intercastes seen and examined.

Queen measurements. HML 1.98–2.03; HL 0.57; HW 0.54–0.56; CeI 94–98; SL 0.41–0.44; SI 73–81; PW 0.41–0.46 (2 measured).

Etymology

Latin: 'brown, the colour of chestnuts'.

Remarks

Known from three collections, two of them single workers, from three Australian states, this species stands in the same relation to *M. fieldi* as *M. megalops*, sp. nov. does to *M. sordidum*. The worker is virtually identical to a typical *M. fieldi* worker, except for the conformation of the compound eye, and sculpture on the katepisternum. (Some *M. fieldi* workers have vestigial microreticulation on this sclerite.) The queen is similar to the *M. fieldi* queen, though with a mat or shagreenate propodeum. Future research may well sink *M. castaneum* under *M. fieldi*, though they are treated as separate species in this work. *Monomorium castaneum* can be distinguished from the similar *M. nanum*, sp. nov. by the rounded propodeum and small metapleural lobes.

Monomorium disetigerum, sp. nov.

(Figs 37, 121, 129)

Material examined

Holotype. Worker, Northern Territory, 15 km SE Alice Springs 23°51'S, 133°58'E, 8.x.1981, D. Davidson & S. Morton (ANIC).

Paratypes. **Northern Territory:** 2 workers, data as for the holotype (ANIC) 4×3 workers, data as for the holotype (2 pins to ANIC, 1 pin to BMNH, 1 pin to MCZ); 4×3 workers, Northern Territory, 20 km SE Alice Springs 23°35'S, 134°00'E, 26.x.1981, D. Davidson & S. Morton (2 pins to ANIC, 1 pin to BMNH, 1 pin to MCZ); 1♀, 2 workers, Northern Territory, Black Point, Coburg Peninsula 11°07'S, 132°09'E, 15–23.ii.1977, T. A. Weir (ANIC).

Other material examined. 136 workers (ANIC); 11 workers (JDM) (see Fig. 37 for distribution).

Worker description

As for worker of *M. fieldi*, but with the following apomorphies.

Head. Frons of head capsule smooth and shining with combination of appressed setulae and incurved decumbent

and subdecumbent setulae. (Viewed from front) compound eyes set in anterior half of head capsule. Eye large, eye width greater than 1.5× greatest width of antennal scape. Posteromedial clypeal margin extending slightly posteriad of posterior surface of antennal fossae. Venter of head capsule without elongate, basket-shaped setae. Mandibles (viewed from front) triangular and smooth, with piliferous punctures.

Alitrunk. Erect and suberect promesonotal setae less than five. Propodeal sculpture absent; propodeum smooth and shining; dorsal propodeal face sloping posteriad, with wedge-shaped flattening or shallow depression that is widest between propodeal angles; lobes present as blunt flanges. Declivitous face of propodeum smoothly convex. Erect and suberect propodeal setae >5; propodeal setulae appressed. Propodeal spiracle lateral and nearer metanotal groove than declivitous face of propodeum.

Petiole and postpetiole. Petiolar node conical, dorsally rounded. Ventral lobe present in some individuals. Height ratio of petiole to postpetiole near 4:3.

Gaster. Pilosity of first gastral tergite consisting mainly of decumbent and subdecumbent setulae, or consisting entirely of well-spaced erect and suberect setae.

General characters. Colour light to tawny yellow, legs lighter in colour than body. Worker caste monomorphic.

Holotype worker measurements. HML 1.18; HL 0.47; HW 0.39; CeI 83; SL 0.32; SI 82; PW 0.24.

Other worker measurements. HML 1.01–1.34; HL 0.41–0.55; HW 0.33–0.43; CeI 77–85; SL 0.30–0.40; SI 84–95; PW 0.13–0.27 (24 measured).

Queen description

As for the queen of *M. fieldi*, but with the following apomorphies.

Head. Compound eyes ovoid.

Alitrunk. Mesoscutum in profile convex anteriad; thereafter flattened. Mesoscutal pilosity consisting of dense incurved setulae and setae; length-width ratio of mesoscutum and scutellum combined near 2:1. Axillae separated by distance less than half greatest width of scutellum. Dorsal propodeal face flattened. Propodeal setulae decumbent and subdecumbent. Propodeal spiracle lateral and nearer metanotal groove than declivitous face of propodeum.

Wing. Queen dealate.

Petiole and postpetiole. Petiolar node conical, dorsally rounded. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3. Anteroventral process a tapering carina. Height-length ratio of postpetiole near 3:1. Sculpture present in form of microreticulation; ventral process present and distinct, formed by extension of anterior process of postpetiole.

General characters. Colour tawny yellow; gaster brown. Brachypterous alates not seen. Ergatoid or worker-female intercastes not seen.

Queen measurements. HML 2.18; HL 0.62; HW 0.57; Cei 93; SL 0.47; SI 82; PW 0.48 (1 measured).

Etymology

Latin: 'bearing two setae'.

Remarks

North of the Tropic of Capricorn, *M. disetigerum* probably rivals the very similar *M. laeve* in abundance. This species may also easily be confused with *M. micula*, sp. nov. and pale morphs of *M. sydneyense*. However, *M. disetigerum*, sp. nov. can normally be distinguished from these species by the presence of a pair of erect promesonotal setae. Where this feature is lacking (due to breakage) or obscured, the presence of long setae on the nodes will always separate *M. disetigerum*, sp. nov. from *M. micula*, sp. nov. The large eye and more rounded propodeum of *M. disetigerum* will also serve to distinguish that species from pale *M. sydneyense* specimens. In a few workers from the Coburg Peninsula the erect setae appear to be lacking in intact specimens, though these resemble *M. disetigerum* in all other respects. Not enough material is available for me to determine whether the setae may have been present originally, or whether they are naturally absent in workers belonging to this population. *Monomorium disetigerum* is nocturnally active, and I have collected this species in early evening on tree trunks and low vegetation.

Monomorium eremophilum, sp. nov.

(Figs 38, 134, 137)

Material examined

Holotype. Worker (top point), South Australia, Koonamore, 26.ii.1973, P. J. M. Greenslade (ANIC).

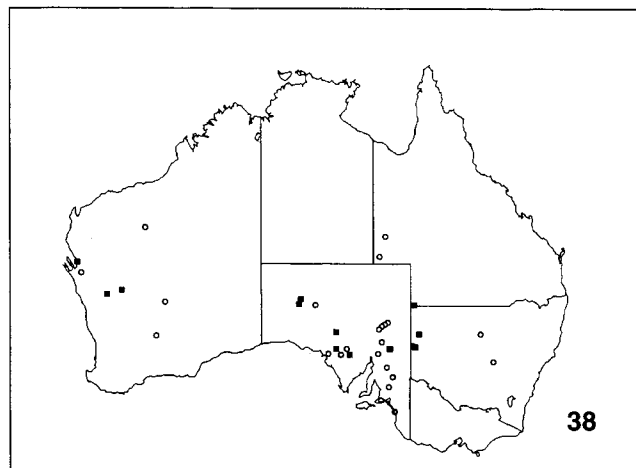
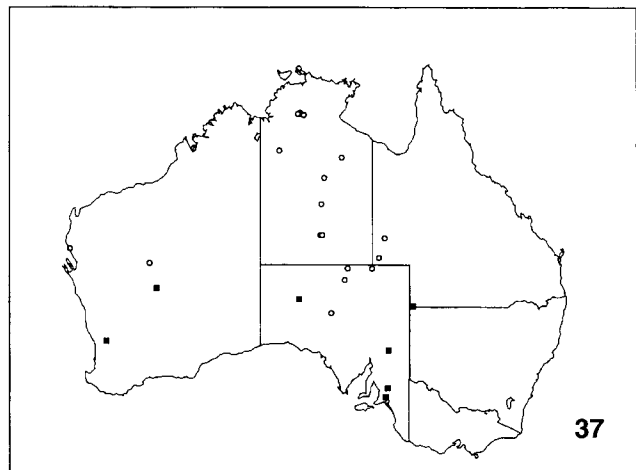
Paratypes. (All paratypes collected by P. J. M. Greenslade). **New South Wales:** 1 worker, 5 km W of Broken Hill, 15.ix.1974 (ANIC); 3 workers, Fowlers Gap, 18.xi.1979 (ANIC). **Queensland:** 2 workers, 40 km E of Cameron Cnr., 22.xi.1979 (BMNH). **South Australia:** 1 worker with same data as the holotype (ANIC); 2 workers, SE shore of Lake Acraman, Gawler Ra., 4.x.1972 (BMNH); 3 workers, 10 km E of Mt Ives Hsd., 22.x.1980, Aii SE (MCZ); 1 worker (gaster missing), 10 km E of Mt Ives Hsd., 22–23.x.1980, B Pt (MCZ); 1 worker, Observatory Hill, Victoria Desert (MCZ).

Other material examined. **Queensland:** 2 workers, 40 km E Cameron Cnr. (ANIC). **South Australia:** 1 worker, 1 km W Emu Camp, Victoria Desert (ANIC); 3 workers, 17 miles W of Kingoonya (ANIC). **Western Australia:** 1 worker, 'The Granites', Mount Magnet (JDM); 1 worker, Scenic Lookout (near 26th Parallel, Great Northern Hwy) (JDM); 1 worker, 5 km N Yalgoo (JDM).

Worker description

As for the worker of *M. sydneyense*, but with the following apomorphies.

Head. Frons of head capsule smooth and shining with evenly spaced, appressed setulae. Compound eyes reniform,



Figs 37, 38. 37, Distribution of *M. disetigerum* (○) and *M. micula* (■) specimens examined during this study. 38, Distribution of *M. eremophilum* (■) and *M. nanum* (○) specimens examined during this study.

with posterior surface of eye emarginate, or elongate, much longer than wide; (viewed laterally) compound eyes set at midline of head capsule; eye large, eye width greater than 1.5× greatest width of antennal scape. Anteromedial clypeal margin emarginate, median clypeal carinae produced apically as pair of pronounced teeth. Venter of head capsule with elongate, basket-shaped setae in at least some individuals. Palp formula 2,2.

Alitrunk. Promesonotal sculpture present in form of microreticulation and striolae on and around katapisternum, otherwise promesonotum smooth and shining; dorsal promesonotal face evenly convex; erect and suberect promesonotal setae absent. Propodeal sculpture present as uniform microreticulation, with few or no striae or costulae; propodeal processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle), or present as pronounced lamellae formed by extension of metapleural

lobes. Declivitous face of propodeum flat. Erect and suberect propodeal setae >5; propodeal setulae absent.

Petiole and postpetiole. Petiolar node conical, dorsally rounded, or cuneate, dorsally rounded, or tumular and inclined anteriorly. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3. Height ratio of petiole to postpetiole near 4:3.

Gaster. Pilosity of first gastral tergite consisting entirely of well-spaced appressed setulae.

General characters. Colour either pale orange with gaster fulvous, or chocolate brown with mandibles and appendages amber. Worker caste monomorphic.

Holotype worker measurements. HML 1.54; HL 0.67; HW 0.62; CeI 93; SL 0.41; SI 67; PW 0.32.

Other worker measurements. HML 1.15–1.71; HL 0.46–0.71; HW 0.43–0.72; CeI 91–102; SL 0.28–0.51; SI 64–77; PW 0.24–0.34 (19 workers.)

Etymology

Greek: 'lover of deserts'.

Remarks

Monomorium eremophilum resembles a diminutive *M. rothsteini*, and shares with that species a PF of 2,2. However, the shape of the eye is quite different, and the two taxa do not appear to be closely related. Moreover, the broad head of *M. eremophilum* serves to distinguish it from other small *Monomorium* with a PF of 1,2 and a rather oblique or reniform eye-shape. Nothing is known of the biology of *M. eremophilum*, which is represented in collections only by workers.

Monomorium fieldi Forel

(Figs 36, 110, 111, 126, 127, 164, 175, 188–189)

Monomorium (Martia) fieldi Forel, 1910: 30, 31.

Monomorium (Mitara) donisthorpei Crawley, 1915: 134, 135, fig. (unnumbered) on p.135. **Syn. nov.**

Monomorium (Mitara) laeve r. *nigrius* Forel, 1915: 74. **Syn. nov.**

Monomorium (Mitara) laeve st. *fraterculus* Santschi, 1919: 328, 329, fig. 1. **Syn. nov.**

Monomorium (Lampromyrmex) fraterculus Santschi (= *Monomorium (Mitara) laeve* var. *fraterculus* Santschi) Santschi, 1928: 467.

Material examined

M. donisthorpei

Paratypes. **Northern Territory:** 4 workers, Darwin, G. F. Hill (MV – Paratype workers T–16247, T–16248, T–16249, T–16250); 2 workers, Darwin, G. F. Hill (BMNH – '1915–169'), 3 workers, Darwin, G. F. Hill (BMNH – '1915–63').

M. fieldi

Syntype. Worker, Northern Territory, Tennant Ck, [J. F.] Field (ANIC).

M. fraterculus

Syntypes. 2 workers + 1 headless worker, Queensland, Townsville, F. P. Dodd (NMBA).

M. laeve nigrius

Syntypes. 3 workers, Queensland, Mt Tambourine, [E. G.] Mjöberg (ANIC).

Other material examined. 9 workers (AMS); 424 workers, 6♀ (ANIC); 31 workers (JDM); 3 workers (NTM); 14 workers, 2♀, 1♂ (MV); 28 workers, 2♂ (QM); 3 workers (QVMT); 60 workers, 2♂ (SAM); 13 workers (WAM) (see Fig. 36 for distribution).

Worker description

Head. Head square or rectangular; vertex slightly concave; frons smooth and shining with combination of appressed setulae and erect and suberect setae. Compound eyes elliptical; (viewed from front) compound eyes set at midpoint of each side of head capsule; (viewed laterally) compound eyes set at midline of head capsule; eye moderate, eye width 0.5–1.5× greatest width of antennal scape. Antennal segments 11; club three-segmented. Anteromedial clypeal margin straight or slightly emarginate, median clypeal carinae not produced as teeth or denticles. Longest lateral anterior clypeal setae long, extending beyond dorsal margin of closed mandibles. Posteromedial clypeal margin level with posterior surface of antennal fossae. Anterior tentorial pits situated nearer antennal fossae than mandibular insertions. Frontal lobes parallel straight. Venter of head capsule with elongate, basket-shaped setae in at least some individuals. Palp formula 1,2. Maximum number of mandibular teeth and denticles: four (basal tooth a minute denticle when present, often absent); mandibles (viewed from front) strap-like with inner and outer edges subparallel, smooth with piliferous punctures; basal tooth not enlarged; basal angle indistinct; apical and basal mandibular margins meeting in tooth or denticle.

Alitrunk. Promesonotal sculpture absent, promesonotum smooth and shining; dorsal promesonotal face evenly convex; erect and suberect promesonotal setae greater than 10; setulae decumbent and subdecumbent. Mesonotal suture absent. Metanotal groove present as distinct and deeply impressed trough between promesonotum and propodeum. Propodeal sculpture absent; propodeum smooth and shining, or present as faint microreticulation with few striae, mainly on lower lateral surface; dorsal propodeal face strongly convex to gently convex, or sloping posteriorly, with wedge-shaped flattening or shallow depression that is widest between propodeal angles; processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle); lobes absent or indistinct, or present as blunt flanges. Propodeal angle absent; declivitous face of propodeum smoothly convex to flat. Erect and suberect propodeal setae 5–10; propodeal setulae decumbent and subdecumbent. Propodeal spiracle lateral and nearer metanotal groove than declivitous face of propodeum, or lateral and about midway between metanotal groove and declivitous face of propodeum; vestibule absent or undeveloped.

Petiole and postpetiole. Petiolar spiracle lateral and in anterior sector of petiolar node. Petiolar node conical, dorsally rounded, or conical, sharply tapered, or cuneate, dorsally rounded; sculpture absent, petiolar node smooth and shining. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3 to near 1:1. Anteroventral process distinct in some individuals as slender carina that tapers posteriad. Ventral lobe always absent. Height ratio of petiole to postpetiole near 4:3 to near 2:1; height-length ratio of postpetiole near 2:1 to near 4:3. Sculpture absent on dorsum, at least: postpetiole smooth and shining. Ventral process absent or vestigial.

Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour of head, alitrunk, petiole and postpetiole brown, gaster brown to black, legs cream to chocolate. Worker caste monomorphic.

Worker measurements. HML 0.89–1.37; HL 0.36–0.50; HW 0.30–0.43; CeI 74–90; SL 0.25–0.40; SI 79–97; PW 0.14–0.30 (25 measured).

Queen description

Head. Head square or rectangular; vertex planar; frons smooth and shining with combination of incurved decumbent and subdecumbent setulae and erect and suberect setae. Compound eyes elliptical; (viewed from front) compound eyes set in anterior half of head capsule, or set at midline of head capsule; (viewed laterally) compound eyes set at midline of head capsule; eye large, eye width greater than 1.5× greatest width of antennal scape.

Alitrunk. Mesoscutum in profile convex anteriorly; thereafter flattened, or evenly flattened. Mesoscutal pilosity consisting of decumbent and subdecumbent setulae anteriorly and erect and suberect setae posteriorly; dorsal appearance of mesoscutum smooth and shining; length-width ratio of mesoscutum and scutellum combined near 2:1 to near 4:3. Axillae contiguous or nearly so, or separated by distance less than half greatest width of scutellum. Propodeal sculpture absent; propodeum smooth and shining; dorsal propodeal face gently convex, or flattened. Propodeal processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle); lobes absent or indistinct. Propodeal angle absent. Erect and suberect propodeal setae greater than 10; propodeal setulae decumbent and subdecumbent. Propodeal spiracle lateral and nearer metanotal groove than declivitous face of propodeum, or lateral and about midway between metanotal groove and declivitous face of propodeum.

Wing. Wing veins predominantly depigmented with distal segments reduced to vestigial lines; vein m-cu absent; vein cu-a absent.

Petiole and postpetiole. Petiolar spiracle lateral and in anterior sector of petiolar node. Petiolar node conical, dorsally rounded, or cuneate, dorsally rounded; sculpture

absent, petiolar node smooth and shining. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3 to near 1:1. Anteroventral process distinct in some individuals as slender carina that tapers posteriad. Height ratio of petiole to postpetiole near 4:3; height-length ratio of postpetiole near 2:1. Sculpture absent on dorsum, at least: postpetiole smooth and shining; ventral process absent or vestigial.

Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour brown. Brachypterous alates not seen. Ergatoid or worker-female intercastes not seen.

Queen measurements. HML 1.57–3.01; HL 0.52–0.69; HW 0.46–0.69; CeI 87–100; SL 0.34–0.45; SI 74–79; PW 0.32–0.66 (7 measured).

Male description

Head. Head width-mesoscutal width ratio near 1:1. Compound eyes protuberant and elliptical; (viewed laterally) compound eyes set at midline of head capsule; ocelli not turreted. Ratio of length of first funicular segment of antenna to length of second funicular segment near 2:5 to near 1:2. Maximum number of mandibular teeth and denticles: two.

Alitrunk. Mesoscutum in profile evenly convex; dorsal appearance of mesoscutum finely microreticulate; mesoscutal pilosity consisting of numerous short setae, incurved medially. Parapsidal furrows vestigial; notauli absent. Axillae separated by distance more than half greatest width of scutellum.

Wing. Wing veins predominantly depigmented with distal segments reduced to vestigial lines; vein m-cu absent; vein cu-a absent.

Petiole and postpetiole. Petiolar spiracle lateral and in anterior sector of petiolar node. Sculpture absent, petiolar node smooth and shining, or present in form of microreticulation; ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 1:1 to near 3:4. Anteroventral process present as pronounced spur, or slender carina that tapers posteriad; ventral lobe always absent. Height-length ratio of postpetiole near 3:1; sculpture present in form of microreticulation; ventral process absent or vestigial.

Gaster. Pilosity of first gastral tergite consisting entirely of well-spaced erect and suberect setae.

General characters. Colour chocolate to russet; legs pale yellow.

Male measurements. HML 2.14–2.57; HL 0.55–0.67; HW 0.62–0.74; CeI 110–119; SL 0.16–0.21; SI 23–28; PW 0.59–0.83 (3 measured).

Remarks

Monomorium fieldi poses some very considerable taxonomic, even systematics problems. The forms

M. donisthorpei and *M. fieldi*, however, are identical, and represent this taxon at its most easily recognisable. Typically, these are small, shining *Monomorium* with a smoothly convex promesonotum, moderately wide head capsule, a deeply impressed metanotal groove, erect and suberect setae on the alitrunk and head capsule, a cuneate petiolar node, and very small or vestigial metapleural lobes. *Monomorium donisthorpei* and *M. fieldi* are uniformly yellowish or reddish brown to chocolate in colour. The two names are therefore combined in this work under the senior synonym *M. fieldi*.

The form *M. laeve nigrius*, however, is very different. (*Monomorium fraterculus* represents the same morphotype as *M. laeve nigrius*, and differs only in being slightly more brown in colour and in having vestigial propodeal carinae. This morphotype is common in southeast Queensland and is clearly conspecific with *M. laeve nigrius*, the name that has taxonomic priority. The comparison between *M. laeve nigrius* and *M. fieldi* is far more important.) The three syntypes and similar specimens of *M. laeve nigrius* are smaller than typical *M. fieldi*, the promesonotum is flattened, the head capsule is narrow, the scapes are shorter than in *M. fieldi*, the propodeum is long and low (like *M. laeve*), and the petiolar node is distinctly conical. To gain a picture of variability within a nest series of *M. fieldi*, I collected 125 workers entering a hole in a grassy area on the St Lucia campus, University of Queensland, in Brisbane, Queensland, and from these selected 15 specimens that represented morphological extremes within the total sample. Measurements of these ants were taken, and were as follows: HML 1.23–1.34, HL 0.46–0.51, HW 0.41–0.45, Cel 82–93, SL 0.34–0.39, SI 81–94, PW 0.26–0.30. The habitus of the specimens was clearly *M. fieldi*, though their body colour varied from yellowish brown to dark chocolate. No specimen approached the habitus of *M. laeve nigrius*. (Comparable measurements for the *M. laeve nigrius* syntype workers are HML 1.11–1.13, HL 0.45–0.46, HW 0.37–0.38, Cel 80–83, SL 0.30–0.32, SI 81–85, PW 0.22–0.24.)

Apart from the syntypes of *M. laeve nigrius*, I have carefully examined the descriptions of this and the other species or subspecies ascribed to the putative subgenus *Mitara*, and several thousand specimens collected throughout Australia. Forel (1915) and Santschi (1919) perceived a similarity between the yellow forms of *M. laeve* (namely, *M. laeve*, *M. ilia*, *M. ilia lamingtonense*, and *M. broomense*: see 'Remarks' under *Monomorium laeve*) and the darker *M. laeve nigrius*. They noted that the petiolar node is conical in *M. laeve* and *M. laeve nigrius*, the appearance of the scape is comparable, and the appendages in both are often paler in colour than the body (frequently darker in *M. fieldi*). *Monomorium laeve nigrius* also usually has a yellowish or reddish tinge to the cuticle.

Despite these similarities, however, *M. laeve* and *M. laeve nigrius* series are not easily confused, if only because of the

colour. Apart from the questionable colouration of a small series of *M. laeve* from Mt Cook (northern Queensland), this species is always pale yellow to gamboge. Faded or discoloured specimens of *M. laeve nigrius* are sometimes partially yellow, but the gaster is invariably darker than in *M. laeve*.

When compared with many *M. sydneyense* workers, *M. laeve nigrius* is not easily characterised. The latter fits neatly into a morphological continuum of workers showing apparent convergence between *M. fieldi* and *M. sydneyense*. Some *Monomorium* that have been assigned to *M. fieldi* because of the presence of erect and suberect setae on the alitrunk and a smooth propodeum, also resemble *M. sydneyense* in having a flattened promesonotum, and a hint of longitudinal carinae corresponding to extended metapleural lobes. These specimens also possess the rectangular head capsule, short antennal scapes, and the paler appendages seen in *M. sydneyense*, and are rather smaller than unambiguous *M. fieldi*. In a few cases the petiolar node is sharply tapered and bereft of long setae. This feature also occurs in some *M. sydneyense* populations.

Most *M. laeve nigrius*-like specimens have been collected in southeast Queensland, in parts of inland New South Wales, and on the Fleurieu Peninsula in South Australia. Ants identical with *M. laeve nigrius* and *M. fraterculus* have been taken at Cooloola, north of Brisbane, on Norfolk Island, and in the Sydney suburb of Lakemba. Truly ambiguous worker specimens that cannot be assigned definitively to either *M. laeve nigrius* or *M. sydneyense* are extremely rare, but several examples from Kangaroo Island and from Cooloola have been seen.

The proper placement of specimens exhibiting this phenotypic ambiguity poses not only a taxonomic but a philosophical dilemma (if species concepts are considered). Since *M. fieldi* and *M. sydneyense* are ubiquitous throughout Australia, including Tasmania, and most specimens examined are stray workers collected in pitfall traps, important data on intra-nest and between-nest variation are lacking and irrecoverable. Also, the number of reproductives available for study is surprisingly few, and these are not easy to distinguish or assign to populations.

On the present evidence, *M. fieldi* and *M. sydneyense* are considered to be distinct and recognisable throughout most of their range, although, aside from the *M. laeve nigrius* morph, worker specimens with a mosaic of *M. fieldi* and *M. sydneyense* characters do occur. Several hypotheses present themselves: (1) the supposed intergrades really represent a complex of sibling species, and may or may not possess subtle identifying morphological characters on closer inspection; (2) there are two taxa, *M. fieldi* and *M. sydneyense*, that are discrete and non-interbreeding entities throughout their range, and the apparent convergence in worker characters is fortuitous; (3) *M. fieldi* and *M. sydneyense*, while reproductively separated through most

of their range, form hybrid zones due to local interbreeding; or (4) *M. fieldi* and *M. sydneyense* are synonyms for a single species capable of expressing an unusually broad morphological variation.

Hypothesis (3) is inadmissible under such species definitions as Mayr's (1942) 'biological species concept' and can only be fitted into Paterson's (1985) 'specific mate recognition system' (SMRS) species concept with difficulty. Other species definitions, such as the 'genotype cluster' definition of Mallet (1995) are more sympathetic. However, (3) appears to provide the 'best fit' for the data. Hypotheses (1) and (4) are the least likely; in (1) because the intergrades are so widely spread, and variation tends towards either the *M. fieldi* morph or the *M. sydneyense* morph, and in (4) because the morphological diversity that would result seems impossibly large for a single species-level taxon. Clearly much more work needs to be done to establish a robust analysis of the real variation that occurs between *M. fieldi* and *M. sydneyense* populations. Good nest series including reproductives, and also genetic data would be ideal.

For taxonomic convenience, *M. laeve nigrius* and *M. fraterculus* are synonymised with *M. fieldi*. Specimens of each of these varieties will key out under *M. fieldi*, rather than *M. sydneyense*, in the worker key provided. (*Monomorium fraterculus barretti*, although similar to *M. fraterculus*, has the characteristic pilosity of *M. sydneyense*, and is discussed under that species.)

Monomorium fieldi is extremely tolerant of disturbed and highly anthropogenic environments. Nests can be found in suburban backyards, in the main streets of major cities, and on industrial sites. Arboreal nests occur in some situations, and workers also forage on vegetation. This species may occur outside of Australia, and detailed comparison with southeast Asian and Pacific taxa in the *monomorium*-group (e.g. *M. chinense*) would be desirable.

Monomorium laeve Mayr

(Figs 39, 119, 128, 154, 155, 163, 174, 190, 191)

Monomorium laeve Mayr, 1876: 101.

Monomorium (Marta) ilia Forel, 1907a: 277, 278. **Syn. nov.**

Monomorium ('*Mitara*' = *Mitara*) *ilia* v. *lamingtonensis* Forel, 1915: 73, 74. **Syn. nov.**

Monomorium (Mitara) '*leve*' (= *laeve*) r. *broomense* Forel, 1915: 74, 75. **Syn. nov.**

Monomorium broomense Forel [stat. n. Taylor and Brown, 1985: p.70].

Material examined

M. ilia

Syntypes. Two workers, Western Australia, Guildford, 'Hamb. S. W. Austr. Exped. 1905' (MV); 3 workers, Western Australia, with same data (date omitted) (ANIC).

M. ilia lamingtonense

Syntypes. Two workers, Queensland, Glen Lamington, [E. G.] Mjöberg (ANIC).

M. laeve

Syntypes. One worker, Queensland, Rockhampton, G. Mayr (NMW); 1 dealate queen, Queensland, Rockhampton, G. Mayr (NMW).

M. laeve broomense

Syntypes. Two workers, Western Australia, Broome, [E. G.] Mjöberg (ANIC).

Other material examined. 8 workers, 1 ♂ (AMS); 404 workers, 29 ♀, 2 ♀ puparia, 14 ♂ (ANIC); 11 workers (JDM); 2 workers (NTM); 5 workers, 2 ♀ (MV) 57 workers, 1 ♀ (SAM); 1 worker (WAM) (see Fig. 39 for distribution).

Worker description

As for the worker of *M. fieldi*, but with the following apomorphies.

Head. Eye moderate, eye width 0.5–1.5× greatest width of antennal scape to large, eye width greater than 1.5× greatest width of antennal scape. Frontal lobes parallel, sinuate. Venter of head capsule without elongate, basket-shaped setae.

Alitrunk. Promesonotal sculpture absent, promesonotum smooth and shining, or present in form of microreticulation on and around katepisternum, otherwise promesonotum smooth and shining. Propodeum smooth and shining; dorsal propodeal face gently convex; lobes present as blunt flanges. Declivitous face of propodeum smoothly convex. Propodeal setulae absent. Propodeal spiracle lateral and about midway between metanotal groove and declivitous face of propodeum.

Petiole and postpetiole. Petiolar node conical, dorsally rounded; sculpture absent, petiolar node smooth and shining. Ventral lobe present in some individuals. Height ratio of petiole to postpetiole near 4:3; height–length ratio of postpetiole near 2:1.

General characters. Colour various shades of yellow. Worker caste monomorphic.

Worker measurements. HML 0.98–1.48; HL 0.40–0.59; HW 0.31–0.48; CeI 72–82; SL 0.27–0.43; SI 86–100; PW 0.18–0.26 (25 measured).

Queen description

As for the queen of *M. fieldi*, but with the following apomorphies.

Head. Head square or rectangular; vertex planar, or convex; frons striolate between frontal carinae, otherwise smooth and shining with a combination of decumbent and subdecumbent setulae and erect and suberect setae, or striolate with a combination of appressed setulae and erect and suberect setae. Compound eyes ovoid; (viewed from front) compound eyes set in anterior half of head capsule; (viewed laterally) compound eyes set posterior of the midline of head capsule, or set at midline of head.

Alitrunk. Mesoscutal pilosity consisting of numerous incurved erect and suberect setae; length-width ratio of mesoscutum and scutellum combined near 2:1. Dorsal propodeal face sloping posteriad, with wedge-shaped flattening or shallow depression that is widest between propodeal angles. Propodeal lobes absent or indistinct, or present as blunt flanges. Propodeal setulae appressed, or decumbent and subdecumbent. Propodeal spiracle lateral and nearer metanotal groove than declivitous face of propodeum.

Petiole and postpetiole. Petiolar node cuboidal, or cuneate, dorsally rounded, or tumular; sculpture absent, petiolar node smooth and shining, or present in form of microreticulation. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 2:1 to near 1:1. Anteroventral process always absent or vestigial. Height-length ratio of postpetiole near 3:1 to near 2:1. Sculpture absent on dorsum, at least: postpetiole smooth and shining, or present in form of microreticulation; ventral process present and distinct.

General characters. Colour tawny yellow-orange to orange, often with some darker infuscation of mesonotum and gastral tergites. Brachypterous alates seen and examined. Ergatoid or worker-female intercastes not seen.

Queen measurements. HML 1.89–2.85; HL 0.53–0.83; HW 0.48–0.69; CeI 80–93; SL 0.41–0.62; SI 79–96; PW 0.34–0.64 (19 measured).

Male description

As for the male of *M. fieldi*, but with the following apomorphies.

Head. Head width-mesoscutal width ratio near 1:1 to near 3:4. Maximum number of mandibular teeth and denticles: four.

Alitrunk. Dorsal appearance of mesoscutum smooth and shining; mesoscutal pilosity consisting of long, dense setae. Axillae separated by distance of about half greatest width of scutellum.

Petiole and postpetiole. Sculpture absent, petiolar node smooth and shining; ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 3:4. Anteroventral process always absent or vestigial. Ventral process of postpetiole present and distinct.

Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour of head dark chocolate, legs depigmented straw yellow.

Male measurements. HML 2.00–2.61; HL 0.55–0.67; HW 0.61–0.75; CeI 104–115; SL 0.17–0.21; SI 26–31; PW 0.80–0.90 (7 measured).

Remarks

I have examined types of four taxa assigned to the species *M. broomense*, *M. ilia* and *M. laeve*. The workers of all four

morphs can be distinguished from the very similar *M. disetigerum* workers by the presence of long setae on the occiput and propodeum, and more than one pair of erect setae on the promesonotum, and from *M. anderseni* workers by the narrower nodes. Despite variability in overall size and minor allometric differences between large and small specimens, there seem to be no features by which the workers of *M. broomense*, *M. ilia*, *M. ilia lamingtonense*, and *M. laeve* can be meaningfully separated. The smallest specimens ('*ilia lamingtonense*') have small compact eyes, compared with somewhat elongate, coarsely faceted eyes in the large *M. broomense*, but these are simply extremes on a continuum: intermediate sized workers exhibit intermediate eye size and morphology.

In addition to the type specimens listed, some hundreds of ants collected throughout Australia have been examined. The largest morphs (*M. broomense*) are common in the southwestern Australian series, but also occur in New South Wales, and among specimens from Kunoth Park in the Northern Territory. *Monomorium ilia* type morphs are ubiquitous, but *M. ilia lamingtonense* predominates among series collected in the tropical savannah and desert areas. This variant is rare in more southern regions. Some pins hold more than one morph, but information as to whether these morphs come from nest series is invariably lacking. Reproductives assigned to the above taxa are common in collections, and uniform in appearance. They are distinctive when taken as a group, and easy to key.

Forel (1907a) noted the similarity in appearance of workers assigned to *M. laeve* and *M. ilia* when erecting *M. ilia* as a species-level taxon. However, the '*M. laeve*' (four workers from Mackay, Queensland) to which Forel referred had brown-black gasters. Since *M. laeve* workers never have brown-black gasters, Forel's comparison seems to be misguided and must surely have included a small species of *Monomorium* other than *M. laeve*: *M. ilia* and *M. laeve* cannot be meaningfully separated, even at the infraspecific level. Similarly, the decision of Taylor and Brown (1985) to raise the taxon *M. laeve broomense* to species level does not have support here, although at a population level the large, gracile *M. broomense* workers are reasonably distinctive. *Monomorium broomense*, *M. ilia*, and *M. ilia lamingtonense* are therefore synonymised under *M. laeve* in this work.

Hybridisation may occasionally occur between *M. laeve* and other closely related species. An isolated large worker, from 'The Granites' in the Tanami Desert, Northern Territory, is dusky yellow with an infuscated antennal club. This specimen appears to possess some features of *M. fieldi*, most notably the short, strongly convex propodeum. A series from near the Baroalba Springs, Northern Territory, reveals more pilosity than other *M. laeve* specimens, and the metapleural gland has a large bulla (small in *M. laeve*). These specimens resemble *M. disetigerum*, apart from the longer setae, and may belong to that species. Another

interesting variation is found in 12 workers from Mt Cook, north Queensland, which are light brown to brown in colour. In other respects these specimens are identical to *M. laeve*, and the odd colouration may be factitious. (Some worker specimens of *M. laeve* pitfall-trapped in the Kimberleys, Western Australia, have slightly darkened exoskeletons. The latter were collected in a solution that contained chloral hydrate.)

Monomorium laeve is abundant throughout Australia, but is found less frequently than *M. fieldi* and *M. sydneyense* in urban settings. However, the ant does enter dwellings, particularly in rural areas. The label on one pin holding three specimens collected at Mt Stromlo, in the Australian Capital Territory, states that they were 'infesting quarters'. In its natural environment this ant feeds on animal food and on seeds (Clark 1924).

***Monomorium megalops*, sp. nov.**

(Figs 40, 117, 118)

Material examined

Holotype. Worker, South Australia, Emu Junction, Victoria Desert, 5.x.1976, P. J. M. Greenslade (ANIC).

Paratypes. **South Australia:** (All specimens collected by P. J. M. Greenslade.) 3 workers, Observatory Hill, 7.x.1976 (ANIC); 2 workers, 12 km W Emu, Victoria Desert, 5–10.x.1976 (ANIC); 2 workers, 50 km E Emu Junction, Victoria Desert, 5.x.1976 (BMNH); 1 worker, Koonamore, iv.1973, trap 17 (BMNH); 2 workers, 2 km NE Koonamore Hsd., 26.ii.1973 (BMNH); 1 worker, 5 km NE Koonamore Hsd., 26.ii.1973 (MCZ); 1 worker, Koonamore, 25.ii.1973 (MCZ); 3 workers, Koonamore, 24–27.ii.1973, pitfall trap (MCZ).

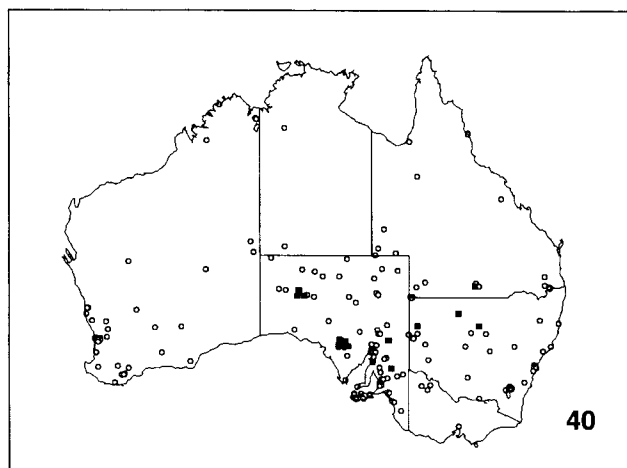
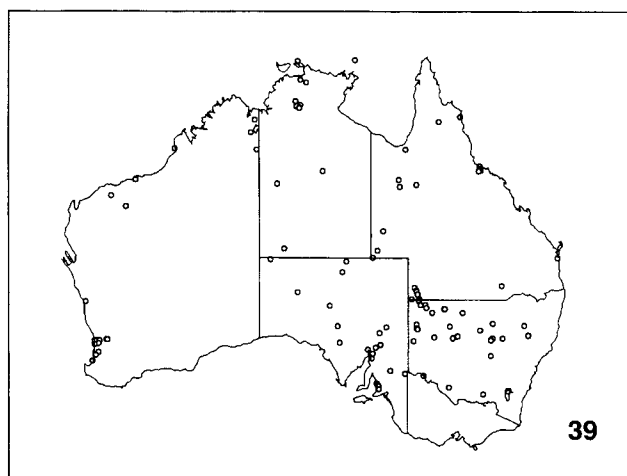
Other material examined. (All specimens collected by P. J. Greenslade, ANIC.) **New South Wales:** 1 worker, Fowlers Gap; 'Kapunda', near Nyngan 8 workers, Lake Mere, 40 km NNW Louth. **Queensland:** 3 workers, 50 km E Cunnamulla. **South Australia:** 5 workers, Koonamore Hsd., 2 workers, Lake Acraman, Gawler Ra., 1 worker, Lake Acraman, salina to SE, Gawler Ra., 12 workers, 7 km NW Morgan, 1 worker, Mt Gairdner, Gawler Ra., 18 workers, 10 km E Mt Ives Hsd., Gawler Ra., 1 worker, Mundoora Nat. Pk, 3 workers, Thurlga, 8 km W Hsd., Gawler Ra., 1 worker, Yardea, 2 km N Brodie's Dam, Gawler Ra., 2 workers, Yardea, 15 km S Moonarie Hsd., Gawler Ra., 1 worker, Yardea, 2 km S Waltumba Well, Gawler Ra.

Worker description

As for the worker of *M. sordidum* (see below), but with the following apomorphies.

Head. Compound eyes reniform, with posterior surface of eye emarginate; Eye large, eye width greater than 1.5× greatest width of antennal scape. Posteromedial clypeal margin extending slightly posteriad of posterior surface of antennal fossae. Frontal lobes parallel straight.

Alitrunk. Propodeal sculpture present as uniform microreticulation, with few or no striae or costulae. Erect and suberect propodeal setae >5; propodeal setulae decumbent and subdecumbent. Propodeal spiracle lateral and about



Figs 39, 40. 39, Distribution of *M. laeve* (○) specimens examined during this study. 40, Distribution of *M. megalops* (■) and *M. sordidum* (○) specimens examined during this study.

midway between metanotal groove and declivitous face of propodeum.

General characters. Colour brown or tawny orange (head may be darker than alitrunk), gaster chocolate. Worker caste monomorphic.

Holotype worker measurements. HML 1.30; HL 0.51; HW 0.41; CeI 82; SL 0.39; SI 94; PW 0.24.

Other worker measurements. HML 1.18–1.50; HL 0.47–0.58; HW 0.38–0.49; CeI 79–87; SL 0.35–0.43; SI 85–97; PW 0.20–0.27 (20 measured).

Etymology

Greek: 'large-eyed'.

Remarks

Apart from the shape and size of its eye, *M. megalops* is virtually identical with *M. sordidum*, and may eventually prove to be no more than a variant of that widespread species.

***Monomorium micula*, sp. nov.**

(Figs 37, 122, 138)

Material examined

Holotype. Worker (top point), South Australia, Ferries-MacDonald Reserve, 27.iv.1969, P. J. M. Greenslade (leg. C. A. Kirkby), 516 (ANIC).

Paratypes. South Australia: (All workers collected by P. J. M. Greenslade.) 1+3 workers, with same data as the holotype (ANIC); 1+2 workers, Cambrai, 28.i–1.ii.1972 (pin 1 – dune IIb, pin 2 – dune III) (BMNH); 2 workers, Cambrai, 18–21.ii.1972, dune IIb (BMNH); 3 workers, Cambrai, 21–25.ii.1972, dune III (MCZ); 1 worker, Cambrai, 6.iii.1972, dune IV (i) (MCZ); 2+2 workers and 1 ergatoid, 12 km W Emu, Victoria Desert, 5–10.x.1976 (pin 1 – *Casuarina*, pin 2 – dune ‘?left, *M. sp.* 201) (ANIC); 1 worker, Koonamore, 24–27.ii.1973, pitfall trap (ANIC).

Other material examined. Queensland: 1 worker, 40 km E of Cameron Cnr (ANIC). **Western Australia:** 1 worker, 7 km N of Leinster (JDM); 1 worker, Wongamine (JDM).

Worker description

As for the worker of *M. sydneyense*, but with the following apomorphies.

Head. Frons of head capsule smooth and shining with evenly spaced, appressed setulae. (Viewed laterally) compound eyes set at midline of head capsule; eye large, eye width greater than $1.5\times$ greatest width of antennal scape. Anteromedial clypeal margin straight or slightly emarginate, median clypeal carinae not produced as teeth or denticles. Frontal lobes parallel, sinuate. Mandibles (viewed from front) strap-like with inner and outer edges subparallel, smooth with piliferous punctures.

Alitrunk. Promesonotal sculpture present in form of microreticulation and striolae on and around katapisternum, otherwise promesonotum smooth and shining; dorsal promesonotal face evenly convex; erect and suberect promesonotal setae absent. Dorsal propodeal face flattened, or sloping posteriad, with wedge-shaped flattening or shallow depression that is widest between propodeal angles; processes present as pronounced lamellae formed by extension of metapleural lobes. Declivitous face of propodeum flat. Erect and suberect propodeal setae absent or very sparse; propodeal setulae absent. Propodeal spiracle lateral and about midway between metanotal groove and declivitous face of propodeum.

Petiole and postpetiole. Petiolar node conical, dorsally rounded; sculpture absent, petiolar node smooth and shining. Anteroventral process always present as pronounced spur. Height ratio of petiole to postpetiole near 4:3; height–length ratio of postpetiole near 2:1 to near 4:3. Sculpture absent on dorsum, at least: postpetiole smooth and shining.

Gaster. Pilosity of first gastral tergite consisting entirely of well-spaced appressed setulae.

General characters. Colour various shades of yellow. Worker caste monomorphic.

Holotype worker measurements. HML 1.03; HL 0.44; HW 0.36; CeI 82; SL 0.32; SI 90; PW 0.21.

Other worker measurements. HML 0.90–1.11; HL 0.36–0.48; HW 0.32–0.38; CeI 76–89; SL 0.27–0.34; SI 84–100; PW 0.16–0.20 (19 measured).

Etymology

Latin: ‘little morsel’.

Remarks

This minute, depigmented species is probably quite common in sandy, inland areas of the Australian mainland, but is easily overlooked because of its small size. *Monomorium micula* can be distinguished from other small, yellow *Monomorium* by a combination of its large eye and the absence of erect and suberect setae on the dorsum of the body.

***Monomorium nanum*, sp. nov.**

(Figs 38, 132, 133, 140, 141)

Material examined

Holotype. Worker (top point), South Australia, 15 km NE of Mt Bryan, 23.i.1975, P. J. M. Greenslade (ANIC).

Paratypes. (All workers collected by P. J. M. Greenslade). **New South Wales:** 2 + 3 workers, ‘Kapunda’, n. of Nyngan, 6.v.1987 (ANIC); 3 workers, Silverton, 15.ix.1974 (BMNH). **Northern Territory:** 2 workers, Kunoth Park, near Alice Springs, 3–6.ii.1975, traps Mn-P (BMNH). **South Australia:** 1 worker, with same data as the holotype (ANIC); 1 worker (6.x.1974), 1 worker (7.x.1974), Moockra Tower (MCZ); 2+3 workers, 7 km NW Morgan, 15–17.xii.1976 (MCZ).

Other material examined. 49 workers (ANIC); 3 workers (JDM) (see Fig. 38 for details)

Worker description

As for the worker of *M. sydneyense*, but with the following apomorphies.

Head. Frons of head capsule smooth and shining with evenly spaced, appressed setulae, or smooth and shining with combination of appressed setulae and erect and suberect setae. Compound eyes reniform, with posterior surface of eye emarginate, or elongate, much longer than wide; (viewed laterally) compound eyes set posterior of midline of head capsule, or set at midline of head capsule; eye large, eye width greater than $1.5\times$ greatest width of antennal scape. Anteromedial clypeal margin emarginate, median clypeal carinae produced apically as pair of pronounced teeth, or emarginate, median clypeal carinae produced as pair of bluntly rounded denticles, or straight or slightly emarginate, median clypeal carinae not produced as teeth or denticles. Venter of head capsule with elongate, basket-shaped setae in at least some individuals. Mandibles (viewed from front) strap-like with inner and outer edges subparallel, smooth with piliferous punctures.

Alitrunk. Promesonotal sculpture absent, promesonotum smooth and shining, or sculpture present in form of microreticulation and striolae on and around katapisternum, or sculpture present in form of microreticulation, striolae and striae on the mesopleuron, and striolae on posterodorsal promesonotal surface; dorsal promesonotal face evenly convex. Metanotal groove present as feebly impressed furrow between promesonotum and propodeum, or present as distinct and deeply impressed trough between promesonotum and propodeum. Propodeal sculpture absent; propodeum smooth and shining, or present as uniform microreticulation, with few or no striae or costulae; propodeal processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle), or present as pronounced lamellae formed by extension of metapleural lobes. Declivitous face of propodeum longitudinally concave between its lateral margins. Propodeal setulae absent.

Petiole and postpetiole. Petiolar node conical, dorsally rounded, or cuneate, dorsally rounded; Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3 to near 1:1. Height ratio of petiole to postpetiole near 4:3.

Gaster. Pilosity of first gastral tergite variable; consisting entirely of well-spaced appressed setulae, or mainly of decumbent and subdecumbent setulae, or of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour variable; from fulvous through shades of brown to piceous, often with head and gaster slightly darker than alitrunk. Worker caste monomorphic.

Holotype worker measurement. HML 1.25; HL 0.51; HW 0.41; CeI 82; SL 0.34; SI 83; PW 0.25.

Other worker measurements. HML 0.88–1.42; HL 0.36–0.57; HW 0.30–0.49; CeI 78–90; SL 0.24–0.36; SI 73–93; PW 0.16–0.36 (51 measured).

Etymology

Latin: 'dwarf'.

Remarks

This tiny species is almost ubiquitous in arid and semi-arid environments in South Australia and Western Australia. The ant is also found in the Northern Territory, New South Wales and Queensland, and may occur in northern Victoria. Despite its broad distribution, this species has remained undescribed, and is known from the worker caste only. The physical appearance of *M. nanum* is as varied as that of *M. sydneyense*, and what is treated here as one species may eventually prove to be a complex of several species.

The variation focuses around two main morphotypes, with some smaller permutations within these forms. The holotype and paratypes represent the larger of the two

morphotypes. These ants are generally uniformly brown, with a striolate posterior promesonotum, strongly microreticulate sculpture of the mesopleuron and propodeum, a large, reniform eye with a bottom lobe that is usually larger than the upper lobe, the longitudinal clypeal carinae produced as small spines or denticles, and the anteromedial clypeal margin strongly emarginate. The appearance of the head and the anterior promesonotum is smooth and shining, with sparse, appressed setulae (or, rarely, erect and suberect setae). Several specimens from the remaining material have somewhat smaller, though still reniform eyes. Similar to the above form is a smaller variant, with a head capsule that is darker than the promesonotum in full-face view, elongate eyes reaching to the venter of the head capsule, and reduced propodeal and mesopleural sculpture. Two workers from 'Kapunda', north of Nyngan, New South Wales, are piceous with a smooth alitrunk, elongate eyes, and a straight anteromedial clypeal margin. The longitudinal clypeal carinae in this pair of specimens are not produced as teeth or denticles.

The most common variant of the smaller morphotype is a minute worker with small, slightly reniform eyes, uniform, often pale brown colouration, and a straight anteromedial clypeal margin. Sculpture on the alitrunk is strongly reduced or absent, and the longitudinal clypeal carinae are obsolete or only faintly visible, and not produced as teeth or denticles. A less common worker is gracile in form, with a long promesonotum (like *M. stictonotum*), many decumbent and subdecumbent setulae on the frons and alitrunk, and a very low petiolar node. Finally, a series from 'The Overlander', in northwestern Western Australia, is smooth and yellowish, with a small, but elongate eye.

As with several other Australian *Monomorium*, intermediates connect these more conspicuous forms, and the morphotypes cannot be meaningfully separated in a workable key. Oddly, I have not seen a nest series of *M. nanum* among the many alcohol specimens I have examined. I am therefore unable to gauge the variation within a population, since the pinned material is composed of stray workers, many of them collected in pitfall traps.

Nothing is known of the biology of *M. nanum*, and additional information is lacking on all labels. Such information is highly desirable, since this species is abundant, and may have an important role as a small, generalist predator and scavenger in the ecosystems in which it occurs.

Monomorium rothsteini Forel

(Figs 41, 108, 115, 149, 158, 192–194)

Monomorium rothsteini Forel, 1902: 444, 445.

Monomorium rothsteini var. *humilior* Forel, 1910: 27, 28. **Syn. nov.**

Monomorium rothsteini var. *leda* Forel, 1915: 71, 72. **Syn. nov.**

Monomorium (Paraholcomyrrex) rothsteini st. *doddi* Santschi, 1919: 328. **Syn. nov.**

Monomorium subapterum Wheeler, 1917: 112–114, fig. 2. **Syn. nov.**

Monomorium subapterum var. *bogischi* Wheeler, 1917: 112. **Syn. nov.**

Chelaner rothsteini (Forel) [comb. nov. Ettershank, 1966: 97].

Chelaner rothsteini humilior (Forel) [comb. nov. Ettershank, 1966: 97]

Chelaner rothsteini leda (Forel) [comb. nov. Ettershank, 1966: 97].

Chelaner rothsteini doddi (Santschi) [comb. nov. Ettershank, 1966: 96].

Chelaner subapterum (Wheeler) [comb. nov. Ettershank, 1966: 97].

Chelaner subapterum bogischi (Wheeler) [comb. nov. Ettershank, 1966: 97].

Monomorium rothsteini Forel [comb. Bolton, 1987: 300, 301].

Monomorium rothsteini humilior Forel [comb. Bolton, 1987: 300, 301].

Monomorium rothsteini leda Forel [comb. Bolton, 1987: 300, 301].

Monomorium rothsteini doddi Santschi [comb. Bolton, 1987: 300, 301].

Monomorium subapterum Wheeler [comb. Bolton, 1987: 300, 301].

Monomorium subapterum bogischi Wheeler [comb. Bolton, 1987: 300, 301].

Material examined

Monomorium rothsteini

Syntypes. Three workers, Queensland, Charters Towers, Wiederkehr (ANIC).

Monomorium rothsteini doddi

Syntypes. Three workers + two workers, Queensland, Townsville, F. P. Dodd (NMBA).

Monomorium rothsteini humilior

Holotype. Worker, Northern Territory, Tennant Ck, [J. F.] Field (MHNB). The MV holds supposed paratypes (1♀, 2 workers), from the same locality, but labelled by Wheeler (types T-15059, T-15060, T-15061, also labelled 'MCZ. cotype 16–18 20866'). Although these specimens were also collected by Field, the omission of a size range—the length is given as '2.5 mm'—in Forel's description suggests he examined only the one specimen. The 'paratypes' are therefore considered to have no actual type status.

Monomorium rothsteini leda

Syntypes. Two workers, Queensland, Alice R., [E. G.] Mjöberg (ANIC – 'Syntype Mus. Not to be designated lectotype'); 2 workers, Western Australia, Kimberley District, [E. G.] Mjöberg (ANIC – 'Syntype ex Geneva Mus. Not to be designated lectotype').

Monomorium subapterum

Syntypes. Five ♂, 3♀, 11 workers, Western Australia, Harding R., Dodd (MCZ – 'Cotype 23234'); ♀ and worker with same data as preceding (MV – T-15245 workers, T-15246); 3♂, 2♀, 12 workers (SAM).

Monomorium subapterum bogischi

Syntypes. Two ♀ and 7 workers, South Australia, Port Wakefield, G. P. Bogisch (MCZ); ♀ and 8 workers with same data as preceding (SAM). A further 3 worker specimens labelled by Wheeler as 'cotypes' are from Koah, Queensland (MCZ). Wheeler did not publish this locality. The type status of these specimens is extremely doubtful, especially in view of their remoteness from the locality where unquestioned syntype material was obtained.

Other material examined. 819 workers, 7♀, 8♂ (ANIC); 29 workers (JDM); 20 workers (NTM); 18 workers, 5♀ (MV); 6 workers

(QM); 51 workers, 5♀, 1♂ (SAM); 51 workers, 3♀ (WAM) (see Fig. 41 for distribution).

Worker description

As for the worker of *M. sordidum*, but with the following apomorphies.

Head. Vertex of head capsule slightly concave to planar. (Viewed from front) compound eyes variable, from a position slightly anterior of the midpoint to a position slightly posterior of the midpoint; (viewed laterally) compound eyes set anterior of midline of head capsule, or set at midline of head capsule; eye moderate, eye width 0.5–1.5× greatest width of antennal scape to large, eye width greater than 1.5× greatest width of antennal scape. Anteromedial clypeal margin broadly and shallowly emarginate, median clypeal carinae present or absent. Posteromedial clypeal margin extending slightly posteriad of posterior surface of antennal fossae. Frontal lobes parallel, sinuate. Palp formula 2,2. Maximum number of mandibular teeth and denticles: three; mandibles (viewed from front) strap-like with inner and outer edges subparallel, striate, with piliferous punctures.

Alitrunk. Promesonotal sculpture present in form of microreticulation and striolae on and around katepisternum, otherwise promesonotum smooth and shining, or present in form of striae on anterior promesonotum, and microreticulation and striolae on mesopleuron; setulae absent. Mesonotal suture absent, or visible externally as faint ridge. Propodeal sculpture present as uniform microreticulation, with few or no striae or costulae, or present as uniform rugosity, with well defined costulae on declivitous face of propodeum. Erect and suberect propodeal setae greater than 10. Vestibule conspicuous through cuticle.

Petiole and postpetiole. Height–length ratio of postpetiole near 2:1 to near 4:3.

General characters. Colour most commonly: 1. orange or reddish with gaster black and appendages light amber to brown, or 2. with head russet to chocolate and alitrunk, petiole and postpetiole tawny orange to russet (sometimes with black infuscation), gaster chocolate to black, and appendages amber to dark brown. Some individuals may be uniformly brown, or even piceous, and there are many morphs of intermediate colour between 1. and 2. Worker caste monomorphic.

Worker measurements. HML 1.40–2.86; HL 0.58–1.09; HW 0.52–1.09; CeI 89–106; SL 0.34–0.77; SI 65–84; PW 0.27–0.56 (83 measured).

Queen description

As for the queen of *M. sordidum*, but with the following apomorphies.

Head. Vertex planar, or convex; frons longitudinally striate with erect and suberect setae. (Viewed from front)

compound eyes set in posterior half of head capsule, or set in anterior half of head capsule; (viewed laterally) compound eyes set posterior of the midline of head capsule, or set at midline of head capsule.

Alitrunk. Mesoscutal pilosity consisting of decumbent and subdecumbent setulae anterior and erect and suberect setae posterior; dorsal appearance of mesoscutum smooth and shining with a few scattered piliferous pits, or striolate and microreticulate. Propodeal sculpture present as uniform rugosity, with well defined costulae on declivitous face of propodeum. Metapleural lobes absent or indistinct. Propodeal spiracle lateral and nearer metanotal groove than declivitous face of propodeum.

Petiole and postpetiole. Propodeal sculpture present; petiolar node rugose. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3. Height ratio of petiole to postpetiole near 1:1; height-length ratio of postpetiole near 2:1. Sculpture present in form of microreticulation; ventral process absent or vestigial.

General characters. Colour variable: brown, orange or red, alone or in combination, head, appendages and gaster often lighter than alitrunk. Brachypterous alates seen and examined. Ergatoid or worker-female intercastes not seen.

Queen measurements. HML 4.10–6.00; HL 1.24–1.51; HW 1.38–1.72; CeI 105–121; SL 0.79–1.10; SI 56–64; PW 1.17–1.59 (16 measured).

Male description

As for the male of *M. sordidum*, but with the following apomorphies.

Alitrunk. Axillae separated by distance of about half greatest width of scutellum.

Petiole and postpetiole. Sculpture present in form of microreticulation, or present; petiolar node rugose. Height-length ratio of postpetiole near 2:1.

General characters. Colour brown to black.

Male measurements. HML 3.86–4.62; HL 0.97–1.10; HW 1.17–1.41; CeI 121–128; SL 0.26–0.34; SI 24–29; PW 1.38–1.66 (7 measured).

Remarks

Monomorium rothsteini has attracted much attention from taxonomists as well as from ecologists. One species and five varieties come directly under the name *M. rothsteini*, and *M. subapterum* and *M. subapterum bogischi* are also clearly referable to *M. rothsteini*. However, the types of *M. rothsteini tostum* and *M. rothsteini squamigena* are actually *Monomorium sordidum* (see 'Remarks' under that species).

I have inspected type specimens of *M. rothsteini*, *M. rothsteini doddi*, *M. rothsteini humilior*, and *M. rothsteini*

leda, and the types of *M. subapterum* and *M. subapterum bogischi*, as well as more than a thousand specimens of the *M. rothsteini* group from all over mainland Australia. No specimens from Tasmania have been seen. *Monomorium rothsteini*, and the varieties *doddi*, *leda* and *humilior* represent only a small percentage of the variation found in this taxon: the workers are all large-bodied *M. rothsteini* with an orange (*doddi*, *leda*, *rothsteini*) or fulvous (*humilior*) head, orange alitrunk and brown gaster, and are found in the tropics and subtropics. As well as the syntypes of *M. rothsteini doddi*, two worker specimens from the type locality (Townsville) with label data identifying them as *doddi* have been inspected. These are from ANIC and MV respectively. One of the two specimens was taken by Dodd, who collected the original types of *M. doddi*. The specimens appear to me to be indistinguishable from the types of *M. leda*.

Monomorium subapterum bogischi is generally smaller than the above varieties, and is common throughout mainland Australia, but most predominantly in the temperate latitudes. Characteristically, this form has a crimson or brown head capsule that is darker than the promesonotum in full-face view, but the variability in colour is considerable. Crimson, brown and even piceous morphs occur in many areas. Nonetheless, the morphology of the workers is similar to the other *M. rothsteini* varieties, though the queens of *bogischi* are often strongly bicoloured, contrasting with the more uniform colouration of northern queens (but see below).

Monomorium subapterum includes the most distinct forms of *M. rothsteini*, and this taxon has perhaps the greatest claim to separate species status. Wheeler apparently never formally described either *M. subapterum* or *M. subapterum bogischi*, instead erecting these taxa in the context of a discussion on brachyptery in the Formicidae (Wheeler 1917). Wheeler's hypothesis, that the presence of brachyptery and intercastes in ant species recapitulates phylogeny, is now regarded as unlikely: Briele (1983) adduced evidence that a member of the *M. rothsteini* group appears to found colonies both by claustral colony foundation and by fission. Founding queens of claustral colonies in the study area were fully alate, whereas queens commencing colonies by budding were brachypterous. Though the colour of the alate and the brachypterous queens was different they were otherwise indistinguishable. Moreover, under laboratory conditions a brachypterous queen changed to the colour of the alate after three weeks. Briele hypothesised that food stress was the determining factor in the type of colony formation.

Wheeler's hypothesis apart, the morphology of *M. subapterum* is, at least superficially, somewhat different to that of the *M. rothsteini* group. Typical *M. subapterum* workers from northwestern and southwestern Australia are

very gracile, with a low propodeum, narrow petiolar node, and spindly appendages. The combined length of the femur and tibia is rather longer for the length of the ant (up to 0.2 mm) than the combined femur-tibia length in typical *M. rothsteini*. Seen from above, the promesonotal humeri are flattened and rather narrow. Similar desert-living populations are among the most spectacular *M. rothsteini*, some Tanami desert workers being a deep, glossy chocolate. These morphs tend to have an almost flattened anterior clypeal margin, with completely obsolete medial clypeal carinae. (This is in contrast to some *M. leda* and *M. humilior* populations, that have sharply defined medial clypeal carinae produced as obtuse angled denticles.) When viewed dorsally, many specimens have longitudinal striae on the posterior promesonotum, but others are smooth in this sector.

Despite this disparity between what can be classed as typical forms, the differences taken over all populations break down. In *M. rothsteini*, morphological and colour variability, at least among the workers, has a distinct clinal pattern in some areas. Hence, the sharply defined bright orange-red *M. subapterum*, which can be found from Perth through to Geraldton becomes darker and more like the deeply tanned desert forms, as one enters the northern Murchison and Gascoyne regions. In the wetter coastal areas *M. humilior*- and *M. leda*-type forms can be found. These increase in body size in the Pilbara, and the Kimberley *M. rothsteini* workers are relatively huge, with a square propodeum and thick petiolar node. East and south of Perth, as well as in the Pilbara and islands off the Pilbara coast, morphs similar to *M. subapterum bogischi* appear. In places like Enderby Island the workers tend to be rather dark. Other variations, usually dark in colour, are found in the Western Australian goldfields. Some of these specimens have disproportionately large heads and a truncated or very low propodeum, but there are intermediates between these and more typical *M. rothsteini*.

Throughout much of South Australia and New South Wales, *M. subapterum bogischi* is the dominant morphotype. Northern Territory and Queensland populations vary from *M. subapterum bogischi* and *M. rothsteini* in the south to *M. leda*, *M. humilior* and *M. doddi* in the north. *Monomorium subapterum*-like morphs are more characteristic of the Tanami and surrounding desert areas. Again, more nondescript populations connect these morphs with other typical forms.

I have examined the form of the clypeus in the various populations, since this is the sort of character that could have taxonomic value in a difficult and variable group. Apart from the fairly uniform flattened clypeus in desert workers, however, this feature appears to be too variable to be useful. Even workers from the type locality for *M. doddi* (Townsville) show a range of clypeal morphology, from distinct clypeal denticles to a smooth undulation. Orange-

and-brown *leda*-type workers from the Gascoyne River (Western Australia) on the same pin also exhibit variable clypeal conformation. The ratio between the length of the femur and the length of the tibia in workers from five distinct populations of *M. rothsteini* has also been examined. The ratio is surprisingly uniform, hardly varying from 53:50.

Finally, there is considerable variability within nest series. Specimens observed at the entrance of two nests in the Biarra district, 11 km northwest of Esk, conformed to either the *M. subapterum bogischi* (crimson head, orange alitrunk) or the *M. rothsteini* (uniformly orange head and alitrunk) morphs. These colour patterns were confirmed when collected specimens were viewed under a stereomicroscope. Specimens taken a year earlier on the same patch of ground were up to 0.5 mm smaller, brown in colour and with very slender nodes. Similarly, a large size variation between workers was observed in a worker series collected near the University of Queensland St Lucia campus at Brisbane. The hooked digitus in the male has also been considered. This feature is identical in all males examined (though not all named taxa are represented by males).

Based on the above evidence, there is reason to believe *M. rothsteini* is a single valid species, and that observed phenotypic variation does not necessarily imply species-level differences between populations. However, non-morphological investigations, including ecological data, would be helpful in confirming this hypothesis. No support exists for the conclusions of some researchers (e.g. Andersen *et al.* 1991) that *M. rothsteini* consists of many, mostly undescribed, species. In this paper all the infraspecific taxa, as well as the taxa *M. subapterum* and *M. subapterum bogischi*, are synonymised under the name *M. rothsteini*.

Intercastes appear to be very rare or absent in *M. rothsteini*. Some workers, notably large *M. humilior* and *M. leda* specimens from the tropics, have a distinct ridge marking the position of the mesonotal suture. One series of three workers from Chillagoe has some of the features of intercastes, namely a distinct and prominent mesonotum, and some development in the sector where the wing sclerites would be found in a reproductive. However, they do not possess even vestigial ocelli.

Monomorium rothsteini is predominantly a seed harvester, taking the seeds of forbs, grasses and plants such as saltbush (*Atriplex* spp.). A small amount (10% <) of animal material is also eaten (Briese and Macauley 1980). The venom of *M. rothsteini* and another Australian *Monomorium* ('sp. 1066') has recently been analysed (Andersen *et al.* 1991). The findings suggest that these species belong to a separate radiation from that of *Monomorium* species found elsewhere in the world, though one constituent in *M. rothsteini* links it with known North American *Monomorium*.

***Monomorium silaceum*, sp. nov.**

(Figs 33, 130)

Material examined

Holotype. Worker (top point), Queensland, Cloncurry, 7.vi.1936, T. G. [Tom Greaves]. 1147 (ANIC).

Paratypes. **Queensland:** 2 workers with same data as the holotype (ANIC); 2×3 workers, Millungera Stn., 31.v.1936, T. G. [Tom Greaves], 1140 (ANIC, MCZ). **Western Australia:** 4 workers, N of Kellerberrin, ii.1991, A. Scougall, JDM '33', vial 53, drawer 37 (BMNH); 3 workers, Mt Whaleback, Newman, vii.1984, K. J. Walker, JDM '33' (ANIC).

Other material examined. 4 workers (JDM) (See Fig. 33 for distribution).

Worker description

As for the worker of *M. fieldi*, but with the following apomorphies.

Head. Eye large, eye width greater than 1.5× greatest width of antennal scape. Frontal lobes parallel, sinuate. Venter of head capsule without elongate, basket-shaped setae.

Alitrunk. Promesonotal sculpture present in form of microreticulation and striolae on and around katapisternum, otherwise promesonotum smooth and shining; erect and suberect promesonotal setae 5–10; setulae appressed. Propodeal sculpture present as uniform microreticulation, with few or no striae or costulae; dorsal propodeal face sloping posteriad, with wedge-shaped flattening or shallow depression that is widest between propodeal angles. Lobes present as blunt flanges. Declivitous face of propodeum flat. Erect and suberect propodeal setae >5; propodeal setulae absent. Propodeal spiracle lateral and about midway between metanotal groove and declivitous face of propodeum.

Petiole and postpetiole. Petiolar node cuneate, dorsally rounded; sculpture absent, petiolar node smooth and shining. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3. Anteroventral process always present as pronounced spur. Height ratio of petiole to postpetiole near 4:3.

General characters. Colour yellow. Worker caste monomorphic

Holotype worker measurements. HML 1.41; HL 0.53; HW 0.48; CeI 91; SI 0.40; SI 83; PW 0.26.

Other worker measurements. HML 1.34–1.62; HL 0.51–0.58; HW 0.44–0.57; CeI 86–98; SL 0.40–0.43; SI 73–84; PW 0.26–0.33 (12 workers).

Etymology

Latin: 'the colour of yellow ochre'.

Remarks

Monomorium silaceum does not appear to be as common as some of the other small, yellow *Monomorium*, and populations are mainly concentrated in the northern half of

the Australian mainland. The species is known only from workers. The broad head capsule and very large eyes identify *M. silaceum*. Fresh worker specimens have a head capsule that is darker in full-face view than the promesonotum, but this feature seems to fade in older material.

Normally, the propodeum of *M. silaceum* is rather cuboidal and sculptured, with a large propodeal spiracle. In the case of a series of three paratype workers from Mt Whaleback, however, the general appearance of the propodeum is smoother and more gracile, resembling that of *M. laeve*.

***Monomorium sordidum* Forel**

(Figs 40, 109, 116, 150, 159, 178)

Monomorium sordidum Forel, 1902: 443, 444.

Monomorium sordidum var. *nigriventris* Forel, 1910: 29, 30. **Syn. nov.**

Monomorium (*Holcomyrme*) *foreli* Viehmeyer, 1913: 32. **Syn. nov.**

Monomorium rothsteini var. *tostum* Wheeler, 1915b: 806, 807. **Syn. nov.**

Monomorium micron Crawley, 1925: 593, 594. **Syn. nov.**

Monomorium rothsteini var. *squamigena* Viehmeyer, 1925: 28. **Syn. nov.**

Chelaner sordidus (Forel) [comb. nov. Ettershank, 1966: 97].

Chelaner sordidus nigriventris (Forel) [comb. nov. Ettershank, 1966: 97].

Chelaner foreli (Viehmeyer) [comb. nov. Ettershank, 1966: 97].

Chelaner rothsteini tostum (Wheeler) [comb. nov. Ettershank, 1966: 97].

Chelaner rothsteini squamigena (Viehmeyer) [comb. nov. Ettershank, 1966: 97].

Monomorium sordidum Forel [comb. Bolton, 1987: 300, 301].

Monomorium sordidum nigriventris Forel [comb. Bolton, 1987: 300, 301].

Monomorium foreli Viehmeyer [comb. Bolton, 1987: 300, 301].

Monomorium rothsteini tostum Wheeler [comb. Bolton, 1987: 300, 301].

Monomorium rothsteini squamigena Viehmeyer [comb. Bolton, 1987: 300, 301].

Material examined***M. foreli***

Syntype. Worker, South Australia, 'Kilpaninno' [published as Killalpaninna], [collector not stated] (ANIC).

M. micron

Holotype. Worker, Western Australia, Clark (BMNH).

Paratypes. Three workers, [no data on collector, date or locality; label 'Cotype' on blue card] (BMNH). NB: both this pin and the holotype bear a label with '211' in ink.

M. rothsteini squamigena

Syntypes. Worker, New South Wales, Trial Bay [no data on collector] (ZMHB).

M. rothsteini tostum

Syntypes. Two workers, South Australia, Everard Range, Capt. S. A. White (SAM).

M. sordidum

Syntypes. Two workers, Australia [published locality New South Wales, Queanbeyan], Froggatt (ANIC - 'Syntype ex Geneva Mus. Not to be designated lectotype').

M. sordidum nigriventris

Syntypes. Three workers, New South Wales, Howlong, Froggatt (ANIC – ‘Syntype ex Geneva Mus. Not to be designated lectotype’).

Other material examined. 3 workers (AMS); 702 workers, 12 ♀, 2 ♂ (ANIC); 36 workers (JDM); 30 workers, 1 ♀, 1 ♀ puparium (MV) 46 workers, 1 ♂ (SAM); 60 workers, 1 ♀, 2 ♂ (WAM) (see Fig. 40 for distribution).

Worker description

Head. Head square or rectangular; vertex slightly concave; frons smooth and shining with combination of appressed setulae and erect and suberect setae. Compound eyes elliptical; (viewed from front) compound eyes set in anterior half of head capsule; (viewed laterally) compound eyes set at midline of head capsule; eye moderate, eye width 0.5–1.5× greatest width of antennal scape. Antennal segments 12; club three-segmented. Anteromedial clypeal margin straight or slightly emarginate, median clypeal carinae not produced as teeth or denticles. Longest lateral anterior clypeal setae long, extending beyond dorsal margin of closed mandibles. Posteromedial clypeal margin level with posterior surface of antennal fossae. Anterior tentorial pits situated nearer antennal fossae than mandibular insertions. Frontal lobes parallel straight, or parallel, sinuate. Venter of head capsule with elongate, basket-shaped setae in at least some individuals. Palp formula 1,2. Maximum number of mandibular teeth and denticles: four; mandibles (viewed from front) strap-like with inner and outer edges subparallel, smooth with piliferous punctures; basal tooth not enlarged; basal angle indistinct; apical and basal mandibular margins meeting in tooth or denticle.

Alitrunk. Promesonotal sculpture present in form of microreticulation and striolae on and around katapisternum, otherwise promesonotum smooth and shining; dorsal promesonotal face evenly convex; erect and suberect promesonotal setae greater than 10; setulae appressed. Mesonotal suture absent. Metanotal groove present as distinct and deeply impressed trough between promesonotum and propodeum. Propodeal sculpture present as faint microreticulation with few striae, mainly on lower lateral surface, or present as uniform microreticulation, with few or no striae or costulae; dorsal propodeal face sloping posteriad, with wedge-shaped flattening or shallow depression that is widest between propodeal angles; processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle); lobes present as blunt flanges. Propodeal angle absent; declivitous face of propodeum flat. Erect and suberect propodeal setae 5–10; propodeal setulae absent. Propodeal spiracle lateral and nearer metanotal groove than declivitous face of propodeum, or lateral and about midway between metanotal groove and declivitous face of propodeum; vestibule absent or undeveloped.

Petiole and postpetiole. Petiolar spiracle lateral and in anterior sector of petiolar node. Petiolar node cuneate, dorsally rounded; sculpture absent, petiolar node smooth and

shining. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3 to near 1:1. Anteroventral process distinct in some individuals as slender carina that tapers posteriad. Ventral lobe always absent. Height ratio of petiole to postpetiole near 4:3; height–length ratio of postpetiole near 2:1. Sculpture absent on dorsum, at least: postpetiole smooth and shining. Ventral process absent or vestigial.

Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour either uniformly brown, or with alitrunk, petiole and postpetiole a tawny yellow, other body parts of a deeper brown colouration, mandibles tawny yellow. Worker caste monomorphic.

Worker measurements. HML 1.25–1.75; HL 0.52–0.71; HW 0.42–0.58; CeI 82–90; SL 0.36–0.50; SI 81–98; PW 0.25–0.34 (40 measured).

Queen description

Head. Head square or rectangular; vertex planar; frons smooth and shining with combination of incurved decumbent and subdecumbent setulae and erect and suberect setae. Compound eyes circular or subcircular, or elliptical; (viewed from front) compound eyes set at midpoint of each side of head capsule; (viewed laterally) compound eyes set at midline of head capsule; eye large, eye width greater than 1.5× greatest width of antennal scape.

Alitrunk. Mesoscutum in profile convex anteriad; thereafter flattened. Mesoscutal pilosity consisting of dense incurved setulae and setae; dorsal appearance of mesoscutum smooth and shining; length–width ratio of mesoscutum and scutellum combined near 2:1 to near 4:3. Axillae separated by distance less than half greatest width of scutellum. Propodeal sculpture minutely and transversely striate; dorsal propodeal face flattened. Propodeal processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle); lobes present as blunt flanges. Propodeal angle absent. Erect and suberect propodeal setae greater than 10; propodeal setulae decumbent and subdecumbent. Propodeal spiracle lateral and about midway between metanotal groove and declivitous face of propodeum.

Wing. Wing veins predominantly depigmented with distal segments reduced to vestigial lines; vein m-cu absent; vein cu-a absent.

Petiole and postpetiole. Petiolar spiracle lateral and in anterior sector of petiolar node. Petiolar node cuneate, dorsally rounded; sculpture absent, petiolar node smooth and shining, or present in form of microreticulation. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3 to near 1:1. Anteroventral process distinct in some individuals as slender carina that tapers posteriad. Height ratio of petiole to postpetiole near

1:1 to near 4:3; height–length ratio of postpetiole near 3:1. Sculpture absent on dorsum, at least: postpetiole smooth and shining, or present in form of microreticulation; ventral process absent or vestigial.

Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour brown. Brachypterous alates seen and examined. Ergatoid or worker-female intercastes not seen.

Queen measurements. HML 2.72–3.93; HL 0.83–1.10; HW 0.79–1.07; CeI 96–114; SL 0.55–0.76; SI 63–77; PW 0.62–1.03 (12 measured).

Male description

Head. Head width–mesoscutal width ratio near 1:1 to near 3:4. Compound eyes protuberant and elliptical; (viewed laterally) compound eyes set at midline of head capsule; ocelli not turreted. Ratio of length of first funicular segment of antenna to length of second funicular segment near 2:5 to near 1:2. Maximum number of mandibular teeth and denticles: three.

Alitrunk. Mesoscutum in profile evenly convex; dorsal appearance of mesoscutum finely microreticulate; mesoscutal pilosity consisting of numerous short setae, incurved medially. Parapsidal furrows present and distinct; notauli absent. Axillae separated by distance more than half greatest width of scutellum.

Wing. Wing veins predominantly depigmented with distal segments reduced to vestigial lines; vein m-cu absent; vein cu-a absent.

Petiole and postpetiole. Petiolar spiracle lateral and in anterior sector of petiolar node. Sculpture present in form of microreticulation; ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 1:1 to near 3:4. Anteroventral process always absent or vestigial; ventral lobe always absent. Height–length ratio of postpetiole near 3:1; sculpture present in form of microreticulation; ventral process absent or vestigial.

Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour dark brown to black.

Male measurements. HML 3.17–3.48; HL 0.76–0.86; HW 0.90–1.07; CeI 112–124; SL 0.21–0.28; SI 22–28; PW 0.90–1.34 (3 measured).

Remarks

Despite an absence of records from Tasmania, *M. sordidum* is possibly the most abundant of the Australian *Monomorium*. This species is ubiquitous in all habitats, from desert to tropical rainforest, and from the remotest regions to suburban backyards in capital cities. Despite its abundance, the biology of *M. sordidum* has not been studied, doubtless

because of the taxonomic confusion surrounding this and other small *Monomorium* species. Presumably this ant is a generalist with catholic tastes.

Six specific and subspecific epithets are attached to *M. sordidum*, yet this ant is far more conservative in its morphology than are most other small Australian *Monomorium*. The form known as ‘*sordidum*’ represents the morph most commonly seen in the vicinity of Canberra. The exoskeleton is relatively thinly sclerotised and the worker is a uniform light brown in colour with only faint microreticulation on the propodeum. In comparison, the head and gaster (chocolate) contrast with the alitrunk (russet or brown) in *M. sordidum nigriventris*, *M. foreli*, and *M. rothsteini tostum*. The propodeum is also more sculptured, particularly in *M. foreli* and *M. rothsteini tostum*. *Monomorium rothsteini squamigena* resembles *M. sordidum*, but is darker, while *M. micron* is a small-bodied *M. sordidum* with a rather yellowish-brown alitrunk in the worker. This latter form tends to occur commonly in Western Australia, where it is the most abundant morph found in the eastern goldfields. *Monomorium ‘micron’* is also not uncommon in the Darling Range and around Perth, together with the larger, darker and more sculptured morphs. Whether these variations represent populations or individuals within a nest is not known.

The above morphological and colour permutations, however, are quite minor, and are part of a rather small variation in habitus for such a widespread animal. Therefore, *M. sordidum nigriventris*, *M. foreli*, *M. micron*, *M. rothsteini squamigena* and *M. rothsteini tostum* are here synonymised under the senior species epithet of *M. sordidum*.

Viehmeyer (1913) assigned *Monomorium foreli* to the subgenus *Holcomyrmex*. Originally erected as a separate genus, this name has been synonymised under *Monomorium*, though it does draw attention to apomorphic features found in the extralimital *M. scabriceps* group (Bolton 1987). As applied to Australian *Monomorium*, the name *Holcomyrmex* included species with a funiculus that lacked an apical club. Apart from *M. foreli*, the other species were *M. bicorne* and *M. whitei* and those taxa here synonymised under the latter two names. *Monomorium bicorne* and *M. whitei* are large *Monomorium* with strong clypeal teeth or denticles, exhibiting strong monophasic allometry and clearly unrelated to *M. foreli*. Viehmeyer’s description also lacks accuracy in at least one other particular: the length of the holotype is given as ‘3.75 mm’. This specimen has been measured by myself and found to be 2.67 mm.

Monomorium sordidum shares with *M. rothsteini* a number of apparent synapomorphies, including the shape and sculpture of the propodeum, the shape of the petiole and postpetiole, the reduction in the number of mandibular teeth in the worker (the fourth tooth in *M. sordidum* is reduced to a minute offset denticle, while the other teeth are large and prominent), and the broad anteromedial sector of the

clypeus. Brachyptery is also common among *M. sordidum* queens. An analysis of the venom constituents in *M. sordidum* may be instructive for phylogeny if compared with the same analysis already performed for *M. rothsteini*.

***Monomorium stictionotum*, sp. nov.**

(Figs 32, 124, 142)

Material examined

Holotype. Worker (top point), South Australia, Emu Camp, Victoria Desert, 7.x.1976, P. J. M. Greenslade (ANIC).

Paratypes. **South Australia**: (All specimens collected by P. J. M. Greenslade.) 1 + 2 workers with same data as the holotype (ANIC); 1 worker, 1 km W Emu Camp, 6.x.1976 (ANIC); 1 worker, 70 km E Emu, 5.x.1976 (ANIC); 2×2 workers, 85 km W Mabel Ck., 9–10.x.1980, Se B1 (BMNH); 3 + 4×1 workers, 53 km E Vokes Hill, Victoria Desert, 9.x.1976 (MCZ).

Other material examined. 35 workers (ANIC); 2 workers (JDM); 4 workers (SAM); 15 workers (WAM) (see Fig. 32 for distribution).

Worker description

As for the worker of *M. sydneyense*, but with the following apomorphies.

Head. Vertex of head capsule planar; frons smooth and shining with evenly spaced, appressed setulae, or smooth and shining with combination of appressed setulae and erect and suberect setae. Compound eyes reniform, with posterior surface of eye emarginate; (viewed from front) compound eyes set in anterior half of head capsule, or set at midpoint of each side of head. Eye large, eye width greater than 1.5× greatest width of antennal scape. Anteromedial clypeal margin emarginate, median clypeal carinae produced apically as pair of pronounced teeth, or emarginate, median clypeal carinae produced as pair of bluntly rounded denticles. Venter of head capsule with elongate, basket-shaped setae in at least some individuals. Maximum number of mandibular teeth and denticles: three; mandibles (viewed from front) strap-like with inner and outer edges subparallel, smooth with piliferous punctures.

Alitrunk. Promesonotal sculpture present in form of uniform microreticulation with few mesopleural striolae (or with microreticulation confined to posterior promesonotum only; anterior promesonotum smooth and shining); dorsal promesonotal face evenly convex. Propodeal sculpture present as uniform microreticulation, with few or no striae or costulae. Declivitous face of propodeum flat. Erect and suberect propodeal setae absent or very sparse, or 5–10.

Petiole and postpetiole. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3 to near 1:1. Ventral lobe always absent. Height ratio of petiole to postpetiole near 4:3.

Gaster. Pilosity of first gastral tergite consisting entirely of well-spaced appressed setulae.

General characters. Colour pale brown to chocolate, mandibles yellow. Gaster may be darker than alitrunk. Worker caste monomorphic.

Holotype worker measurements. HML 1.36; HL 0.54; HW 0.45; CeI 83; SL 0.45; SI 100; PW 0.28.

Other worker measurements. HML 1.11–1.47; HL 0.46–0.58; HW 0.36–0.49; CeI 80–90; SL 0.34–0.46; SI 88–100; PW 0.18–0.25 (17 measured).

Etymology

Greek: 'punctate + back'.

Remarks

Monomorium stictionotum is only weakly distinguished from *M. aithoderum*, and may eventually prove to be a variant of the latter species. The conformation of the eye is the only feature by which the two species can be separated. As presently recognised, this ant has a fairly wide distribution, mainly in the arid and semi-arid regions of South Australia and Western Australia. Despite its abundance, the worker caste of *M. stictionotum* is the only caste that can be identified.

Monomorium stictionotum is fairly uniform in colour and morphological features throughout its range, but the series from Kukerin, Western Australia, differ from other collections in that the workers have stout, erect setae on the alitrunk and vertex. Other workers have mainly appressed setulae on the alitrunk and vertex, but one specimen from the Olympic Dam site, South Australia, has a few small erect setae on the promesonotum.

This species may also be confused with *M. nanum*, but can be distinguished its humped and more elongate promesonotum, and the greater distance between the eye and the mandibular insertion.

***Monomorium sydneyense* Forel**

(Figs 35, 123, 139, 151, 176)

Monomorium sydneyense Forel, 1902: 442, 443.

Monomorium (*Mitara*) *sydneyense* subsp. *nigella* Emery, 1914b: 184, fgs 3a, b. **Syn. nov.**

Monomorium (*Lampromyrmex*) *fraterculus* var. *barretti* Santschi, 1928: 467, 468. **Syn. nov.**

Material examined

M. fraterculus barretti

Syntypes. Two workers, Victoria, Elsternwick, [collector as per label – 'Barrett'] (NMBA).

M. sydneyense

Syntypes. Three workers, Australia [published locality Sydney], [W. W.] Froggatt (ANIC).

M. sydneyense nigellum

Syntype. Worker, New South Wales, Loftus, 27.iv.1913 [collector F. Silvestri – acknowledged in the introduction to the article] (MSNM).

Other material examined. 393 workers, 5♀, 3♂ (ANIC); 21 workers (JDM); 13 workers (MV); 60 workers, 2♂ (QM); 48 workers (SAM); 33 workers (WAM) (see Fig. 35 for distribution).

Worker description

Head. Head square or rectangular; vertex slightly concave; frons smooth and shining with evenly spaced, appressed setulae, or smooth and shining with combination of appressed setulae and erect and suberect setae, or mat in appearance with evenly spaced, appressed setulae. Compound eyes elliptical; (viewed from front) compound eyes set in anterior half of head capsule; (viewed laterally) compound eyes set posterior of midline of head capsule; eye moderate, eye width 0.5–1.5× greatest width of antennal scape to large, eye width greater than 1.5× greatest width of antennal scape. Antennal segments 11; club three-segmented. Anteromedial clypeal margin emarginate, median clypeal carinae produced apically as pair of pronounced teeth, or straight or slightly emarginate, median clypeal carinae not produced as teeth or denticles. Longest lateral anterior clypeal setae long, extending beyond dorsal margin of closed mandibles. Posteromedial clypeal margin level with posterior surface of antennal fossae. Anterior tentorial pits situated nearer antennal fossae than mandibular insertions. Frontal lobes parallel straight. Venter of head capsule without elongate, basket-shaped setae. Palp formula 1,2. Maximum number of mandibular teeth and denticles: four; mandibles (viewed from front) strap-like with inner and outer edges subparallel, smooth with piliferous punctures or striate with piliferous punctures; basal tooth not enlarged; basal angle indistinct; apical and basal mandibular margins meeting in tooth or denticle.

Alitrunk. Promesonotal sculpture present in form of microreticulation and striolae on and around katapisternum, otherwise promesonotum smooth and shining, or present in form of uniform microreticulation with few mesopleural striolae; dorsal promesonotal face evenly convex, or convex anteriorly, otherwise flattened; erect and suberect promesonotal setae absent, or 5–10 setae present; setulae appressed. Mesonotal suture absent. Metanotal groove present as distinct and deeply impressed trough between promesonotum and propodeum. Propodeal sculpture present as faint microreticulation with few striae, mainly on lower lateral surface, or present as uniform microreticulation, with few or no striae or costulae; dorsal propodeal face sloping posteriorly, with wedge-shaped flattening or shallow depression that is widest between propodeal angles; processes present as pronounced lamellae formed by extension of metapleural lobes. Propodeal angle absent; declivitous face of propodeum flat to longitudinally concave between its lateral margins. Erect and suberect propodeal setae absent or very sparse to >5; propodeal setulae absent, or appressed. Propodeal spiracle lateral and nearer metanotal groove than declivitous face of propodeum; vestibule absent or undeveloped.

Petiole and postpetiole. Petiolar spiracle lateral and in anterior sector of petiolar node. Petiolar node conical, dorsally rounded, or cuneate, dorsally rounded, or cuneate, sharply tapered; sculpture absent, petiolar node smooth and shining, or present in form of microreticulation. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 2:1 to near 1:1. Anteroventral process distinct in some individuals as slender carina that tapers posteriorly. Ventral lobe present in some individuals. Height ratio of petiole to postpetiole near 4:3 to near 2:1; height–length ratio of postpetiole near 2:1. Sculpture absent on dorsum, at least: postpetiole smooth and shining, or present in form of microreticulation. Ventral process absent or vestigial.

Gaster. Pilosity of first gastral tergite consisting entirely of well-spaced appressed setulae, or consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour from yellow to chocolate brown, many individuals bicoloured, with gaster, appendages and often head brown or fulvous, and alitrunk of a lighter colour. Worker caste monomorphic.

Worker measurements. HML 0.80–1.33; HL 0.35–0.55; HW 0.27–0.46; CeI 79–88; SL 0.24–0.38; SI 75–90; PW 0.16–0.27 (55 measured).

Queen description

Head. Head square or rectangular; vertex planar; frons smooth and shining with combination of incurved decumbent and subdecumbent setulae and erect and suberect setae, or striolate with a combination of appressed setulae and erect and suberect setae. Compound eyes elliptical; (viewed from front) compound eyes set in anterior half of head capsule; (viewed laterally) compound eyes set posterior of the midline of head capsule, or set at midline of head capsule; eye large, eye width greater than 1.5× greatest width of antennal scape.

Alitrunk. Mesoscutum in profile evenly flattened. Mesoscutal pilosity consisting of dense incurved setulae and setae; dorsal appearance of mesoscutum smooth and shining; length–width ratio of mesoscutum and scutellum combined near 2:1 to near 4:3. Axillae contiguous or nearly so. Propodeal sculpture present as uniform microreticulation, with few or no striae or costulae; dorsal propodeal face flattened. Propodeal processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle); lobes present as blunt flanges. Propodeal angle absent. Erect and suberect propodeal setae 5–10; propodeal setulae decumbent and subdecumbent. Propodeal spiracle lateral and nearer metanotal groove than declivitous face of propodeum.

Wing. Wing veins predominantly depigmented with distal segments reduced to vestigial lines; vein m-cu absent; vein cu-a absent.

Petiole and postpetiole. Petiolar spiracle lateral and in anterior sector of petiolar node. Petiolar node cuneate, dorsally rounded; sculpture absent, petiolar node smooth and shining. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3 to near 1:1. Anteroventral process always absent or vestigial. Height ratio of petiole to postpetiole near 1:1 to near 4:3; height-length ratio of postpetiole near 3:1. Sculpture absent on dorsum, at least: postpetiole smooth and shining; ventral process present and distinct.

Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour russet. Brachypterous alates not seen. Ergatoid or worker-female intercastes not seen.

Queen measurements. HML 2.00–2.52; HL 0.62–0.69; HW 0.57–0.64; CeI 93–96; SL 0.44–0.51; SI 75–96; PW 0.44–0.67 (4 measured).

Male description

Head. Head width–mesoscutal width ratio near 3:4. Compound eyes protuberant and elliptical; (viewed laterally) compound eyes set at midline of head capsule; ocelli not turreted. Ratio of length of first funicular segment of antenna to length of second funicular segment near 2:5. Maximum number of mandibular teeth and denticles: three.

Alitrunk. Mesoscutum in profile evenly convex; dorsal appearance of mesoscutum striolate and microreticulate; mesoscutal pilosity consisting of long, dense setae, or consisting of numerous short setae, incurved medially. Parapsidal furrows vestigial; notauli absent. Axillae separated by distance of about half greatest width of scutellum.

Wing. Wing veins predominantly depigmented with distal segments reduced to vestigial lines; vein m-cu absent; vein cu-a absent.

Petiole and postpetiole. Petiolar spiracle lateral and in anterior sector of petiolar node. Sculpture present in form of microreticulation; ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 1:1 to near 3:4. Anteroventral process always absent or vestigial; ventral lobe always absent. Height-length ratio of postpetiole near 3:1 to near 2:1; sculpture present in form of microreticulation; ventral process absent or vestigial.

Gaster. Pilosity of first gastral tergite consisting entirely of well-spaced appressed setulae.

General characters. Colour chocolate.

Male measurements. HML 2.08–2.39; HL 0.57–0.62; HW 0.62–0.74; CeI 108–119; SL 0.20–0.21; SI 28–31; PW 0.75–0.85 (3 measured).

Remarks

More variable in its worker caste than any other Australian *Monomorium*, *M. sydneyense* can be found in a welter of

related forms. The external appearance varies from almost uniformly smooth and yellow in colour to pitchy dark chocolate, with a uniformly shagreenate or otherwise sculptured head, alitrunk and nodes. The common features uniting most of these workers are the absence of erect and suberect setae on the dorsum of the major body segments, the presence of a cuboidal (and usually more-or-less microreticulate) propodeum, and a rectangular head capsule. Among 55 workers measured, the CeI varied only from 79–88. Erect and suberect setae may be found in a few populations, but with the exception of a tiny minority of individuals (alluded to in 'Remarks' under *M. fieldi*) such workers closely resemble the type specimens of *M. sydneyense* and *M. sydneyense nigellum*.

Monomorium sydneyense and *M. sydneyense nigellum* scarcely differ. The *Monomorium fraterculus barretti* syntypes have a rather shorter and less sculptured propodeum than *M. sydneyense sensu stricto*, but distinct propodeal carinae are present, and the pilosity is identical to that of the preceding two taxa. Taken as a whole, these named taxa (described from workers) represent no more than minor variation in a species where many distinctive populations occur. *Monomorium sydneyense nigellum* and *M. fraterculus barretti* are therefore synonymised under the senior synonym of *M. sydneyense*.

Variability in colour and cuticular appearance in many *M. sydneyense* populations is clinal. Unfortunately, only a few queens (only one alate) and males can be assigned with confidence to this taxon, so the variation described here is that of the worker caste.

Specimens from the type locality (Sydney) have a shining promesonotum, with punctation confined to the mesopleuron in the region of the katepisternum. This is the pattern for most of New South Wales, though some populations on the north coast have a uniformly shagreenate promesonotum, while others have shining humeral patches amid the shagreenation. Many specimens have been taken at Cooloola, just north of Brisbane, and these reveal both shagreenate and smooth, dark-coloured individuals in about the same ratio. Workers from Mt Coot-tha (Brisbane), with shagreenate exoskeleton and a strongly truncated and oblique propodeum, are the smallest Australian *Monomorium*. Workers from some samples are only 1 mm in total length.

Series from the north of Australia are always shagreenate, and sometimes almost black in colour with russet legs. In Broome, Western Australia, the ant shows reduced sculpture and is orange with a black gaster. This morph has been found in a kitchen, and foraging on wooden structures in the backyard of a house.

The greatest variation appears to be in the Adelaide hills, South Australia, where P. J. M. Greenslade made many collections in the vicinity of Belair. A number of pins hold both brown and paler, yellowish morphs. Further south, on

Kangaroo Island, some specimens have a truncated propodeum with reduced sculpturing, and in a few cases converge on *M. fieldi* morphology. The many workers collected by Greenslade east of Adelaide tend to be pale in colour, as are specimens from both the north and south Flinders Ranges.

In Western Australia, populations sampled in the extreme southwest are very similar to the type specimens, but the colour gradually lightens as one moves towards the mid-west coast. However, most ants have a darker head capsule than promesonotum when viewed full-face, even in lighter-coloured workers. Around Perth and in the Darling Ranges, many nests produce minute, often uniformly yellow workers, most of which have a truncated and mainly smooth propodeum. While these ants generally exhibit the usual cephalic features for *M. sydneyense*, the longitudinal clypeal carinae of some workers are produced as minute spines. I have seen two pins of workers taken by the Rev. B. B. Lowery in Kings Park, Perth, on the same day. The workers on one pin have this feature, whilst it is lacking in workers on the other pin. Those workers possessing clypeal spines have a slightly darker colouration, but are otherwise indistinguishable from the remaining specimens. This phenomenon appears to be localised in scattered populations on the southwest coast, and without taxonomic significance. *Monomorium sydneyense* workers taken at various Tasmanian localities are invariably dark brown.

Apart from the variation described above, two distinctive morphs in *M. sydneyense* are retained under that species epithet, though further investigation may reveal them to be sibling species. A uniformly pale yellow form with large eyes occurs in New South Wales, The Northern Territory, South Australia and Western Australia. The ant has a distinctly truncated and high propodeum with obsolescent metapleural lobes (unlike typical *sydneyense*). The morphology is consistent throughout the range of this ant. A number of such pale workers from Manbulloo, near Katherine in the Northern Territory, are sympatric with the usual dark, shagreenate northern *M. sydneyense*, heightening suspicions that they do belong to a separate species. In the Adelaide Hills, however, where this form also occurs I cannot separate it from pale *M. sydneyense*, with which it seems to converge: a 'ring species'?

The other morph is known from a few samples taken at Emmettvale, New South Wales and Glen Osmond, South Australia. Workers are very large, and light brown in colour, with large eyes, a rounded and truncated propodeum, and a broad petiolar node. However, specimens with intermediate morphology between this form and typical *M. sydneyense* do occur. The taxon *M. sydneyense* poses a number of interesting problems, including the reason for the plasticity evident among its populations when compared with, say, *M. sordidum*, which varies very little throughout its range. Comprehensive nest series with reproductives are badly needed.

Monomorium sydneyense is found in a wide range of habitats. Workers often forage arboreally as well as terrestrially. This species can be quite common in urban areas. In Perth the minute yellow form, along with *M. fieldi*, is frequently found in sandy suburban backyards, even those overrun by the coastal brown ant (*Pheidole megacephala*).

The *rubriceps*-group

Monomorium albipes, sp. nov.

(Figs 42 105, 106)

Material examined

Holotype. Worker (top point), Queensland, Gayundah Ck, Hinchinbrook Island, 11.xi.1984, G. Thompson, pyrethrum knockdown (ANIC).

Paratypes. **Queensland**: 2 workers, with same data as holotype (ANIC); 1 worker with same data as holotype, except for date (12.xi.1984) (BMNH); 1 worker, Mt Webb Nat. Pk. 15°04'S, 145°07'E, 27–30.iv.1981, A. Calder & J. Feehan, berlesate ANIC 719, rainforest litter (MCZ).

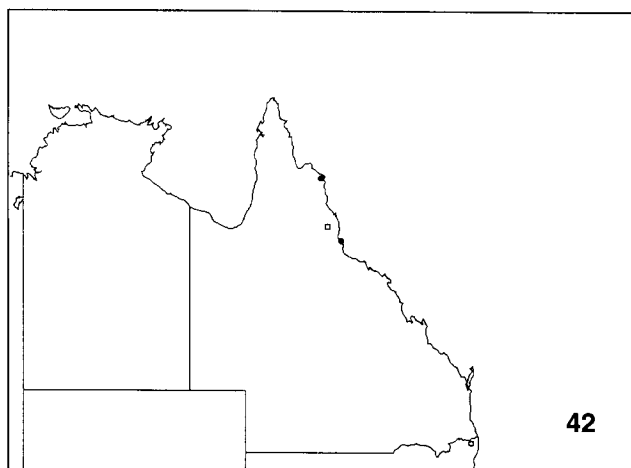
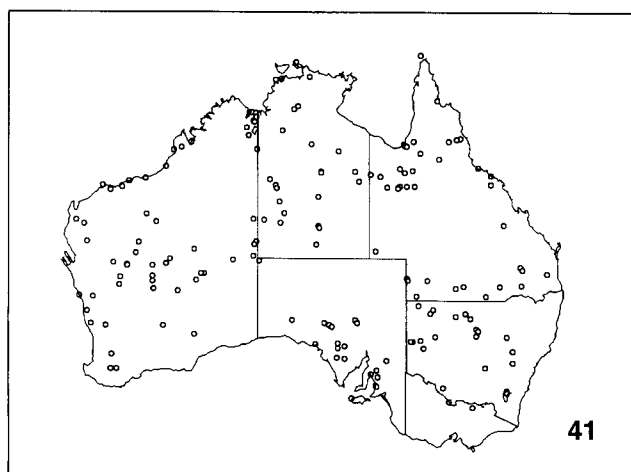
Worker description

As for the worker of *M. rubriceps* (see below), but with the following apomorphies.

Head. Head rounded; vertex planar; frons smooth and shining with combination of appressed setulae and erect and suberect setae. Eye large, eye width greater than 1.5× greatest width of antennal scape. Anteromedial clypeal margin convex, straight or slightly emarginate, median clypeal carinae indistinct. Palp formula unknown. Maximum number of mandibular teeth and denticles: four; mandibles (viewed from front) triangular and smooth, with piliferous punctures.

Alitrunk. Promesonotal sculpture absent, promesonotum smooth and shining; evenly flattened dorsally; setulae appressed. Metanotal groove present as feebly impressed furrow between promesonotum and propodeum. Propodeal sculpture absent; propodeum smooth and shining; dorsal propodeal face gently convex; processes absent (propodeum angulate in profile), or present on posterior propodeal angles as small denticles or sharp flanges. Propodeal angle present; length ratio of dorsal face to declivitous face near 2:1, or near 4:3; declivitous face of propodeum flat. Erect and suberect propodeal setae 5–10; propodeal setulae appressed, or decumbent and subdecumbent. Propodeal spiracle lateral and nearer declivitous face of propodeum than metanotal groove.

Petiole and postpetiole. Petiolar node conical, sharply tapered, or cuneate, dorsally rounded. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 2:1 to near 4:3. Anteroventral process vestigial. Height ratio of petiole to postpetiole near 1:1 to near 4:3; height-length ratio of postpetiole near 2:1 to near



Figs 41, 42. 41, Distribution of *M. rothsteini* (○) specimens examined during this study. 42, Distribution of *M. albipes* (●), *M. nightcapense* (○) and *M. ravenshoeense* (□) specimens examined during this study.

4:3. Ventral process vestigial to small, difficult to see or distinct.

General characters. Beautiful shining species, almost vitreous in appearance. Colour dark russet or piceous, mandibles dark orange, funiculus of antenna and tarsi amber. Worker caste monomorphic.

Holotype worker measurements. HML 2.55; HL 0.87; HW 0.79; CeI 91; SL 0.62; SI 78; PW 0.53.

Other worker measurements. HML 2.44–2.72; HL 0.85–0.90; HW 0.76–0.81; CeI 88–95; SL 0.63–0.69; SI 81–85; PW 0.52–0.59 (4 measured).

Etymology

Latin: 'white-footed'.

Remarks

Arguably the most beautiful of all the Australian *Monomorium*, *M. albipes* cannot be mistaken for any other

species. The burnished brown cuticle, the saddle-shaped promesonotum with long, white, erect setae, and the high, squamiform petiolar and postpetiolar nodes serve to identify this ant. Like other members of the *M. rubriceps* species-complex, this taxon forages arboreally, several workers having been collected by pyrethrum knockdown. The Mt Webb specimen, however, was obtained from a berlesate sample.

Monomorium bihamatum, sp. nov.

(Figs 43, 73, 77, 78)

Material examined

Holotype. Worker (top point), Western Australia, Balladonia, 13.i.1970, B. B. Lowery, limestone mallee, 10'' rainfall, 6 pm, Chelaner (ANIC).

Paratypes. **New South Wales:** 5 workers, Condobolin, 11.i.1967, B. B. Lowery, 650 [?ft], common on mallee gums, returning with mallee seeds, nest in sand (MCZ). **South Australia:** 3 workers, Streaky Bay, 23.ix.1957, B. B. Lowery, limestone mallee, on mallee gums, Chelaner (BMNH). **Western Australia:** 1 worker with same data as the holotype (ANIC), 2 workers and 1 ergatoid, Esperance district, 4.i.1966, C. Mercovich (BMNH); 6 workers, 38 miles N of Balladonia Hsd. 31°55'S, 127°49'E, 11.xi.1969, R. W. Taylor, Key's field notes, trip 163, stop 19542.1, ANIC ant vial no. 9.207 (ANIC).

Other material examined. **New South Wales:** 2 workers, Hillston (ANIC); 1 worker, Nymagee (AM). **South Australia:** 6 workers, Ooldea (SAM); 2 workers, Poochera 32°43'S, 134°50'E (ANIC); 4 workers, Tailern Bend (ANIC). **Western Australia:** 1 worker, Beonaddy Swamp, off Wanneroo Rd (JDM); 1 worker, WA Goldfields Survey (JDM).

Worker description

As for the worker of *M. longiceps* (see below), but with the following apomorphies.

Head. Vertex of head capsule slightly concave to planar. Eye large, eye width greater than 1.5× greatest width of antennal scape. Frontal lobes parallel straight. Venter of head capsule with elongate, basket-shaped setae in at least some individuals.

Alitrunk. Promesonotal sculpture present in form of uniform microreticulation with few mesopleural striolae. Mesonotal suture absent. Propodeal processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle), or vestigial (propodeum angulate in profile); lobes present as blunt flanges. Propodeal angle absent, or present.

Petiole and postpetiole. Petiolar spiracle lateral and in anterior sector of petiolar node. Petiolar node cuboidal; sculpture present in form of microreticulation, or present; petiolar node rugose. Height ratio of petiole to postpetiole near 1:1; height-length ratio of postpetiole near 2:1 to near 4:3. Sculpture present in form of microreticulation. Ventral process absent or vestigial, or present and distinct.

General characters. Colour of head, trunk, and appendages reddish-orange, gaster orange. Worker caste monomorphic.

Holotype worker measurements. HML 2.89; HL 0.97; HW 0.87; CeI 90; SL 0.80, SI 92; PW 0.64.

Other worker measurements. HML 2.44–3.22; HL 0.86–1.05; HW 0.75–0.96; CeI 82–93; SL 0.69–0.82; SI 81–96; PW 0.48–0.69 (30 measured).

Etymology

Latin: 'two-hooked'.

Remarks

Although this species resembles *M. legulus*, sp. nov. in gross morphology, the nature of the cuticular sculpture places *M. bihamatum* near *M. longiceps*. Some workers, including the holotype, also have vestigial denticles at the propodeal angle.

Monomorium bihamatum is reasonably common throughout temperate Australia, where it is mostly associated with mallee and harvests mallee seeds (label data). However, the worker from Beonaddy Swamp, near Perth, was found in mixed *Eucalyptus* woodland.

Monomorium brachythrix, sp. nov.

(Figs 44, 76, 85)

Material examined

Holotype. Worker, Western Australia, Eneabba, ix.1975, J. Fox, pitfall trap A290, JDM 163 (ANIC).

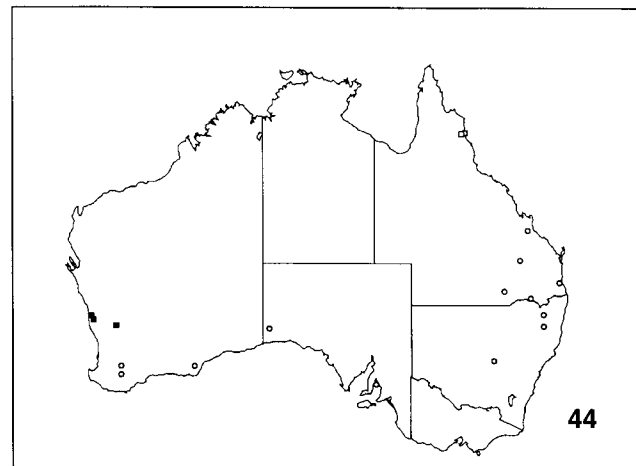
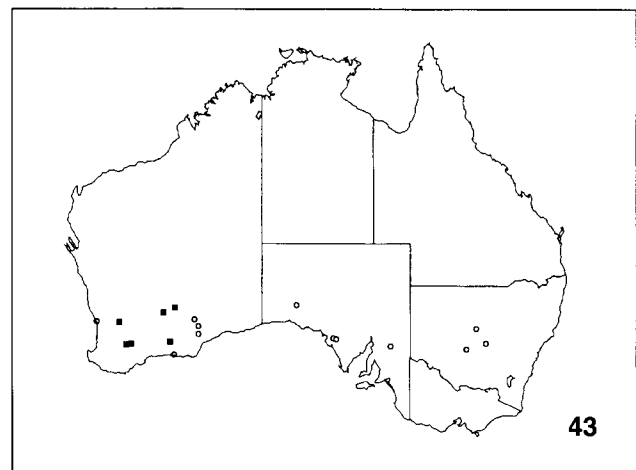
Paratypes. **Western Australia:** 1 worker with same data as the holotype (JDM); 4 workers, Eneabba, ii.1980, M. Sartori & R. Stone, minesite, rehab. study A1372 E80, JDM 525 (2 pins each to BMNH, MCZ); 1 worker, 5 km E of Burakin, 29.iv.1989, B. E. Heterick, soil, native veg., rural environ., 521/6MonBH45 (ANIC); 1 worker, 5 km E Ledge Point, 10.iii.1989, B. E. Heterick, soil, native veg., rural environ., 510/6MonBH42 (ANIC).

Worker description

As for the worker of *M. leae* (see below), but with the following apomorphies.

Head. Head square or rectangular; vertex slightly concave; frons smooth and shining with incurved decumbent and subdecumbent setulae. Compound eyes elliptical; (viewed from front) compound eyes set in anterior half of head capsule; (viewed laterally) compound eyes set at midline of head capsule. Posteromedial clypeal margin extending slightly posteriad of posterior surface of antennal fossae. Anterior tentorial pits situated nearer antennal fossae than mandibular insertions. Frontal lobes parallel, sinuate. Palp formula unknown.

Alitrunk. Dorsal promesonotal face convex anteriorly, otherwise flattened. Metanotal groove present as distinct and deeply impressed trough between promesonotum and



Figs 43, 44. 43, Distribution of *M. bihamatum* (○) and *M. legulus* (■) specimens examined during this study. 44, Distribution of *M. brachythrix* (■), *M. euryodon* (○) and *M. nigriceps* (□) specimens examined during this study.

propodeum. Propodeal sculpture present as faint microreticulation with few striae, mainly on lower lateral surface; dorsal propodeal face gently convex, or sloping posteriad, with wedge-shaped flattening or shallow depression that is widest between propodeal angles; processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle. Propodeal angle absent; declivitous face of propodeum flat. Erect and suberect propodeal setae greater than 10; propodeal setulae decumbent and subdecumbent.

Petiole and postpetiole. Petiolar spiracle lateral and in anterior sector of petiolar node. Petiolar node tumular and inclined posteriad; sculpture absent, petiolar node smooth and shining. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3 to near 1:1. Anteroventral process always absent or vestigial. Height ratio of petiole to postpetiole near 1:1 to near 4:3; height-length ratio of postpetiole near 4:3 to near 1:1.

Sculpture absent on dorsum, at least: postpetiole smooth and shining. Ventral process absent or vestigial, or present and distinct.

Gaster. Pilosity of first gastral tergite consisting entirely of well-spaced erect and suberect setae.

General characters. Colour fulvous. Worker caste monomorphic.

Holotype worker measurements. HML 1.59; HL 0.55; HW 0.46; CeI 83; SL 0.37; SI 80; PW 0.32.

Other worker measurements. HML 1.34–1.79; HL 0.50–0.61; HW 0.40–0.49; CeI 77–88; SL 0.34–0.42; SI 76–85; PW 0.32–0.34 (7 measured).

Etymology

Greek: 'short-haired'.

Remarks

This small member of the *rubriceps*-group resembles a species of *Solenopsis*, but can be distinguished from members of that genus by its 3-segmented antennal club and larger eye. The species is known from a few workers only, all taken from coastal woodland and sand-plain heath north of Perth. The Burakin specimen has a narrower petiolar node than the other workers, and in this respect approaches *M. leae* (i.e. the '*flavipes-insularis*' and '*leae*' morphs).

Monomorium burchera, sp. nov.

(Figs 45, 97, 104)

Material examined

Holotype. Worker (top point), New South Wales, Mebbin SF, 15 miles SW of Murwillumbah, 5.ix.1967, B. B. Lowery, med. sclerophyll, 600 ft (ANIC).

Paratypes. **New South Wales:** 2 workers, data as for the holotype; 4 workers, collection data as for the holotype (except locality given as: '15 miles W of Murwillumbah'), additional data: 'on dead stump, A352' (MCZ); 3 workers, data as for the 4 paratype workers (BMNH).

Worker description

As for the worker of *M. rubriceps*, but with the following apomorphies.

Head. Head square or rectangular; vertex slightly concave; frons smooth and shining with combination of appressed setulae and erect and suberect setae. (Viewed laterally) compound eyes set posterior of midline of head capsule; Anteromedial clypeal margin convex, straight or slightly emarginate, median clypeal carinae indistinct. Palp formula unknown. Mandibles (viewed from front) triangular and striate, with piliferous punctures.

Alitrunk. Metanotal groove present as distinct and deeply impressed trough between promesonotum and propodeum. Propodeal sculpture present as uniform rugosity, with well defined costulae on declivitous face of propodeum; dorsal propodeal face sloping posteriad, with

wedge-shaped flattening or shallow depression that is widest between propodeal angles; processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle). Propodeal angle absent; declivitous face of propodeum smoothly convex. Erect and suberect propodeal setae >5. Petiole and postpetiole. Petiolar node cuboidal; sculpture absent, petiolar node smooth and shining. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 1:1. Anteroventral process always present as pronounced spur. Height ratio of petiole to postpetiole near 1:1 to near 4:3; height-length ratio of postpetiole near 4:3 to near 1:1.

General characters. Colour of head reddish orange, alitrunk, petiole and post-petiole piceous, gaster orange with a broad, transverse brown band or bands, appendages brown. Worker caste monomorphic.

Holotype worker measurements. HML 2.74; HL 0.97; HW 0.76; CeI 79; SL 0.56; SI 74; PW 0.53.

Other worker measurements. HML 2.55–2.96; HL 0.89–0.97; HW 0.72–0.77; CeI 76–82; SL 0.52–0.58; SI 72–76; PW 0.46–0.57 (8 measured).

Etymology

Named in honour of Ms Jennifer Manthey (nee Burcher), late of CSIRO, Indooroopilly, Brisbane.

Remarks

Mebbin State Forest, near Murwillumbah, is the only known locality for this striking species. *Monomorium burchera* has a similar colour pattern to some *M. rubriceps* populations, but the features of the alitrunk and nodes indicate that this ant belongs to the *M. edentatum*–*M. gilberti* complex. The sting apparatus is strongly developed in *M. burchera*, suggesting that the bright colouration may have an aposematic function.

Monomorium centrale Forel

(Figs 46, 81)

Monomorium centrale Forel, 1910: 28–29.

Chelaner centralis (Forel) [comb. nov. Ettershank, 1966: 96].

Monomorium centrale Forel [comb. Bolton, 1987: 300, 301].

Material examined

Holotype. Worker, Northern Territory, Tennant Ck, Froggatt (MHNH).

Other material examined. 105 workers, 4 ♀, 2 ♂ (ANIC); 9 workers (JDM); 3 workers (WAM) (see Fig. 46 for distribution).

Worker description

As for the worker of *M. leae*, but with the following apomorphies.

Head. Head square or rectangular; vertex planar. Compound eyes elliptical; (viewed from front) compound

eyes set in anterior half of head capsule. Anteromedial clypeal margin emarginate, median clypeal carinae produced as pair of bluntly rounded denticles.

Alitrunk. Promesonotal sculpture present in form of striae on anterior promesonotum, and microreticulation and striolae on mesopleuron; dorsal promesonotal face convex anteriad, otherwise flattened. Metanotal groove absent to present as feebly impressed furrow between promesonotum and propodeum. Propodeal sculpture present as uniform microreticulation, with few or no striae or costulae; processes absent (propodeum angulate in profile). Propodeal angle present; length ratio of dorsal face to declivitous face near 2:1 to near 1:1; declivitous face of propodeum longitudinally concave between its lateral margins. Propodeal setulae decumbent and subdecumbent. Propodeal spiracle lateral and nearer declivitous face of propodeum than metanotal groove to lateral and about midway between metanotal groove and declivitous face of propodeum.

Petiole and postpetiole. Petiolar spiracle lateral and in anterior sector of petiolar node. Petiolar node cuboidal; sculpture present in form of microreticulation. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3. Height ratio of petiole to postpetiole near 1:1 to near 4:3; height-length ratio of postpetiole near 2:1 to near 4:3. Sculpture present in form of microreticulation.

General characters. Colour of head, alitrunk, petiole, and post-petiole russet (anterior promesonotum may be more orange in colour), gaster and appendages fulvous. Worker caste monomorphic but variable in size, with series of intercastes between largest and smallest workers (monophasic allometry).

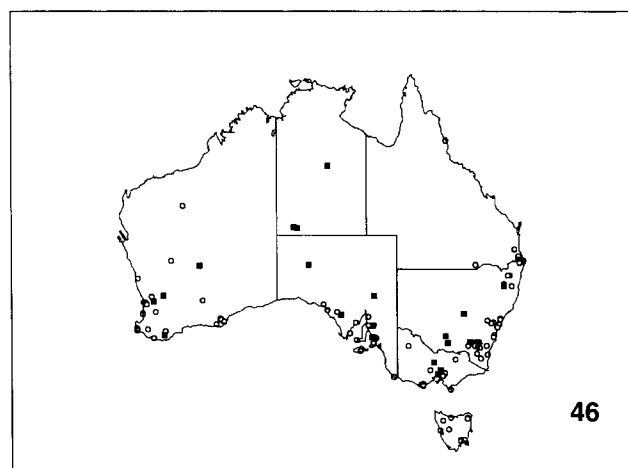
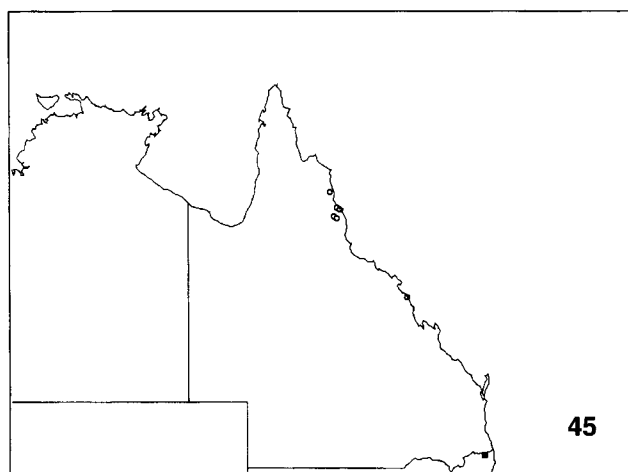
Worker measurements. HML 1.47–2.46; HL 0.58–0.88; HW 0.46–0.80; CeI 80–92; SL 0.34–0.61; SI 75–86; PW 0.31–0.52 (26 measured).

Queen description

As for the queen of *M. leae*, but with the following apomorphies.

Head. Head square or rectangular; vertex slightly concave; frons striolate between frontal carinae, otherwise smooth and shining with a combination of decumbent and subdecumbent setulae and erect and suberect setae. Compound eyes elliptical; (viewed from front) compound eyes set in anterior half of head capsule to set at midpoint of each side of head capsule; (viewed laterally) compound eyes set at midline of head capsule.

Alitrunk. Mesoscutum in profile convex anteriad; thereafter flattened. Mesoscutal pilosity consisting of numerous incurved erect and suberect setae; dorsal appearance of mesoscutum smooth and shining with a few scattered piliferous pits. Axillae separated by distance less than half greatest width of scutellum. Propodeal sculpture present as uniform rugosity, with well defined costulae on



Figs 45, 46. 45, Distribution of *M. burchera* (■) and *M. gilberti* (○) specimens examined during this study. 46, Distribution of *M. centrale* (■) and *M. leae* (○) specimens examined during this study.

declivitous face of propodeum; dorsal propodeal face sloping posteriad, with wedge-shaped flattening or shallow depression that is widest between propodeal angles. Propodeal processes present on posterior propodeal angles as small denticles or sharp flanges.

Petiole and postpetiole. Petiolar spiracle lateral and slightly anteriad of petiolar node. Petiolar node cuneate, dorsally rounded; sculpture present; petiolar node rugose. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3. Anteroventral process a slender carina. Height ratio of petiole to postpetiole near 1:1; height-length ratio of postpetiole near 3:1. Sculpture present in form of microreticulation.

Gaster. Pilosity of first gastral tergite consisting of combination of decumbent and subdecumbent setulae and longer, erect and suberect setae.

General characters. Colour fulvous. Brachypterous alates not seen. Ergatoid or worker-female intergrades seen and examined.

Queen measurements. HML 3.22–3.54; HL 0.90–1.03; HW 0.87–0.99; CeI 96–99; SL 0.62–0.74; SI 68–74; PW 0.78–0.98 (4 measured).

Male description

As for the male of *M. leae*, but with the following apomorphies.

Head. Maximum number of mandibular teeth and denticles: two.

Alitrunk. Dorsal appearance of mesoscutum striolate and microreticulate; mesoscutal pilosity consisting of numerous short setae, incurved medially. Parapsidal furrows present and distinct; notauli present.

Petiole and postpetiole. Petiolar spiracle lateral and in anterior sector of petiolar node. Sculpture present in form of microreticulation. Anteroventral process distinct in some individuals as slender carina that tapers posteriad. Height–length ratio of postpetiole near 4:3 to near 1:1; sculpture present in form of microreticulation; ventral process absent or vestigial.

General characters. Colour chocolate; legs brown.

Male measurements. HML 2.61–2.82; HL 0.83–0.88; HW 0.93–1.06; CeI 112–128; SL 0.21–0.26; SI 21–25; PW 0.88–0.93 (2 measured).

Remarks

Monomorium centrale is a somewhat nondescript member of the *rubriceps*-group. The morphology is quite uniform, apart from the petiolar node that varies in thickness. In a few specimens from the Porongurup Range, southwestern Australia, the node is almost cuneate.

The typical worker of *Monomorium centrale* bears a close superficial resemblance to workers of some *M. leae* populations, but can be distinguished by the deeper indentation of the anteromedial clypeal margin, and the microreticulation on the lateral panels of the promesonotum. Moreover, the head capsule in *M. centrale* is normally darker than the promesonotum (compared with a lighter-coloured head capsule or a head capsule concolorous with the promesonotum in most *M. leae*). However, specimens of *M. centrale* (including the holotype) from more northerly latitudes tend to a rather uniform colouration. The range of *M. centrale* overlaps with *M. leae*, but in general, *M. centrale* is more an ant of inland arid and semi-arid areas.

Monomorium draculai, sp. nov.

(Figs 47, 86, 88)

Material examined

Holotype. Worker (top point), Queensland, 2.5 km N Mt Lewis via Julatten, 3.xi.1983, D. K. Yeates & G. I. Thompson, 1040 m, pyrethrum knockdown, R. F., ANIC ants vial 40–213 (ANIC).

Paratypes. **Queensland:** 2×2 workers, same data as the holotype (ANIC, BMNH); 3 workers, Mt Lewis, 6.viii.1975, B. B. Lowery, 2000 ft, on tree (MCZ).

Worker description

As for the worker of *M. rubriceps*, but with the following apomorphies.

Head. Head square or rectangular; vertex convex; frons smooth and shining with combination of appressed setulae and erect and suberect setae. (Viewed laterally) compound eyes set posterior of midline of head capsule; eye moderate, eye width 0.5–1.5× greatest width of antennal scape to large, eye width greater than 1.5× greatest width of antennal scape. Anteromedial clypeal margin emarginate, clypeal carinae produced as two elongate, parallel spines. Mandibles (viewed from front) triangular and smooth, with piliferous punctures.

Alitrunk. Metanotal groove present as feebly impressed furrow between promesonotum and propodeum. Dorsal propodeal face gently convex; processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle). Propodeal angle absent; declivitous face of propodeum flat. Erect and suberect propodeal setae 5–10; propodeal setulae appressed.

Petiole and postpetiole. Petiolar spiracle lateral and slightly anterior of petiolar node. Petiolar node tumular and inclined posteriad; sculpture absent, petiolar node smooth and shining. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 3:4. Height–length ratio of postpetiole near 4:3 to near 1:1.

General characters. Colour of head, gaster and appendages shining orange, petiole and postpetiole darker orange, alitrunk shining maroon. Worker caste monomorphic.

Holotype worker measurements. HML 2.40; HL 0.80; HW 0.68; CeI 83; SL 0.62; SI 92; PW 0.46.

Other worker measurements. HML 2.34–2.88; HL 0.79–0.93; HW 0.66–0.85; CeI 83–101; SL 0.59–0.69; SI 76–90; PW 0.41–0.48 (8 measured).

Etymology

Proper name, inspired by the spinose clypeal teeth.

Remarks

This spectacular species is remarkable for its smooth and elongate clypeal teeth produced as sharp spines. Among Australian '*Chelaner*' this feature is shared only with *M. parantarcticum*, sp. nov. *Monomorium draculai* is known only from a few workers taken on Mt Lewis in northern Queensland. Label data suggests this may be an arboreal species.

The morphology of the postpetiole, the thickened femora, and the shape of the metapleural lobes enable *M. draculai* to be placed in the *M. rubriceps* species-complex, despite its singular appearance.

Monomorium durokoppinense, sp. nov.

(Fig. 48)

Material examined

Holotype. Worker (top point), Western Australia, Durokoppin Reserve, 27 km N of Kellerberrin, iii/vii/xi.1987, L. A. Lobry de Bruyn (WAM).

Paratype. **Western Australia**: 1 worker, with same data as the holotype (WAM).

Worker description

As for the worker of *M. leae*, but with the following apomorphies.

Head. Head square or rectangular; vertex planar. Compound eyes elliptical; (viewed from front) compound eyes set in posterior half of head capsule; eye large, eye width greater than $1.5\times$ greatest width of antennal scape. Anteromedial clypeal margin emarginate, median clypeal carinae produced as pair of bluntly rounded denticles. Longest lateral anterior clypeal setae moderate, reaching dorsal margin of closed mandibles. Posteromedial clypeal margin situated between anterior and posterior surfaces of antennal fossae. Frontal lobes parallel, sinuate. Maximum number of mandibular teeth and denticles: four; apical and basal mandibular margins meeting in curve.

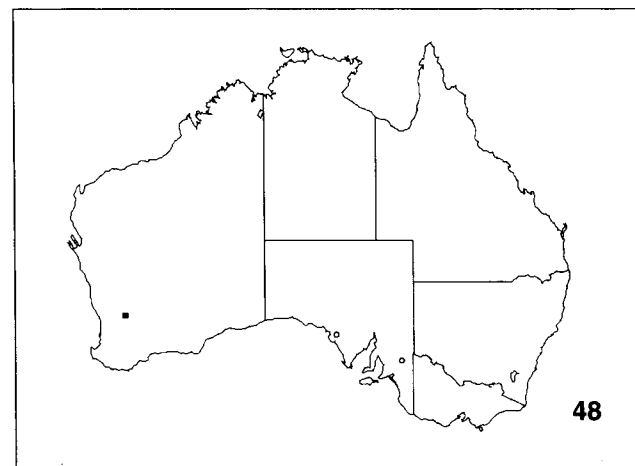
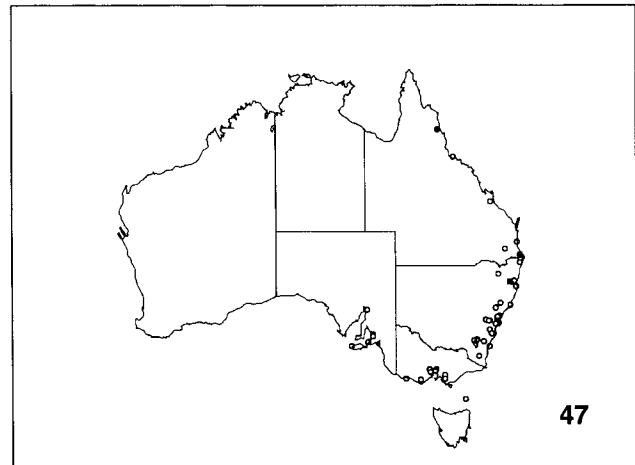
Alitrunk. Promesonotal sculpture present in form of microreticulation on lateral promesonotal surfaces and mesopleuron, otherwise smooth and shining; erect and suberect promesonotal setae >5 ; dorsal promesonotal face convex anteriad, otherwise flattened. Mesonotal suture visible externally as faint ridge. Metanotal groove absent. Propodeal sculpture present as uniform microreticulation, with few or no striae or costulae; processes absent (propodeum angulate in profile. Propodeal angle present; length ratio of dorsal face to declivitous face near 2:1; declivitous face of propodeum longitudinally concave between its lateral margins. Propodeal setulae decumbent and subdecumbent.

Petiole and postpetiole. Petiolar node cuboidal; sculpture present in form of microreticulation. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 1:1. Anteroventral process a small spur. Ventral lobe always absent. Height ratio of petiole to postpetiole near 1:1; height-length ratio of postpetiole near 3:1. Sculpture present in form of microreticulation.

General characters. Colour of alitrunk and nodes brick-red, head and appendages orange, gaster light brown.

Holotype worker measurements. HML 1.87; HL 0.66; HW 0.54; CeI 82; SL 0.46; SI 85; PW 0.39.

Paratype worker measurements. HML 1.84; HL 0.64; HW 0.53; CeI 82; SL 0.46; SI 87; PW 0.39.



Figs 47, 48. 47, Distribution of *M. draculai* (●), *M. parantarcticum* (■), and *M. rubriceps* (○) specimens examined during this study. 48, Distribution of *M. durokoppinense* (■) and *M. macarthurii* (○) specimens examined during this study.

Etymology

Named after the locality where the ants were collected.

Remarks

The alitrunk and nodes of the two known specimens are similar in appearance to those of *M. centrale*, but the colour pattern and form of the clypeus place this species close to *M. macarthurii*, sp. nov. and *M. xantheklemma*, sp. nov.

Monomorium euryodon, sp. nov.

(Figs 11, 44, 91)

Material examined

Holotype. Worker (top point), South Australia, 36 miles NW Adelaide, 15.viii.1971, B. B. Lowery, sandy coastal heath, nest in sand, SA 357, ANIC ants, vial 66.16 (ANIC).

Paratypes. **Queensland:** 2 workers, 5 km NE Mount Morgan 23°37'S, 150°24'E, 27.x.1976, R. W. Taylor & T. A. Weir, acc. no. 76/246, ANIC ant vial 66.15 (ANIC); 1 queen, 5 workers, St George, 19.i.1966, B. B. Lowery, black soil, plain box timber, large series under small shrub in sandy debris, R.66 (BMNH); 2 workers, Taroom, 20.viii.1975, B. B. Lowery, brigalow and box trees, in soil (MCZ); 1 queen, 7 workers (1 head missing), 4 miles WNW Yelarbon, 1.iii.1949, T. Greaves, 6966 (MCZ). **South Australia:** 1♀, 2♂, 2 workers with same data as the holotype (ANIC).

Other material examined. **New South Wales:** 10 workers, Armidale (ANIC); 4 workers, Armidale (QM); 13 workers, Glen Innes (SAM); 9 workers, Trundle (ANIC). **Queensland:** 3 workers, Ithaca [= Ithaca] Ck., Brisbane (ANIC). **South Australia:** 1♀, 3 workers, Hughes (SAM); 1 worker, Lochiel (ANIC). **Western Australia:** 2 workers, 160 ENE of Esperance 33°13'S, 123°27'E (ANIC); 2 workers, Nippering, 8 km W of Dumbleyung (JDM).

Worker description

As for the worker of *M. leae*, but with the following apomorphies.

Head. Head square or rectangular, or cordate. Compound eyes elliptical; (viewed from front) compound eyes set in anterior half of head capsule. Anteromedial clypeal margin convex, straight or slightly emarginate, median clypeal carinae indistinct. Posteromedial clypeal margin level with posterior surface of antennal fossae. Frontal lobes parallel, sinuate. Basal tooth enlarged, much broader than other non-apical teeth.

Alitrunk. Dorsal promesonotal face convex anteriorly, otherwise flattened. Metanotal groove present as feebly impressed furrow between promesonotum and propodeum. Propodeal sculpture present as faint microreticulation with few striae, mainly on lower lateral surface; propodeal processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle). Propodeal angle absent; declivitous face of propodeum longitudinally concave between its lateral margins. Erect and suberect propodeal setae greater than 10; propodeal setulae decumbent and subdecumbent.

Petiole and postpetiole. Petiolar spiracle lateral and in anterior sector of petiolar node. Petiolar node cuneate, dorsally rounded; sculpture absent, petiolar node smooth and shining. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 2:1, or near 4:3. Anteroventral process distinct in some individuals as slender carina that tapers posteriorly. Height ratio of petiole to postpetiole near 1:1 to near 4:3; height-length ratio of postpetiole near 2:1 to near 4:3. Sculpture absent on dorsum, at least: postpetiole smooth and shining.

General characters. Colour fulvous to deep orange. Worker caste polymorphic.

Worker holotype measurements. HML 2.63; HL 0.97; HW 0.89; CeI 92; SL 0.61; SI 69; PW 0.51.

Other worker measurements. HML 1.54–2.99; HL 0.58–1.07; HW 0.46–1.04; CeI 78–96; SL 0.34–0.64; SI 60–82; PW 0.32–0.66 (29 measured).

Queen description

As for the queen of *M. leae*, but with the following apomorphies.

Head. Head square or rectangular, or cordate; frons striolate with a combination of appressed setulae and erect and suberect setae. Compound eyes circular or subcircular; (viewed laterally) compound eyes set at midline of head.

Alitrunk. Mesoscutum in profile evenly flattened. Mesoscutal pilosity consisting of dense incurved setulae and setae; length-width ratio of mesoscutum and scutellum combined near 4:3. Axillae separated by distance less than half greatest width of scutellum. Propodeal sculpture present as faint microreticulation with few striae, mainly on lower lateral surface; dorsal propodeal face flattened. Propodeal processes present on posterior propodeal angles as small denticles or sharp flanges. Propodeal spiracle lateral and about midway between metanotal groove and declivitous face of propodeum.

Wing. Vein m-cu absent.

Petiole and postpetiole. Petiolar spiracle lateral and in anterior sector of petiolar node. Petiolar node cuneate, dorsally rounded. Anteroventral process distinct in some individuals as slender carina that tapers posteriorly. Height ratio of petiole to postpetiole near 3:4 to near 1:1; height-length ratio of postpetiole near 3:1. Sculpture present in form of microreticulation.

General characters. Colour of head, alitrunk, petiole, postpetiole russet; gaster, legs amber. Brachypterous alates not seen. Ergatoid or worker-female intercastes not seen.

Queen measurements. HML 3.44–3.78; HL 1.01–1.09; HW 1.01–1.14; CeI 95–105; SL 0.70–0.75; SI 64–74; PW 0.98 (4 measured).

Male description

As for the male of *M. leae*, but with the following apomorphies.

Head. Head width-mesoscutal width ratio near 4:3. Ratio of length of first funicular segment of antenna to length of second funicular segment near 1:2. Maximum number of mandibular teeth and denticles: four.

Alitrunk. Mesoscutum in profile evenly convex; dorsal appearance of mesoscutum striolate and microreticulate; mesoscutal pilosity consisting of numerous short setae, incurved medially. Parapsidal furrows present and distinct.

Wing. Vein m-cu absent.

Petiole and postpetiole. Anteroventral process distinct in some individuals as slender carina that tapers posteriorly. Height-length ratio of postpetiole near 4:3; sculpture present in form of microreticulation; ventral process present and distinct.

General characters. Brown.

Male measurements. HML 2.84–2.90; HL 0.75–0.83; HW 0.84–0.93; CeI 113–118; SL 0.21; SI 22–25; PW 0.75–0.78 (2 measured).

Etymology

Greek: 'broad-toothed'.

Remarks

This member of the *rubriceps*-group is widespread throughout Australia, reaching at least as far north as the central Queensland coast. *Monomorium euryodon* may be confused with some forms of *M. leae*, but can be distinguished by the enlarged basal tooth, and presence of true polymorphism in the worker caste. The ant prefers sandy soils.

Monomorium gilberti Forel

(Figs 45, 98, 112)

Monomorium gilberti Forel, 1902: 640, 641.

Vollenhovia turneri Forel, 1910: 26, 27. **Syn. nov.**

Monomorium edentatum subsp. *turneri* (Forel) [comb. and stat. n. Emery, 1914a: 407 (footnote)].

Monomorium gilberti var. *mediorubra* Forel, 1915: 72, 73. **Syn. nov.**

Monomorium (*Notomyrmex*) *edentatum turneri* (Forel); Emery 1922: 169.

Chelaner gilberti (Forel) [comb. nov. Ettershank, 1966: 97].

Chelaner gilberti mediorubrus (Forel) [comb. nov. Ettershank, 1966: 97].

Chelaner turneri (Forel) [comb. and stat. nov. Ettershank, 1966: 97].

Monomorium gilberti Forel [comb. Bolton, 1987: 300, 301].

Monomorium gilberti mediorubrum Forel [comb. Bolton, 1987: 300, 301].

Monomorium turneri (Forel) [comb. Bolton, 1987: 300, 301].

Material examined

M. gilberti

Syntype. Worker, Queensland, Macky (sic), 'Coll. A. Forel' (MHNB).

M. gilberti mediorubrum

Syntype. Worker, Queensland, Malanda, [E. G.] Mjöberg (ANIC – 'Syntype ex Geneva Mus. Not to be designated lectotype').

M. turneri

Syntype. Worker, Queensland, Kuranda, Cairns, Turner (described as *Vollenhovia turneri*) (ANIC – 'Syntype ex Geneva Mus. Not to be designated lectotype').

Other material examined. **Queensland:** 4 workers, Cairns dist. (SAM); 1 ♀, 2 workers, Kuranda (SAM); 1 worker, Malanda (ANIC); 1 worker, McDowall Ra., 17 km N Daintree (ANIC); 3 workers, Tolga (ANIC).

Worker description

As for the worker of *M. rubriceps*, but with the following apomorphies.

Head. Head square or rectangular; frons smooth and shining with combination of appressed setulae and erect and suberect setae. Mandibles (viewed from front) triangular and smooth, with piliferous punctures, or triangular and striate, with piliferous punctures.

Alitrunk. Promesonotal setulae appressed. Metanotal groove present as distinct and deeply impressed trough between promesonotum and propodeum. Propodeal sculpture present as faint microreticulation with few striae, mainly on lower lateral surface, or present as uniform rugosity, with well defined costulae on declivitous face of propodeum; dorsal propodeal face strongly convex, or gently convex, or sloping posteriad, with wedge-shaped flattening or shallow depression that is widest between propodeal angles; processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle). Propodeal angle absent; declivitous face of propodeum flat. Erect and suberect propodeal setae >5; propodeal setulae appressed.

Petiole and postpetiole. Petiolar node cuboidal; sculpture absent, petiolar node smooth and shining. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3 to near 1:1. Height–length ratio of postpetiole near 4:3 to near 1:1.

General characters. Colour of head chocolate to black, anterior promesonotum russet to chocolate, propodeum dark red, petiole and postpetiole chocolate, appendages chocolate. Worker caste monomorphic.

Worker measurements. HML 2.80–3.44; HL 0.93–1.16; HW 0.75–1.06; CeI 80–98; SL 0.57–0.76; SI 76–98; PW 0.52–0.64 (11 measured.)

Queen description

As for the queen of *M. rubriceps*, but with the following apomorphies.

Head. Head square or rectangular; vertex planar; frons striolate between frontal carinae, otherwise smooth and shining with a combination of decumbent and subdecumbent setulae and erect and suberect setae. (Viewed laterally) compound eyes set posterior of the midline of head capsule.

Alitrunk. Axillae contiguous or nearly so. Propodeal processes absent (propodeum angulate in profile), or present on posterior propodeal angles as small denticles or sharp flanges. Propodeal angle present. Propodeal spiracle lateral and nearer metanotal groove than declivitous face of propodeum.

Petiole and postpetiole. Petiolar node cuboidal; striolate and shining. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3. Anteroventral process distinct in some individuals as slender carina that tapers posteriad. Height–length ratio of postpetiole near 4:3.

General characters. Colour generally reddish-brown to russet; petiole and postpetiole lighter in colour.

Brachypterous alates not seen. Ergatoid or worker-female intercastes not seen.

Queen measurements. HML 4.40; HL 1.40; HW 1.27; CeI 91; SL 0.78; SI 61; PW 0.93 (1 measured.)

Remarks

Forel's association (Forel 1910) of this species with the genus *Vollenhovia* is puzzling; the more so, since he had correctly described the same ant as a *Monomorium* 12 years earlier. *Monomorium gilberti* completely lacks the large subpetiolar process found in *Vollenhovia*.

This ant is very distinctive, and Australian specimens vary only in the width of the head capsule and the thickness of the node. For this reason *M. turneri* and *M. gilberti mediorubrum* are synonymised under *M. gilberti*. At the time of this research, I had available for study only two extralimital specimens, a worker from New Guinea and a queen from Rose Island, Papua. The New Guinean worker differs from Australian workers only in its uniformly dark chocolate colouration, more rounded propodeum and obliquely inclined postpetiolar node. The queen exhibits the same colouration as a *M. gilberti* queen from northeast Queensland. Later, I received on loan a type of *Monomorium edentatum* Emery. This worker was collected 4.iii.1890 by L. Loria on 'Woodlark' (=Woodlark Island). The ant is of the same colouration and general habitus as the New Guinean worker. However, since there was no other material available for detailed comparison at the time of this research, the taxonomic relationship between *M. edentatum* and *M. gilberti* has been left open for the present.

Biological data is lacking for the few specimens available for study. However, one worker from the MacDowall Range, north of Daintree, was recovered from a pyrethrum knockdown, and three specimens from Tolga were collected from a log.

Monomorium leae Forel

(Figs 46, 94, 95, 101, 102, 148, 162, 172, 195–197)

Monomorium leae Forel, 1913: 185–187.

Monomorium (Notomyrmex) hemiphaeum Clark, 1934: 61, pl. IV, Figs 19–20 (= *leae*)

[synonymy Ettershank, 1966: 97].

Monomorium flavipes Clark, 1938: 369–370, fig. 8. **Syn. nov.**

Monomorium insularis Clark, 1938: 368–369, fig. 7. **Syn. nov.**

Chelaner leae (Forel) [comb. nov. Ettershank, 1966: 97].

Chelaner flavipes (Clark) [comb. nov. Ettershank, 1966: 96].

Chelaner insularis (Clark) [comb. nov. Ettershank, 1966: 97].

Monomorium leae Forel [comb. Bolton, 1987: 300, 301].

Monomorium flavipes Clark [comb. Bolton, 1987: 300, 301].

Monomorium insularis Clark [comb. Bolton, 1987: 300, 301].

Material examined

M. flavipes

Syntypes. ♀, South Australia, Reevesby Island, xii.1936, J. Clark (MV – Syntype T–11444); worker with same data as syntype ♀ (MV – Syntype T–11445).

M. hemiphaeum

Syntypes. Worker, Victoria, Beech Forest, 11–19.i.1932, J. Clark (MV – Syntype T–11448); intercaste with same data as syntype worker (MV – Syntype T–11449).

M. insularis

Syntypes. ♀, South Australia, Reevesby Island, xii.1936, J. Clark (MV – Syntype T–11446); worker with same data as syntype ♀ (MV – Syntype T–11447).

M. leae

Syntype. Worker, Tasmania, 'Hobarth' (sic), Lea (ANIC – 'Syntype ex Geneva Mus. Not to be designated lectotype')

Other material examined. 13 workers (ANAC); 434 workers, 27♀, 14♂, 2 ergatoids (ANIC); 21 workers (JDM); 4 workers, 2♀, 3♂, 1 ergatoid (MV); 1 worker (QM); 37 workers, 8♂, 1 ergatoid (SAM); 1 worker (WAM) (see Fig. 46 for distribution).

Worker description

Head. Head square or rectangular to rounded; vertex slightly concave, or planar; frons smooth and shining with combination of incurved decumbent and subdecumbent setulae and erect and suberect setae. Compound eyes circular or subcircular, or elliptical; (viewed from front) compound eyes set in posterior half of head capsule, or set in anterior half of head capsule; (viewed laterally) compound eyes set at midline of head capsule; eye moderate, eye width 0.5–1.5× greatest width of antennal scape. Antennal segments 12; club three-segmented. Anteromedial clypeal margin straight or slightly emarginate, median clypeal carinae not produced as teeth or denticles. Longest lateral anterior clypeal setae long, extending beyond dorsal margin of closed mandibles. Posteromedial clypeal margin level with posterior surface of antennal fossae to extending slightly posteriad of posterior surface of antennal fossae. Anterior tentorial pits situated nearer antennal fossae than mandibular insertions. Frontal lobes parallel straight. Venter of head capsule without elongate, basket-shaped setae. Palp formula 2,3. Maximum number of mandibular teeth and denticles: five; mandibles (viewed from front) triangular and smooth, with piliferous punctures; basal tooth not enlarged; basal angle indistinct; apical and basal mandibular margins meeting in tooth or denticle.

Alitrunk. Promesonotal sculpture present in form of microreticulation and striolae on and around katapisternum, otherwise promesonotum smooth and shining; dorsal promesonotal face evenly convex to convex anteriad, otherwise flattened; erect and suberect promesonotal setae greater than 10; setulae decumbent and subdecumbent. Mesonotal suture absent. Metanotal groove present as feebly impressed furrow between promesonotum and propodeum to present as distinct and deeply impressed trough between

promesonotum and propodeum. Propodeal sculpture present as faint microreticulation with few striae, mainly on lower lateral surface, or present as uniform rugosity, with well defined costulae on declivitous face of propodeum; dorsal propodeal face sloping posteriad, with wedge-shaped flattening or shallow depression that is widest between propodeal angles; processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle) to absent (propodeum angulate in profile), or present on posterior propodeal angles as small denticles or sharp flanges; lobes present as blunt flanges. Propodeal angle absent, or present; declivitous face of propodeum flat, or longitudinally concave between its lateral margins. Erect and suberect propodeal setae 5–10; propodeal setulae absent, or decumbent and subdecumbent. Propodeal spiracle lateral and about midway between metanotal groove and declivitous face of propodeum; vestibule conspicuous through cuticle.

Petiole and postpetiole. Petiolar spiracle lateral and slightly anteriad of petiolar node. Petiolar node cuboidal, or conical, dorsally rounded, or cuneate, dorsally rounded, or tumular and inclined anteriad; sculpture absent, petiolar node smooth and shining, or present in form of microreticulation. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 1:1 to near 3:4. Anteroventral process present as pronounced spur, or slender carina that tapers posteriad. Ventral lobe present in some individuals. Height ratio of petiole to postpetiole near 3:4; height–length ratio of postpetiole near 2:1 to near 1:1. Sculpture absent on dorsum, at least: postpetiole smooth and shining, or present in form of microreticulation. Ventral process present and distinct.

Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour variable, with several distinctive colour morphs connected in a continuum by intermediate forms. Distinctive morphs include: (1) *M. 'flavipes'* (southern mainland states): tawny yellow to bright orange with lighter coloured legs; (2) *M. 'hemiphaeum'* (eastern Australia) shining amber, and with progressively more extensive infuscation, found along a cline reaching northern Qld; (3) *M. 'leae'* (Tasmania): castaneus with fulvous legs. A striking colour morph also occurs in rainforest in the Lamington Plateau, mountains in southeast Qld, Mt Bellenden Ker in northeast Qld, and possibly elsewhere. In this morph the alitrunk, petiole and postpetiole are deep russet to piceous, the head and appendages are deep yellow to orange, and the gaster is orange, occasionally with brown bands near the tergal margins. This colour pattern is also found in *M. tambourinense* and several species in the *M. rubriceps*-group. Worker caste monomorphic but variable in size, with series of intercastes between largest and smallest workers (monophasic allometry).

Worker measurements. HML 1.18–2.57; HL 0.46–0.91; HW 0.34–0.81; CeI 75–91; SL 0.31–0.69; SI 73–94; PW 0.24–0.58 (103 measured).

Queen description

Head. Head square or rectangular; vertex slightly concave, or planar; frons smooth and shining with combination of appressed setulae and erect and suberect setae, or smooth and shining with combination of incurved decumbent and subdecumbent setulae and erect and suberect setae, or microreticulate and striolate with combination of incurved decumbent and subdecumbent setulae and erect and suberect setae. Compound eyes circular or subcircular to elliptical; (viewed from front) compound eyes set in anterior half of head capsule; (viewed laterally) compound eyes set posterior of the midline of head capsule; eye large, eye width greater than 1.5× greatest width of antennal scape.

Alitrunk. Mesoscutum in profile evenly convex, or convex anteriad; thereafter flattened, or evenly flattened. Mesoscutal pilosity consisting of dense incurved setulae and setae, or consisting of decumbent and subdecumbent setulae anteriad and erect and suberect setae posteriad; dorsal appearance of mesoscutum smooth and shining; length–width ratio of mesoscutum and scutellum combined near 2:1, or near 4:3. Axillae contiguous or nearly so, or separated by distance less than half greatest width of scutellum. Propodeal sculpture present as faint microreticulation with few striae, mainly on lower lateral surface, or present as uniform rugosity, with well defined costulae on declivitous face of propodeum; dorsal propodeal face flattened. Propodeal processes absent (propodeum angulate in profile), or present on posterior propodeal angles as small denticles or sharp flanges; lobes present as blunt flanges. Propodeal angle present. Erect and suberect propodeal setae greater than 10; propodeal setulae decumbent and subdecumbent. Propodeal spiracle lateral and nearer declivitous face of propodeum than metanotal groove, or lateral and about midway between metanotal groove and declivitous face of propodeum.

Wing. Wing veins tubular and strongly sclerotised; vein m-cu present as an entire vein enclosing first discoidal cell; vein cu-a present.

Petiole and postpetiole. Petiolar spiracle lateral and slightly anteriad of petiolar node, or lateral and positioned in pedicel well anteriad of petiolar node. Petiolar node cuboidal, or conical, dorsally rounded, or cuneate, dorsally rounded, or cuneate, sharply tapered; sculpture absent, petiolar node smooth and shining, or present in form of microreticulation. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 2:1 to near 4:3. Anteroventral process present as pronounced spur, or slender carina that tapers posteriad. Height ratio of petiole to postpetiole near 1:1 to near 4:3; height–length ratio

of postpetiole near 2:1 to near 1:1. Sculpture absent on dorsum, at least: postpetiole smooth and shining, or present in form of microreticulation; ventral process present and distinct.

Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour variable; often uniformly orange or tawny yellow or bicoloured orange and brown/piceous. Brachypterous alates not seen. Ergatoid or worker-female intercastes seen and examined.

Queen measurements. HML 2.15–3.08; HL 0.67–0.93; HW 0.54–0.83; CeI 81–94; SL 0.39–0.67; SI 71–90; PW 0.41–0.83 (20 measured).

Male description

Head. Head width–mesoscutal width ratio near 1:1. Compound eyes protuberant and elliptical; (viewed laterally) compound eyes set at midline of head capsule; ocelli not turreted. Ratio of length of first funicular segment of antenna to length of second segment near 1:2 to near 1:3. Maximum number of mandibular teeth and denticles: three.

Alitrunk. Mesoscutum in profile convex anteriad, thereafter flattened; dorsal appearance of mesoscutum smooth and shining, or finely microreticulate; mesoscutal pilosity consisting of long, dense setae. Parapsidal furrows vestigial, or present and distinct; notauli present. Axillae separated by distance more than half greatest width of scutellum.

Wing. Wing veins tubular and strongly sclerotised; vein m-cu present as an entire vein enclosing first discoidal cell; vein cu-a present.

Petiole and postpetiole. Petiolar spiracle lateral and slightly anteriad of petiolar node. Sculpture absent, petiolar node smooth and shining; ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 1:1 to near 3:4. Anteroventral process always absent or vestigial; ventral lobe always absent. Height–length ratio of postpetiole near 2:1 to near 4:3; sculpture absent on dorsum, at least: postpetiole smooth and shining to present in form of microreticulation; ventral process absent or vestigial, or present and distinct.

Gaster. Pilosity of first gastral tergite consisting mainly of decumbent and subdecumbent setulae.

General characters. Chocolate.

Male measurements. HML 1.27–2.04; HL 0.49–0.78; HW 0.52–0.78; CeI 96–108; SL 0.13–0.18; SI 20–29; PW 0.41–0.88 (11 measured).

Remarks

Monomorium leae is arguably the most taxonomically difficult of the Australian *Monomorium* species, and shares with *M. sydneyense* the distinction of having the greatest morphological plasticity. Sculpture and colour vary greatly

among populations, and the ant's habitat ranges from tropical rainforest to dry *Eucalyptus* and *Callitris* woodland. Moreover, workers from the same nest differ in size and morphology. This is particularly so for specimens referable to *M. 'insularis'* or *M. 'flavipes'*. Larger workers often have an angulate propodeum and a rugose alitrunk, whereas smaller workers frequently possess a rounded propodeum and a smoother appearance.

Despite its morphological variability, however, the habitus of *M. leae* clusters around two basic forms: '*flavipes–insularis*' (found throughout temperate Australia) and '*hemiphaeum*' (predominantly found on the east coast of Australia). The two can be distinguished primarily by the depth of the metanotal groove: in '*flavipes–insularis*' this groove is no more than a furrow and is often almost completely obsolete (especially in large workers), whereas in '*hemiphaeum*' the metanotal groove is moderately to deeply impressed in all members of a nest series (see Andersen 1991c: 32–34). Other characteristics that usually separate '*flavipes–insularis*' from *M. hemiphaeum sensu stricto* include the following:

- (1) head shape (typically rectangular in '*flavipes–insularis*' and rounded in '*hemiphaeum*');;
- (2) the median clypeal sector between the antennal insertions (narrow and impressed in '*flavipes–insularis*' and wider and more protuberant in '*hemiphaeum*');;
- (3) the anteromedial clypeal margin (straight or slightly emarginate in '*flavipes–insularis*' and rounded and projecting in '*hemiphaeum*');;
- (4) the appearance of the petiolar node (cuneate or subcuboidal in '*flavipes–insularis*' and tumular in '*hemiphaeum*');;
- (5) the appearance of the promesonotum seen in profile (flattened in '*flavipes–insularis*' and smoothly convex in '*leae*');;
- (6) the appearance of the cuticle (mat and dull in '*flavipes–insularis*' and smooth and shining in '*hemiphaeum*').

Finally, worker-queen intercastes are commonly present in nest series of '*hemiphaeum*', but intercastes of '*flavipes–insularis*' appear to be rare. One intercaste from the Thomas River (Western Australia) belongs to the latter group.

Despite these differences, however, there are many important similarities: such include the shape of the eyes and their position on the head, the notched frontal carinae under the frontal lobes, the long suberect setae on the antennal scapes, the number and appearance of the stout promesonotal setae, the five to eight transverse stria always present on the metapleuron (vestigial in some South Australian and Victorian populations), and the microstructure of the petiole and postpetiole. Furthermore, specimens referable to the type '*leae*' show characteristics intermediate between '*flavipes–insularis*' and

'*hemiphaeum*'. The '*leae*' morph resembles '*flavipes-insularis*' in the following respects: the propodeum often has a longer dorsal than declivitous surface, the propodeal angle is distinct, the shape and appearance of the head capsule are similar, the petiolar node is cuneate and sharply tapered, and allometric variation between workers within a nest is pronounced. However, '*leae*' shares with '*hemiphaeum*' the impressed metanotal groove, and smooth, glossy cuticle. In '*leae*', moreover, the anteroventral petiolar process is rather large, compared with the smaller anteroventral petiolar process in '*flavipes-insularis*'. The type of '*leae*' comes from Tasmania, but '*leae*'-like morphs are frequently encountered in New South Wales. This form has also been collected in Western Australia (Talyuberlup picnic ground and Dryandra State Forest).

'*Hemiphaeum*'-like forms can also be found in Western Australia, particularly the deep southwest. Specimens from the Porongurup and the Stirling Ranges have the impressed metanotal groove and the rounded propodeum of typical *hemiphaeum*, and even the same slightly brownish tinge on the frons. They are, however, rather smaller than the type, and the eyes are also smaller.

There are at least five other distinctive forms, including a beautiful bicoloured ant found in northern New South Wales and southern Queensland. Morphologically, this ant has the appearance of '*leae*', but some larger specimens have a thickened petiolar node and a flattened promesonotum with a slightly projecting humeral rim or carina. Another variety, mainly found in the Australian Capital Territory, has a rugose propodeum and a subcuboidal node with dense transverse rugulae or microreticulation. Finally, the form most commonly encountered in the Eyre and Yorke Peninsulas is shining, smooth and dull brownish-orange in colour, with a rounded propodeum and without a trace of a metanotal groove. The petiolar node is very thin, and the eyes are rather small with fewer ommatidia (<20) than possessed by most *M. leae*. In all cases, however, the ants share the characteristics of *M. leae* as defined in the key, and they are connected with other morphological variations by intermediates.

After hundreds of hours spent examining representatives of the various populations of *M. leae*, taken from all over Australia, I have found no discrete and unvarying morphological features that will separate them at a species level. This is despite the superficial appearance of separate species. Other taxonomic methods (such as allozyme analysis) may pick up consistent differences that would enable such sibling species to be identified. On the other hand, the queens of *M. leae* are much less variable between populations, and the males do not appear to differ much at all. Conversely, although the workers of *M. centrale* superficially closely resemble the '*flavipes-insularis*' morph, the males are very different. Similarly with *M. euryodon*, in which the reproductives lack the vein m-cu (always present in *M. leae*).

I see no justification in retaining the distinction between *M. flavipes* and *M. insularis*. Clark collected both type series on the same day and on the same tiny South Australian island. The queen and worker types seen are no more than small ('*insularis*') and large ('*flavipes*') specimens from the same population. Astonishingly, Clark made no comparison between the two in his descriptions. In Western Australia workers with an equally broad size range are commonly collected within individual nests of '*flavipes-insularis*'.

Ettershank's decision to amalgamate '*hemiphaeum*' and '*leae*' is a much more serious one (Ettershank 1966). However, there is reason to believe from an analysis of the material that his synonymy is justified. Since the '*leae*' and '*flavipes-insularis*' groups are even more closely connected morphologically, the names '*flavipes*' and '*insularis*' are also combined under the senior synonym of *M. leae*.

Among extralimital material, the New Caledonian species *Monomorium forcipatum* (Emery) and *Monomorium melleum* (Emery) clearly belong to the *M. leae* complex and are close to *M. leae*. They are both yellow or orange ants, and cannot easily be separated from *M. leae*. The measurements for two syntype workers of *M. forcipatum* are: HML 2.26–2.49; HL 0.76–0.80; HW 0.64–0.74; CeI 0.57–0.60; SL 0.57–0.60; SI 81–89; PW 0.39–0.48. This variation is well within that measured for *M. leae*, and these ants are virtually indistinguishable from some Australian populations of *M. leae*. The only difference found by myself is the strongly emarginate anteromedial clypeal border and the median clypeal carinae ending in small teeth. In this respect, the specimens resemble *M. centrale* rather than *M. leae*. Because of its biogeography and the lack of other material for comparison, *M. forcipatum* has been retained as a separate taxon for the present. However, a closer analysis of the members of the *M. leae* group could well see *M. forcipatum* synonymised under *M. leae*. The *M. melleum* syntype workers have a dome-shaped promesonotum and a convex propodeum similar to that found in *M. kilianii*. These features, while slight, separate them from the *M. leae* examined.

Monomorium leae is a generalist species with the capacity to persist in anthropogenic environments, such as gardens in outer suburbs of major cities. Regardless of the habitat, most nests are found in cryptic situations, i.e. under rocks, in moss, in rotten logs, and around the boles of trees.

Monomorium legulus, sp. nov.

(Figs 43, 198–199)

Material examined

Holotype. Worker, Western Australia, Comet Hill, 15.ix.1988, B. E. Heterick, tree-trunk, litter/soil, native veg., rural environ., 432/6MonBH 34 (ANIC).

Paratypes. **Western Australia:** 1 worker, 26 miles NW of Randells, 27.x.1947, T. Greaves, Chelaner (ANIC); 3 workers, Salmon

Gums, 70 miles N of Esperance, 7.i.1970, B. B. Lowery, dry sclerophyll, 6 pm, on shrubs and in litter, Chelaner (MCZ); 3 workers, Salmon Gums, 7.i.1970, B. B. Lowery, Chelaner (BMNH).

Other material examined. **Western Australia:** 8 workers, Kukerin (WAM); 6 workers, Lake Grace (WAM); 1 worker, Tammin (MV).

Worker description

As for the worker of *M. longiceps*, but with the following apomorphies.

Head. Frons of head capsule longitudinally striate with combination of incurved decumbent and subdecumbent setulae and erect and suberect setae. (Viewed from front) compound eyes set at midpoint of each side of head capsule; eye large, eye width greater than $1.5\times$ greatest width of antennal scape. Anteromedial clypeal margin emarginate, median clypeal carinae produced apically as pair of pronounced teeth. Frontal lobes parallel straight. Venter of head capsule with elongate, basket-shaped setae in at least some individuals. Mandibles (viewed from front) triangular and smooth, with piliferous punctures.

Alitrunk. Mesonotal suture absent. Metanotal groove present as feebly impressed furrow between promesonotum and propodeum. Propodeal processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle. Propodeal angle absent.

Petiole and postpetiole. Petiolar spiracle lateral and in anterior sector of petiolar node. Petiolar node cuboidal. Height ratio of petiole to postpetiole near 1:1. Sculpture present in form of microreticulation.

General characters. Colour of head and anterior promesonotum red, or reddish-orange, posterior promesonotum, propodeum, petiole and post-petiole same, heavily infuscated with black, gaster orange, legs brown, variously infuscated, antenna red. Worker caste monomorphic.

Holotype worker measurements. HML 3.28; HL 1.07; HW 0.99; Cel 92; SL 0.87; SI 88; PW 0.74.

Worker measurements. HML 2.86–3.95; HL 0.99–1.34; HW 0.82–1.21; Cel 86–100; SL 0.65–0.96; SI 79–93; PW 0.56–0.89 (20 measured).

Etymology

Latin: 'collector' [i. e., of small seeds].

Remarks

This species is superficially similar to *M. bihamatum*, with which it occurs sympatrically, but differs consistently in colour and sculpture. *Monomorium legulus* is known only from southern Western Australia, but may occur elsewhere. I have found this species at Comet Hill trailing on the ground and up and down tree trunks. Several workers were carrying small seeds, which have been identified as *Eucalyptus* subgenus *Symphyomyrtus* (Prof. W. T. Clifford, personal communication). Two of these seeds are pinned with the holotype.

Monomorium longiceps Wheeler

(Figs 49, 84)

Monomorium (*Notomyrmex*) *longiceps* Wheeler, 1934: 146–147.

Chelaner longiceps (Wheeler) [comb. nov. Ettershank, 1966: 97].

Monomorium longiceps Wheeler [comb. Bolton, 1987: 300, 301].

Material examined

Lectotype. One worker, Western Australia, Ludlow, J. Clark (MCZ-'Cotype' 23233), here designated. [A syntype worker has been chosen to become a lectotype, so as to fix the species name for the typical form of *M. longiceps*, i.e. an ant with dark appendages and tumular rather than cuboidal petiolar node. The other syntype specimen on the pin becomes a paralectotype.]

Paralectotype. One worker, same data as lectotype (MCZ), here designated.

Other material examined. 17 workers (ANIC); 8 workers (JDM); 3 workers (SAM); 2 workers, 2 ♀ (WAM) (see Fig. 49 for distribution).

Worker description

Head. Head square or rectangular; vertex planar; frons microreticulate and striolate with combination of incurved decumbent and subdecumbent setulae and erect and suberect setae. Compound eyes circular or subcircular; (viewed from front) compound eyes set in anterior half of head capsule; (viewed laterally) compound eyes set at midline of head capsule; eye moderate, eye width $0.5\text{--}1.5\times$ greatest width of antennal scape to large, eye width greater than $1.5\times$ greatest width of antennal scape. Antennal segments 12; club three-segmented. Anteromedial clypeal margin emarginate, median clypeal carinae produced apically as pair of pronounced teeth, or emarginate, median clypeal carinae produced apically as pair of pronounced teeth, with an additional tooth or denticle on either side, or straight or slightly emarginate, median clypeal carinae not produced as teeth or denticles. Longest lateral anterior clypeal setae long, extending beyond dorsal margin of closed mandibles. Posteromedial clypeal margin level with posterior surface of antennal fossae. Anterior tentorial pits situated nearer antennal fossae than mandibular insertions. Frontal lobes parallel straight, or parallel, sinuate. Venter of head capsule without elongate, basket-shaped setae. Palp formula 2,3. Maximum number of mandibular teeth and denticles: five; mandibles (viewed from front) triangular and striate, with piliferous punctures; basal tooth not enlarged; basal angle indistinct; apical and basal mandibular margins meeting in tooth or denticle.

Alitrunk. Promesonotal sculpture present in form of microreticulation and rugosity over entire promesonotum; dorsal promesonotal face convex anteriorly, otherwise flattened; erect and suberect promesonotal setae greater than 10; setulae decumbent and subdecumbent. Mesonotal suture absent, or visible as fine line under transparent surface of cuticle. Metanotal groove absent, or present as feebly impressed furrow between promesonotum and propodeum. Propodeal sculpture present as uniform rugosity, with well defined costulae on declivitous face of propodeum; dorsal

propodeal face sloping posteriad, with wedge-shaped flattening or shallow depression that is widest between propodeal angles; processes present on posterior propodeal angles as small denticles or sharp flanges; lobes present as blunt flanges. Propodeal angle present; length ratio of dorsal face to declivitous face near 2:1 to near 4:3; declivitous face of propodeum flat. Erect and suberect propodeal setae greater than 10; propodeal setulae decumbent and subdecumbent. Propodeal spiracle lateral and about midway between metanotal groove and declivitous face of propodeum; vestibule conspicuous through cuticle.

Petiole and postpetiole. Petiolar spiracle lateral and slightly anteriad of petiolar node. Petiolar node cuboidal, or tumular and inclined posteriad; sculpture present; petiolar node rugose. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3 to near 1:1. Anteroventral process always present as pronounced spur. Ventral lobe always absent. Height ratio of petiole to postpetiole near 1:1 to near 4:3; height-length ratio of postpetiole near 4:3. Sculpture present in form of microreticulation, or present; postpetiole rugose. Ventral process present and distinct.

Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour of head and anterior promesonotum reddish orange to fulvous, variously infuscated with brown in some individuals, posterior promesonotum, propodeum, petiole and postpetiole concolorous with these parts, or darkly infuscated, gaster orange to red, legs and antennae orange through to dark brown. Worker caste monomorphic.

Worker measurements. HML 1.85–2.49; HL 0.67–0.91; HW 0.56–0.74; CeI 75–84; SL 0.48–0.63; SI 84–93; PW 0.32–0.48 (28 measured).

Queen description

Head. Head rounded; vertex slightly concave; frons longitudinally striate with combination of incurved decumbent and subdecumbent setulae and erect and suberect setae. Compound eyes circular or subcircular, or elliptical; (viewed from front) compound eyes set in posterior half of head capsule, or set in anterior half of head capsule; (viewed laterally) compound eyes set at midline of head capsule; eye large, eye width greater than 1.5× greatest width of antennal scape.

Alitrunk. Mesoscutum in profile evenly flattened. Mesoscutal pilosity consisting of dense incurved setulae and setae; dorsal appearance of mesoscutum striolate and microreticulate; length-width ratio of mesoscutum and scutellum combined near 4:3. Axillae separated by distance less than half greatest width of scutellum. Propodeal sculpture present as uniform rugosity, with well defined costulae on declivitous face of propodeum; dorsal propodeal face flattened. Propodeal processes present on posterior

propodeal angles as small denticles or sharp flanges; lobes present as blunt flanges. Propodeal angle present. Erect and suberect propodeal setae greater than 10; propodeal setulae decumbent and subdecumbent. Propodeal spiracle lateral and about midway between metanotal groove and declivitous face of propodeum.

Petiole and postpetiole. Petiolar spiracle lateral and slightly anteriad of petiolar node. Petiolar node cuneate, dorsally rounded; sculpture present in form of microreticulation. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 2:1 to near 4:3. Anteroventral process always present as pronounced spur. Height ratio of petiole to postpetiole near 1:1; height-length ratio of postpetiole near 2:1. Sculpture present in form of microreticulation; ventral process present and distinct.

Wing. Dealate

Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour tawny orange; propodeum infuscated with brown; appendages brown. Brachypterous alates not seen. Ergatoid or worker-female intercastes not seen.

Queen measurements. HML 2.97–3.26; HL 0.93–0.98; HW 0.78–0.88; CeI 83–89; SL 0.67; SI 87; PW 0.72 (2 measured).

Remarks

The above species is one of several red or reddish-orange *Monomorium* that are mostly found in dry sclerophyll woodlands, particularly those dominated by mallee or *Acacia* spp. This ant has been taken by vegetation sweeps, hand collection in litter, and in pitfall traps.

Monomorium longiceps is rather variable in appearance. Infuscation of the propodeum, petiole and postpetiole may be present or absent. The morphology may also vary: some workers are more robust than the typical form, with a strongly rugose alitrunk and pronounced clypeal teeth.

Monomorium macarthuri, sp. nov.

(Figs 48, 82, 83)

Material examined

Holotype. 1 worker, South Australia, Maggea, 25.ix.1974, P. J. M. Greenslade (ANIC).

Paratypes. **South Australia:** 1 worker with same data as the holotype (ANIC); 1 worker, Poochera 32°45'S, 134°50'E, SAM *Nothomyrmecia* search (MCZ).

Worker description

As for the worker of *M. longiceps*, but with the following apomorphies.

Head. Frons of head capsule smooth and shining with scattered foveae and striolae, pilosity combination of incurved decumbent and subdecumbent setulae and erect and suberect setae. Compound eyes elliptical; (viewed laterally) compound eyes set posterior of midline of head capsule. Anteromedial clypeal margin straight or slightly emarginate, median clypeal carinae not produced as teeth or denticles. Frontal lobes parallel, sinuate. Mandibles (viewed from front) triangular and smooth, with piliferous punctures.

Alitrunk. Promesonotal sculpture present in form of scattered foveae and striolae, mainly on the mesopleuron, and mesopleural striae. Mesonotal suture absent. Metanotal groove present as feebly impressed furrow between promesonotum and propodeum. Dorsal propodeal face strongly convex; processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle). Propodeal angle absent. Erect and suberect propodeal setae 5–10.

Petiole and postpetiole. Petiolar node cuboidal. Height ratio of petiole to postpetiole near 3:4 to near 1:1. Sculpture present in form of microreticulation. Ventral process vestigial.

General characters. Colour alitrunk, petiole and postpetiole reddish-orange, head, gaster and appendages gamboge yellow. Worker caste monomorphic.

Holotype worker measurements. HML 2.05; HL 0.74; HW 0.60; CeI 81; SL 0.54; SI 90; PW 0.47.

Worker measurements. HML 1.95–2.02; HL 0.64; HW 0.52; CeI 80; SL 0.46–0.47; SI 89–91; PW 0.41–0.43 (2 measured).

Etymology

Named in honour of Mr. A. J. McArthur, of the South Australian Museum.

Remarks

Monomorium macarthuri is an attractive species characterised by an unusually large, round postpetiole. This condition is normally associated with the genus *Cardiocondyla*, and is not found in any other Australian *Monomorium*. The ant is known only from three workers from two widely separated collections. The Poochera specimen was taken in a pitfall trap [A. McArthur, personal communication].

Monomorium nightcapense, sp. nov.

(Fig. 42)

Material examined

Holotype. Worker (top point), New South Wales, Blue Knob, Mt Nightcap Ra., 5.ix.1966, B. B. Lowery, rainforest, 3000 ft., ANIC ants vial 1.147 (ANIC).

Paratypes. **New South Wales:** 2 + 3 workers with same data as the holotype (ANIC, BMNH); 5 workers and 1 ergatoid, same collection

details as holotype, additional data: 'in centre of large moss-covered branch, A211' [ants on this pin wrongly identified as *M. kilianii*] (MCZ).

Worker description

As for the worker of *M. rubriceps*, but with the following apomorphies.

Head. Head square or rectangular; vertex planar; frons smooth and shining with combination of incurved decumbent and subdecumbent setulae and erect and suberect setae. Compound eyes circular or subcircular, or elliptical; eye large, eye width greater than 1.5× greatest width of antennal scape. Anteromedial clypeal margin straight or slightly emarginate, median clypeal carinae not produced as teeth or denticles. Mandibles (viewed from front) triangular and smooth, with piliferous punctures.

Alitrunk. Promesonotal sculpture absent, promesonotum smooth and shining; setulae decumbent and subdecumbent. Metanotal groove present as feebly impressed furrow between promesonotum and propodeum. Propodeal sculpture absent; propodeum smooth and shining; dorsal propodeal face flattened; processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle). Declivitous face of propodeum flat. Erect and suberect propodeal setae >5.

Petiole and postpetiole. Petiolar node tumular and inclined posteriad. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 1:1. Anteroventral process always absent or vestigial. Height-length ratio of postpetiole near 4:3 to near 1:1. Ventral process vestigial.

General characters. Colour of most of head capsule brown, mandibles and surrounding part of head, alitrunk, petiole, postpetiole, and appendages amber, anterior sector of first gastral tergite yellow, remainder of gaster dark brown. Worker caste monomorphic.

Holotype worker measurements. HML 3.10; HL 1.08; HW 0.98; CeI 90; SL 0.92; SI 94; PW 0.64.

Other worker measurements. HML 2.92–3.23; HL 0.98–1.08; HW 0.88–0.98; CeI 88–91; SL 0.81–0.91; SI 93–96; PW 0.55–0.61 (7 measured).

Etymology

Named after the Nightcap Ranges.

Remarks

The appearance of *M. nightcapense* is very similar to that of *M. rubriceps*, but the eye is large and the alitrunk is smooth and bare of sculpture. This ant is one of several species in the *M. rubriceps* species-complex that are known from one or a few collections only. This ant, like others in the species-complex, nests in wood.

***Monomorium nigriceps*, sp. nov.**

(Fig. 44)

Material examined

Holotype. Worker (top point), Queensland, Windsor Tableland, 8.i.1989, E. Schmid & ANZSES, 1186 m, site 9 pyrethrum (ANIC).

Paratypes. **Queensland:** 1+2 workers, with same data as the holotype (ANIC, MCZ); 1 worker, Thornton Peak, 11 miles NE Daintree, 1.xii.1983, Monteith, Yeates & Thompson, QM berlesate no. 605, rainforest 1100 m, moss on rocks and trees (BMNH).

Worker description

As for the worker of *M. leae*, but with the following apomorphies.

Head. Head square or rectangular. Compound eyes elliptical; (viewed from front) compound eyes set in anterior half of head capsule. Anteromedial clypeal margin emarginate, median clypeal carinae produced as pair of bluntly rounded denticles. Posteromedial clypeal margin level with posterior surface of antennal fossae. Palp formula unknown. Apical and basal mandibular margins meeting in curve.

Alitrunk. Dorsal promesonotal face evenly convex. Metanotal groove present as distinct and deeply impressed trough between promesonotum and propodeum. Propodeal sculpture present as faint microreticulation with few striae, mainly on lower lateral surface; processes absent (propodeum angulate in profile). Propodeal angle present; length ratio of dorsal face to declivitous face near 2:1; declivitous face of propodeum longitudinally concave between its lateral margins. Propodeal setulae decumbent and subdecumbent.

Petiole and postpetiole. Petiolar node cuneate, dorsally rounded; sculpture absent, petiolar node smooth and shining. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3 to near 1:1. Ventral lobe always absent. Height ratio of petiole to postpetiole near 4:3; height-length ratio of postpetiole near 2:1 to near 4:3.

General characters. Colour of alitrunk, petiole, postpetiole and appendages orange, head and gaster dark chocolate. Worker caste monomorphic.

Holotype worker measurements. HML 1.77; HL 0.62; HW 0.53; CeI 85; SL 0.41; CeI 78; PW 0.36.

Worker measurements. HML 1.69–1.78; HL 0.60–0.64; HW 0.52–0.54; CeI 84–87; SL 0.41–0.54; SI 78–83; PW 0.34–0.37 (4 measured).

Etymology

Latin: 'black-headed'.

Remarks

This rainforest member of the *rubriceps*-group appears to have a restricted distribution in Northeast Queensland. As

the name suggests, the black head of this species is diagnostic, and clearly separates it from the otherwise similar *M. leae* and *M. centrale*. The strongly indented anteromedial clypeal margin found in *M. nigriceps* is reminiscent of *M. forcipatum* (New Caledonia). Since the time of the study, an additional specimen has been identified among material collected by Prof. R. Kitching through canopy fogging in Eungella National Park.

***Monomorium parantarcticum*, sp. nov.**

(Figs 47, 96, 103)

Material examined

Holotype. Worker, Point Lookout 30°29'S, 152°25'E, New England, New South Wales, 12–22.ii.1984, I. D. Naumann. Vial No. 38/13 (ANIC).

Paratypes. **New South Wales:** 4 workers with the same data as the holotype (MCZ).

Worker description

As for the worker of *M. rubriceps*, but with the following apomorphies.

Head. Head square or rectangular; vertex planar; frons smooth and shining with combination of incurved decumbent and subdecumbent setulae and erect and suberect setae. (Viewed laterally) compound eyes set anterior of midline of head capsule. Anteromedial clypeal margin emarginate, median clypeal carinae produced apically as pair of pronounced teeth. Mandibles (viewed from front) triangular and smooth, with piliferous punctures.

Alitrunk. Promesonotal setulae decumbent and subdecumbent. Metanotal groove present as distinct and deeply impressed trough between promesonotum and propodeum. Propodeal sculpture present on lower lateral surfaces only, dorsal surface smooth and shining; strongly defined costulae present on declivitous face of propodeum. Dorsal propodeal face sloping posteriad, with wedge-shaped flattening or shallow depression that is widest between propodeal angles; propodeal processes absent (propodeum smoothly rounded in profile). Propodeal angle absent; declivitous face of propodeum longitudinally concave between its lateral margins. Erect and suberect propodeal setae 5–10.

Petiole and postpetiole. Petiolar spiracle lateral and in anterior sector of petiolar node, or lateral and slightly anteriad of petiolar node. Petiolar node cuboidal. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 1:1 to near 3:4. Anteroventral process always present as pronounced spur. Height ratio of petiole to postpetiole near 1:1 to near 4:3; height-length ratio of postpetiole near 2:1.

General characters. Colour brick red, legs tan; gaster with vague, transverse brown band at junction of first and second gastral tergites. Worker caste monomorphic.

Holotype worker measurements. HML 2.97; HL 1.05; HW 0.87; CeI 84; SL; 0.75; SI 86; PW 0.61.

Paratype worker measurements. HML 2.66–3.03; HL 0.95–1.05; HW 0.80–0.90; CeI 84–87; SL 0.67–0.74; SI 82–83; PW 0.55–0.60.

Etymology

Greek: 'close to antarcticum' (NZ species).

Remarks

Monomorium parantarcticum is remarkably similar to some series of New Zealand's *M. antarcticum* (White). Most notably, the elongate, parallel clypeal teeth of the Australian ant closely match those in New Zealand material. However, the colour of *M. parantarcticum* is not like any of the New Zealand series examined for this work. The latter specimens are a variable dull amber to chocolate. The strongly defined transverse costulae found on the declivitous face of the propodeum of *M. parantarcticum* are lacking in *M. antarcticum*, the average scape index is lower, and the petiolar node is rather more cuboidal than in the New Zealand species. Moreover, the shape of the postpetiolar node links *M. parantarcticum* with the *M. rubriceps* complex. *Monomorium parantarcticum* is evidently a very rare or localised ant, known from a single series at the time of this study. More recently, additional specimens have been unearthed among material collected by Professor R. Kitching from fogged canopies in the Werrikimbe and Styx River districts, New South Wales.

Monomorium ravenshoense, sp. nov.

(Figs 42, 114)

Material examined

Holotype. Worker, Queensland, near Ravenshoe, 3.vii.1960, C. N. Smithers (ANIC).

Paratypes. **Queensland:** 2 workers, with same data as the holotype (AM, MCZ).

Worker description

As for the worker of *M. rubriceps*, but with the following apomorphies.

Head. Head square or rectangular; vertex planar; frons smooth and shining with combination of appressed setulae and erect and suberect setae. Compound eyes circular or subcircular; eye large, eye width greater than 1.5× greatest width of antennal scape. Antennal club gradually tapering and barely discernible. Anteromedial clypeal margin convex, straight or slightly emarginate, median clypeal carinae indistinct. Mandibles (viewed from front) triangular and striate, with piliferous punctures.

Alitrunk. Dorsal promesonotal face evenly flattened; setulae decumbent and subdecumbent. Mesonotal suture absent. Metanotal groove present as feebly impressed furrow between promesonotum and propodeum. Dorsal propodeal face gently convex; processes present on posterior propodeal angles as small denticles or sharp flanges. Propodeal angle present; length ratio of dorsal face to declivitous face near 2:1 to near 4:3; declivitous face of propodeum flat. Erect and suberect propodeal setae >5. Propodeal spiracle lateral and nearer declivitous face of propodeum than metanotal groove.

Petiole and postpetiole. Petiolar node cuneate, dorsally rounded; sculpture absent, petiolar node smooth and shining. Anteroventral process absent or vestigial in specimens seen. Height ratio of petiole to postpetiole near 1:1 to near 4:3; height-length ratio of postpetiole near 2:1. Ventral process absent or vestigial.

General characters. Colour russet with darker areas of infuscation, gaster dark brown, tending to black apically. Worker caste monomorphic.

Holotype worker measurements. HML 3.28; HL 1.13; HW 0.99; CeI 88; SL 0.90; SI 91; PW 0.63.

Other worker measurements. HML 3.47; HL 1.20; HW 1.09; CeI 91; SL 0.92; SI 84; PW 0.68 (1 measured).

Etymology

Named after the NE Queensland town of Ravenshoe.

Remarks

Monomorium ravenshoense is described from three workers collected near Ravenshoe. Despite the lack of material, the combination of a large eye and a strongly flattened promesonotum is distinctive among members of the *rubriceps*-group and clearly diagnostic for the species. Nothing more is known about the ant.

Monomorium rubriceps Mayr

(Figs 47, 107, 113, 165, 173, 200–202)

Monomorium rubriceps Mayr, 1876: 101.

Monomorium rubriceps r. *extremigrum* Forel, 1915: 73

Monomorium rubriceps var. *rubrum* Forel, 1915: 72 (footnote).

Syn. nov.

Monomorium rubriceps var. *cinctum* Wheeler, 1917: 113–115; figs 3a–e. **Syn. nov.**

Monomorium (*Notomyrmex*) *sanguinolentum* Wheeler, 1927: 135–138; fig. 4a, b. **Syn. nov.**

Chelaner rubriceps (Mayr) [comb. nov. Ettershank, 1966: 97].

Chelaner rubriceps extremigrus (Forel) [comb. nov. Ettershank, 1966: 96].

Chelaner rubriceps rubrus (Forel) [comb. nov. Ettershank, 1966: 97].

Chelaner rubriceps cinctus (Wheeler) [comb. nov. Ettershank, 1966: 96].

Chelaner sanguinolentum (Wheeler) [comb. nov. Ettershank, 1966: 97].

Monomorium rubriceps Mayr [comb. Bolton, 1987: 300, 301].

Monomorium rubriceps extreminigrum Forel [comb. Bolton, 1987: 300, 301].

Monomorium rubriceps rubrum Forel [comb. Bolton, 1987: 300, 301].

Monomorium rubriceps cinctum Wheeler [comb. Bolton, 1987: 300, 301].

Monomorium (Notomyrmex) sanguinolentum Wheeler [comb. Bolton, 1987: 300, 301].

Material examined

M. rubriceps

Paralectotype. Worker, Queensland, Rockhampton, G. Mayr (NMW – ‘Paralectotype *Monomorium rubriceps* Mayr desig. by R. W. Taylor’).

M. rubriceps cinctum

Syntypes (probable). Intercaste and 2 workers, Victoria, Australia, A. Koebele [cited in publication] (MCZ – ‘cotype 23185’); ♀, Victoria, Australia, Wm. M. Wheeler (MCZ); worker, Victoria, Australia (MV – ‘MCZ cotype 23158’, ‘Paratype worker T-15058’ [separate labels]).

M. rubriceps extreminigrum

I have not been able to establish the whereabouts of the holotype of this taxon.

M. rubriceps rubrum

Syntypes. Three workers, New South Wales, Froggatt (ANIC).

M. sanguinolentum

Syntypes. 2♂, pupal ♀ and 9 workers, Norfolk Island, A. M. Lea (MCZ – ‘MCZ. cotype 22850’); 3 workers with same data as above (MCZ); one probable syntype worker (MCZ – ‘data labels identical with those of types (testé R. W. Taylor)’); one probable syntype worker (ANIC – ‘data labels identical with those of type (testé R. W. Taylor)’).

Other material examined. 2 workers (AMS); 191 workers, 4♀, 5♂, 12 ergatoids (ANIC); 11 workers, 3♀, 3♂ (MV); 21 workers, 2♀, 2♂, 1 ergatoid (QM); 3 workers (QVMT); 92 workers, 4♂, 2 ergatoids (SAM) (see Fig. 47 for distribution).

Worker description

Head. Head square or rectangular, or rounded; vertex slightly concave to planar; frons smooth and shining with combination of appressed setulae and erect and suberect setae, or smooth and shining with combination of incurved decumbent and subdecumbent setulae and erect and suberect setae. Compound eyes elliptical; (viewed from front) compound eyes set in anterior half of head capsule; (viewed laterally) compound eyes set at midline of head capsule; eye moderate, eye width 0.5–1.5× greatest width of antennal scape. Antennal segments 12; club three-segmented. Anteromedial clypeal margin emarginate, median clypeal carinae indistinct. Longest lateral anterior clypeal setae long, extending beyond dorsal margin of closed mandibles. Posteromedial clypeal margin level with posterior surface of antennal fossae. Anterior tentorial pits situated nearer antennal fossae than mandibular insertions. Frontal lobes parallel straight. Venter of head capsule without elongate, basket-shaped setae. Palp formula 2,3. Maximum number of mandibular teeth and denticles: five; mandibles (viewed from front) triangular and striate, with piliferous punctures, or strap-like with inner and outer edges subparallel, striate, with piliferous punctures; basal tooth not enlarged; basal

angle indistinct; apical and basal mandibular margins meeting in tooth or denticle.

Alitrunk. Promesonotal sculpture present in form of microreticulation and striolae on and around katapisternum, otherwise promesonotum smooth and shining; dorsal promesonotal face evenly convex; erect and suberect promesonotal setae greater than 10; setulae appressed, or decumbent and subdecumbent. Mesonotal suture absent. Metanotal groove present as feebly impressed furrow between promesonotum and propodeum to present as distinct and deeply impressed trough between promesonotum and propodeum. Propodeal sculpture present as faint microreticulation with few striae, mainly on lower lateral surface; dorsal propodeal face flattened to sloping posteriad, with wedge-shaped flattening or shallow depression that is widest between propodeal angles; processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle), or absent (propodeum angulate in profile), or present on posterior propodeal angles as small denticles or sharp flanges; lobes present as blunt flanges. Propodeal angle absent, or present; declivitous face of propodeum flat to longitudinally concave between its lateral margins. Erect and suberect propodeal setae >5 to 5–10; propodeal setulae decumbent and subdecumbent. Propodeal spiracle lateral and about midway between metanotal groove and declivitous face of propodeum; vestibule conspicuous through cuticle.

Petiole and postpetiole. Petiolar spiracle lateral and in anterior sector of petiolar node. Petiolar node conical, dorsally rounded, or cuneate, dorsally rounded; sculpture absent, petiolar node smooth and shining. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3. Anteroventral process distinct in some individuals as slender carina that tapers posteriad. Ventral lobe always absent. Height ratio of petiole to postpetiole near 1:1; height–length ratio of postpetiole near 2:1 to near 1:1. Sculpture absent on dorsum, at least: postpetiole smooth and shining. Ventral process present and distinct.

Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Extremely variable in colour, even within nest series: typical or distinctive morphs include the following: (1) *Monomorium 'rubriceps cinctum'*, head brown, or brown with areas of orange on frons and around mandibles, mandibles, alitrunk, petiole and postpetiole tawny orange, gaster bright yellow basally, rest of gaster with one or more transverse dark brown bands; (2) *M. 'rubriceps rubrum'*, as for (1), but with a bright orange head and alitrunk; (3) *M. 'sanguinolentum'*, as for 1, but with head darker, and gaster without a yellow basal region or lighter bands; (4) a colour morph with head tawny yellow, alitrunk, petiole, postpetiole and appendages dark brown or

chocolate; (5) morph as for (4) but with anterior promesonotum yellowish orange; (6) a series from the Australian Capital Territory, head dark chocolate, alitrunk, petiole and postpetiole gamboge, gaster as for (1), appendages dark brown: there are many other colour patterns that interconnect with these more distinctive morphs. Worker caste monomorphic but variable in size, with series of intercastes between largest and smallest workers (monophasic allometry).

Worker measurements. HML 2.72–3.81; HL 0.91–1.24; HW 0.77–1.15; CeI 86–96; SL 0.64–0.96; SI 72–88; PW 0.51–0.75 (26 measured).

Queen description

Head. Head rounded; vertex slightly concave; frons striolate with decumbent and subdecumbent setulae of variable lengths. Compound eyes circular or subcircular; (viewed from front) compound eyes set in anterior half of head capsule; (viewed laterally) compound eyes set at midline of head capsule; eye large, eye width greater than 1.5× greatest width of antennal scape.

Alitrunk. Mesoscutum in profile evenly flattened. Mesoscutal pilosity consisting of decumbent and subdecumbent setulae anteriorly and erect and suberect setae posteriorly; dorsal appearance of mesoscutum smooth and shining; length-width ratio of mesoscutum and scutellum combined near 2:1 to near 4:3. Axillae separated by distance less than half greatest width of scutellum. Propodeal sculpture present as uniform rugosity, with well defined costulae on declivitous face of propodeum; dorsal propodeal face flattened. Propodeal processes present on posterior propodeal angles as small denticles or sharp flanges; lobes present as blunt flanges. Propodeal angle present. Erect and suberect propodeal setae 5–10; propodeal setulae decumbent and subdecumbent. Propodeal spiracle lateral and nearer metanotal groove than declivitous face of propodeum, or lateral and about midway between metanotal groove and declivitous face of propodeum.

Wing. Wing veins tubular and strongly sclerotised; vein m-cu present as an entire vein enclosing first discoidal cell; vein cu-a present.

Petiole and postpetiole. Petiolar spiracle lateral and in anterior sector of petiolar node. Petiolar node cuneate, dorsally rounded, or tumular and inclined posteriorly; sculpture absent, petiolar node smooth and shining. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 2:1 to near 4:3. Anteroventral process always absent or vestigial. Height ratio of petiole to postpetiole near 1:1; height-length ratio of postpetiole near 2:1 to near 4:3. Sculpture absent on dorsum, at least: postpetiole smooth and shining; ventral process present and distinct.

Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour generally reddish-orange with two or more brown gastral bands; in other examples alitrunk, petiole and postpetiole partly or wholly infuscated with brown or black. Brachypterous alates not seen. Ergatoid or worker-female intercastes seen and examined.

Queen measurements. HML 4.29–5.38; HL 1.29–1.60; HW 1.29–1.60; CeI 96–107; SL 0.83–1.09; SI 64–73; PW 0.93–1.26 (9 measured).

Male description

Head. Head width-mesoscutal width ratio near 1:1. Compound eyes protuberant and elliptical; (viewed laterally) compound eyes set posterior of the midline of head capsule; ocelli not turreted. Ratio of length of first funicular segment of antenna to length of second funicular segment near 2.5 to near 1:2. Maximum number of mandibular teeth and denticles: four.

Alitrunk. Mesoscutum in profile evenly flattened; dorsal appearance of mesoscutum finely microreticulate; mesoscutal pilosity consisting of long, dense setae. Parapsidal furrows present and distinct; notauli present. Axillae separated by distance more than half greatest width of scutellum.

Wing. Wing veins tubular and strongly sclerotised; vein m-cu present as an appendix, or present as an entire vein enclosing first discoidal cell; vein cu-a present.

Petiole and postpetiole. Petiolar spiracle lateral and in anterior sector of petiolar node, or lateral and slightly anteriorly of petiolar node. Sculpture absent, petiolar node smooth and shining; ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 3:4. Anteroventral process always absent or vestigial; ventral lobe always absent. Height-length ratio of postpetiole near 4:3; sculpture absent on dorsum, at least: postpetiole smooth and shining; ventral process absent or vestigial.

Gaster. Pilosity of first gastral tergite consisting of combination of appressed setulae and longer, erect and suberect setae.

General characters. Colour brown to chocolate.

Male measurements. HML 2.90–3.62; HL 0.83–0.98; HW 0.85–1.06; CeI 95–108; SL 0.28–0.39; SI 30–42; PW 0.88–1.09 (11 measured).

Remarks

Monomorium rubriceps is restricted to the humid east coast and to inshore and offshore islands, including Norfolk Island. On the mainland, the species can be found from the western side of Spencer's Gulf in South Australia, to Magnetic Island in North Queensland. However, few samples have been collected north of the New South Wales–

Queensland border, and the ant appears to be absent inland from the Great Dividing Range.

Much of the morphological and colour variation in *M. rubriceps* occurs in populations from the central and northern coasts of New South Wales. South Australian and western Victorian *M. rubriceps* are relatively uniform in colour, and usually have a thinner petiolar node than ants from populations further east and north. Most of these specimens conform to the '*rubriceps cinctum*' and '*rubriceps rubrum*' type descriptions. (For further discussion on *M. 'rubriceps cinctum*', erected as a taxon based on brachyptery, see this author's remarks under *M. rothsteini*.) Within New South Wales, *M. rubriceps rubrum* has been taken at localities such as Bulga, the Allyn River Valley and Upper Booyong. A variant of '*rubriceps*', with a dark red or even piceous alitrunk and nodes, is more common further north; typical localities include Kingscliff, Brunswick Heads and the Myall Lakes. The Myall Lakes material is interesting in that intermediates between the light and dark *M. rubriceps* occur. Most Queensland material also belongs to this dark *M. rubriceps* variant.

Monomorium sanguinolentum was described from Norfolk Island, but identical material has been taken from Brown Mtn, near Bega, and at Toowoomba, west of Brisbane. Specimens similar to the *M. sanguinolentum* morph but with one or more yellow gastral bands have been collected from a variety of localities from the New South Wales border to as far south as Melbourne, Victoria. Finally, ants with uniform brown or chocolate colouration have come from several centres in the Blue Mountains, west of Sydney.

Apart from colouration, there is little variation overall, though specimens within nest series often differ in size without exhibiting polymorphic traits. Significant differences between colour forms for characters such as cephalic and scape indices, or in patterns of sculpturing, have not been found. Males from Victoria, New South Wales, the Australian Capital Territory, and Norfolk Island possess a brush of setae on the third and fourth gastral sternites (Fig. 165), and this may well prove to be a species-specific character. This feature is only lacking on a single series of three male ants from Canberra, and they exhibit other anomalies (e.g. the possession of a high petiolar node), although clearly they belong to the *M. rubriceps* species-complex. The subspecies '*rubriceps cinctum*' and '*rubriceps rubrum*' have therefore been amalgamated under '*rubriceps*'. Equally, there appear to be no significant features that would set '*sanguinolentum*' apart. The species may well be adventive to Norfolk Island, having arrived there by rafting or on air currents, or (more probably) in materials transported by settlers. Brown (1958) lists *M. rubriceps rubrum* and *M. rubriceps cinctum* among ants that have been intercepted at New Zealand ports. Brown thought they probably came on imported poles.

I was unable to obtain the holotype of *M. rubriceps extreminigrum*. Forel distinguished this taxon from *M. rubriceps* on the basis of the low, thick nodes and shorter propodeal denticles. He found the taxon difficult to separate from *M. kilianii* and *M. gilberti*. The type worker came from Cedar Creek in Queensland. In Queensland there are several localities named 'Cedar Ck', but the only population centre is the Cedar Creek near Mount Glorious, in southeast Queensland. If this is the locality mentioned, there is no question of confusion with *M. gilberti*, which is found only in northeast Queensland. Moreover, the black head and red alitrunk separate this form from any of the *M. kilianii* or *M. tambourinense* populations examined, as does the presence of propodeal denticles. Nonetheless, because of the brief description, and lack of any material that can be assigned to this taxon, I consider it safer to leave the name as it stands.

Monomorium rubriceps is a very adaptable species, and can nest either in the ground or in vegetation. B. B. Lowery found a nest in a hollow twig in Ourimbah State Forest (label data). Brown (1958) comments that nests of '*rubriceps rubrum*' have been found under the loose bark of eucalyptus, and nests of '*rubriceps cinctum*' in volcanic rocks near Lake Purrumbete (Victoria). The latter were harvesting seeds. Label data also indicate that *M. rubriceps* may occasionally be a pest: a series from Melbourne was found damaging Telecom cable junctions.

Monomorium sculpturatum Clark

(Figs 50, 93, 100)

Monomorium (Notomyrmex) sculpturatum Clark, 1934: 59–60; pl. IV, figs 17–18.

Chelaner sculpturatus (Clark) [comb. nov. Ettershank, 1966: 97].

Monomorium sculpturatum Clark [comb. Bolton, 1987: 300, 301].

Material examined

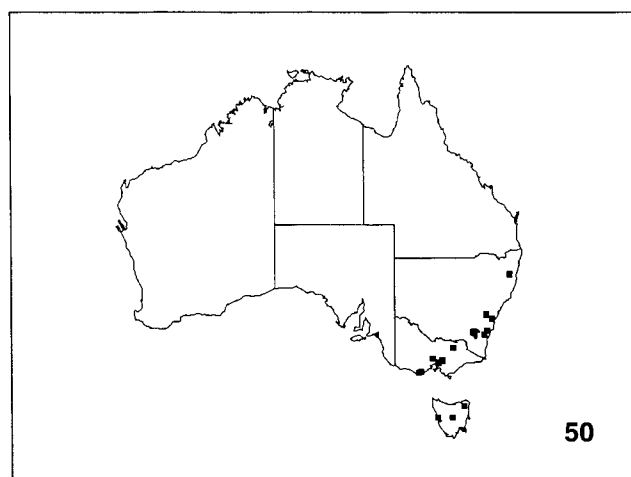
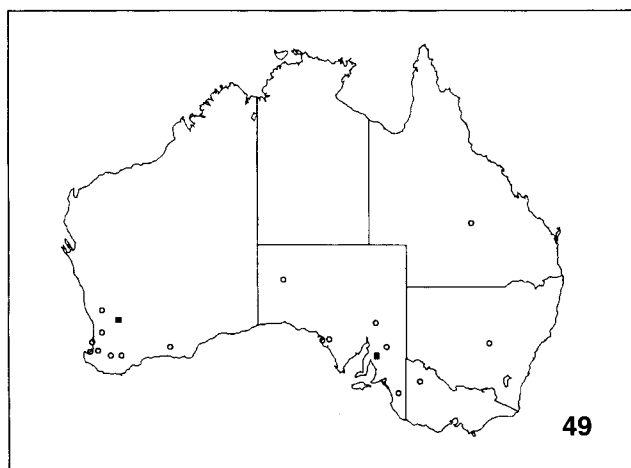
Syntype. Queen, Victoria, Beech Forest, 11–19.i.1932, J. Clark (MV – as '*Monomorium sculpturata*' [but published as '*Monomorium sculpturatum*']: syntype – T-11451). [A syntype worker also collected by Clark was missing from its pin, hence was not sent: Ms Catriona McPhee, MV, personal communication.]

Other material examined. 83 workers, 2♀, 3 ergatoids (ANIC); 1 worker (MV); 2 workers (SAM) (see Fig. 50 for distribution).

Worker description

As for the worker of *M. leae*, but with the following apomorphies.

Head. Head square or rectangular; vertex planar, or convex; frons longitudinally striate with combination of incurved decumbent and subdecumbent setulae and erect and suberect setae. Compound eyes elliptical; (viewed from front) compound eyes set in anterior half of head capsule. Anteromedial clypeal margin convex, straight or slightly emarginate, median clypeal carinae indistinct. Posteromedial



Figs 49, 50. 49, Distribution of *M. longiceps* (○) and *M. xantheklemma* (■) specimens examined during this study. 50, Distribution of *M. sculpturatum* (■) specimens examined during this study.

clypeal margin level with posterior surface of antennal fossae. Palp formula 2,2. Maximum number of mandibular teeth and denticles: six; mandibles (viewed from front) triangular and striate, with piliferous punctures.

Alitrunk. Promesonotal sculpture present in form of microreticulation and rugosity over entire promesonotum; dorsal promesonotal face evenly convex. Mesonotal suture visible externally as faint ridge. Metanotal groove present as distinct and deeply impressed trough between promesonotum and propodeum. Propodeal sculpture present as uniform rugosity, with well defined costulae on declivitous face of propodeum. Processes present on posterior propodeal angles as sharp spines. Propodeal angle present; length ratio of dorsal face to declivitous face near 4:3; declivitous face of propodeum flat. Propodeal setulae absent.

Petiole and postpetiole. Petiolar spiracle lateral and positioned in pedicel well anterior of petiolar node. Petiolar node tumular and inclined anterior; sculpture present; petiolar node rugose. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 1:1. Anteroventral process always present as pronounced spur. Ventral lobe always absent. Height ratio of petiole to postpetiole near 1:1; height-length ratio of postpetiole near 3:4 to near 1:2. Sculpture present; postpetiole rugose.

General characters. Colour of head, alitrunk, petiole, postpetiole and gaster amber to russet, legs and mandibles tawny yellow. Worker caste monomorphic.

Worker measurements. HML 1.83–2.30; HL 0.72–0.83; HW 0.61–0.76; CeI 87–96; SL 0.50–0.60; SI 72–86; PW 0.34–0.47 (31 measured).

Queen description

As for the worker of *M. leae*, but with the following apomorphies.

Head. Vertex of head capsule planar; frons longitudinally striate with combination of incurved decumbent and subdecumbent setulae and erect and suberect setae. Compound eyes elliptical.

Alitrunk. Mesoscutum in profile convex anterior; thereafter flattened. Mesoscutal pilosity consisting of decumbent and subdecumbent setulae anterior and erect and suberect setae posterior; length-width ratio of mesoscutum and scutellum combined near 4:3. Axillae separated by distance of about half greatest width of scutellum. Propodeal sculpture present as uniform rugosity, with well defined costulae on declivitous face of propodeum. Propodeal processes present on posterior propodeal angles as sharp spines. Propodeal spiracle lateral and nearer declivitous face of propodeum than metanotal groove.

Petiole and postpetiole. Petiolar spiracle lateral and positioned in pedicel well anterior of petiolar node. Petiolar node tumular and inclined anterior; sculpture present; petiolar node rugose. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 4:3 to near 1:1. Anteroventral process always present as pronounced spur. Height ratio of petiole to postpetiole near 1:1; height-length ratio of postpetiole near 2:1. Sculpture present; postpetiole rugose.

Gaster. Pilosity of first gastral tergite consisting of combination of decumbent and subdecumbent setulae and longer, erect and suberect setae.

General characters. Colour orange, appendages lighter. Brachypterous alates not seen. Ergatoid or worker-female intercastes seen and examined.

Queen measurements. HML 2.43–2.79; HL 0.83–0.88; HW 0.78–0.83; CeI 94; SL 0.57–0.67; SI 73–81; PW 0.62 (3 measured – dealate).

Remarks

Because of its long propodeal spines, *M. sculpturatum* cannot be confused with any other Australian *Monomorium*. However, characters of the clypeus, petiole and postpetiole enable the ant to be placed firmly in the *M. leae* species-complex. *Monomorium sculpturatum* is an inhabitant of the moister forests along the east coast of Australia, from the Armidale plateau in New South Wales to Tasmania, where it is a cryptic forager in moss, leaf litter and in rotten logs.

Monomorium xantheklemma, sp. nov.

(Figs 49, 66, 160)

Material examined

Holotype. Worker (top point), South Australia, Sevenhill, 12.ix.1969, B. B. Lowery, 1500 ft, nest under rock in grassy paddock, SA 197, ANIC ants vial 66.66 (ANIC).

Paratypes. **South Australia**: 2 workers, same data as holotype (ANIC); 17 workers and 1 ergatoid, Clare, 3.iii.1950, J. McAreavey, Chelaner (BMNH); 3 worker, Sevenhill, 21.ii.1957, B. B. Lowery (MCZ); 1♂ and 2 workers, Sevenhill, 12.ix.1963, B. B. Lowery, 1500 ft, R F Valley between rocks, ANIC ant vial 66–66 (MCZ); 1♂, 2 workers and 1 ergatoid, Sevenhill, 21.ii.1957, B. B. Lowery, 1400 ft, under rock on bare ridge top (ANIC).

Other material examined. **South Australia**: 1♂, 10 workers, Clare, 3.iii.1980, J. McAreavey (ANIC). **Western Australia**: 1 worker, n. of Kellerberrin, ii.1991, A. Scougall (JDM).

Worker description

As for the worker of *M. longiceps*, but with the following apomorphies.

Head. Frons of head capsule smooth and shining with scattered foveae and striolae, pilosity combination of incurved decumbent and subdecumbent setulae and erect and suberect setae. Compound eyes elliptical. Anteromedial clypeal margin emarginate, median clypeal carinae produced as pair of bluntly rounded denticles. Frontal lobes parallel straight. Mandibles (viewed from front) triangular and smooth, with piliferous punctures; basal angle indistinct; apical and basal mandibular margins meeting in curve.

Alitrunk. Promesonotal sculpture present in form of scattered foveae and striolae, mainly on the mesopleuron, and mesopleural striae. Mesonotal suture absent. Metanotal groove absent. Dorsal propodeal face gently convex; processes absent (propodeum smoothly rounded in profile or with slight hump at propodeal angle); lobes present and produced apically so as to form acute angled, sharp projections. Propodeal angle absent.

Petiole and postpetiole. Petiolar node cuboidal. Sculpture absent on dorsum, at least: postpetiole smooth and shining. Ventral process absent or vestigial, or present and distinct.

General characters. Colour of head, alitrunk, petiole and postpetiole a shiny, dark reddish orange to tawny yellow

(head lighter in colour in some individuals), gaster and appendages tawny yellow. Worker caste monomorphic.

Holotype worker measurements. HML 2.05; HL 0.74; HW 0.60; CeI 81; SL 0.54; SI 90; PW 0.47

Other worker measurements. HML 1.92–2.58; HL 0.69–0.86; HW 0.58–0.77; CeI 83–92; SL 0.48–0.64; SI 82–92; PW 0.40–0.57 (20 measured).

Male description

As for the male of *M. leae*, but with the following apomorphies.

Head. Head width–mesoscutal width ratio near 1:1 to near 3:4. Compound eyes protuberant and circular or subcircular, or protuberant and elliptical. Ratio of length of first funicular segment of antenna to length of second funicular segment near 1:2. Maximum number of mandibular teeth and denticles: five.

Alitrunk. Mesoscutum in profile evenly convex; mesoscutal pilosity consisting of numerous short setae, incurved medially. Parapsidal furrows present and distinct; notauli present.

Wing. Wing veins predominantly depigmented with distal segments reduced to vestigial lines.

Petiole and postpetiole. Ratio of greatest node breadth (viewed from front) to greatest node width (viewed in profile) near 3:4. Sculpture absent on dorsum, at least: postpetiole smooth and shining; ventral process absent or vestigial.

Gaster. Pilosity of first gastral tergite consisting entirely of well-spaced erect and suberect setae.

General characters. Colour amber to brown

Male measurements. HML 1.99–2.08; HL 0.53–0.63; HW 0.53–0.60; CeI 95–106; SL 0.14–0.17; SI 26–29; PW 0.62–0.72 (3 measured).

Etymology

Greek: 'orange + peel'.

Remarks

Monomorium xantheklemma belongs to a small complex of attractive and rare orange or red-and-orange '*Chelaner*'. This particular species is a shining orange with scattered foveae over the head and alitrunk, a condition not found in related taxa. The known distribution of *M. xantheklemma*, which is the Clare Valley in eastern South Australia, and north of Kellerberrin in the eastern wheat-belt, Western Australia, is rather peculiar.

The *fossulatum*-group Bolton

Monomorium australicum Forel

Monomorium subcoecum australicum Forel, 1907b: 20.

Monomorium talpa Emery, 1911: 252. **Syn. nov.**

Ireneidris myops Donisthorpe, 1943: 81, 82 [= *Monomorium talpa* Emery: synonymy Ettershank, 1966: 92].

Monomorium australicum Forel [raised to species by Ettershank, 1966: 87].

Material examined

Lectotype. Worker; [label 1] 'Australia. Biró 1900'; [label 2] N. S. Wales. Mt Victoria'; [label 3] 'det. Forel *australicum* (typus)'; [label 4] '*Monomorium subcoecum* var. *australicum* Forel 1907' (HNHM). Although *M. australicum* was described from worker material collected in the Blue Mountains in New South Wales, this species has almost certainly been introduced to Australia. Forel (1907b) gives the length of the worker as '1.8 mm', implying he had only the one individual before him, and my independent investigations have led me to the same conclusion. Despite this finding, Article 73, Recommendation 73F of the Code (ICZN 1999) discourages the assumption of holotype status where this is not clear-cut. The type specimen is therefore designated as a lectotype in this work.

Description

Lectotype worker measurements. HML 1.13; HL 0.39; HW 0.38; CeI 94; SL 0.34; SI 94; PW 0.21.

Remarks

Monomorium australicum belongs to the *fossulatum*-group, an aberrant group of *Monomorium* with minute eyes of one or two facets, and closely approximated antennal insertions. *Monomorium talpa*, recorded from countries immediately to the north of Australia, has been placed in the same species-group. *Monomorium talpa* is widespread in the Pacific region, having been recorded from New Guinea, Micronesia, the Solomon Islands, and Samoa (Wilson and Taylor 1967). I have examined syntype worker specimens of *M. talpa*, and two other specimens identified as *M. talpa* by R. W. Taylor, and can find no difference between them and the *M. australicum* type specimen.

I have also examined two syntype workers of *Monomorium subcoecum* Emery and three paratype workers of *Ireneidris myops* Donisthorpe. Ettershank (1966) synonymised the latter species under *M. talpa*. The workers of *M. subcoecum* lack the domed promesonotum and deeply impressed metanotal groove found in *M. australicum* and *M. talpa*, but these features are present in the paratypes of *I. myops*. I consider that *M. subcoecum* is a distinct species, though clearly belonging in the *fossulatum*-group. I also conclude that *I. myops* and *M. talpa* are junior synonyms of *M. australicum*. Accordingly, *M. talpa* is here synonymised under *M. australicum*.

No other Australian material referable to *M. australicum* has been seen, but at least one other member of the *fossulatum*-group has been collected from several locations in northeast Queensland (Yeppoon and Cannon Vale), and the Northern Territory (Holmes Jungle and Holmes Springs). In all of these specimens the promesonotum is rather flattened, being at most only gently rounded. The Cannon Vale series closely resembles *M. subcoecum* overall, and the

katepisternum is smooth. In the other series, however, the entire mesopleuron is sculptured. The latter specimens, at least, may represent a southward extension of the known range of *Monomorium fossulatum* Emery, a common species throughout the Indo-Australian and Pacific region (Bolton 1987). The appearance of these ants agrees with the description and figure provided in Wilson and Taylor (1967), though no identified specimens of *M. fossulatum* have been seen.

Species inquirenda

Monomorium occidaneus was described by Crawley (1922) from specimens collected at the Swan River, Western Australia. Although a full description and a drawing of the worker alitrunk are given, they are insufficient to characterise the species in question. Included in the description is the antenna, but the key question of the number of antennomeres is rather confused. Crawley mentions joints two to seven of the funiculus, but omits to advise the number of antennomeres in the club. Assuming this is three, the ant would be a *Monomorium* with an 11-segmented antenna.

The species described by Crawley is consistent with a pale form of *M. sydneyense*, and the stated worker length of 2 mm (allowing for its approximate nature) also agrees with *M. sydneyense*. However, the description could also be applied to a minor worker of *M. leae*. I have not been able to obtain the worker and queen syntypes of *M. occidaneus*, and the only named material—a series of *M. leae* identified as '*occidaneus*' by Clark (label data)—is doubtful, in view of known misidentifications involving other material examined by Clark. I consider the safest option is to leave the name as a *species inquirenda* until the syntypes can be examined.

Taxonomic position of *Monomorium flavigaster* (Clark)

Among the nominate species currently placed in *Monomorium* is *Monomorium flavigaster* (Clark). On the evidence provided below, this taxon, which has had a chequered taxonomic history, falls outside of the generic diagnosis for *Monomorium* provided in this work.

Monomorium flavigaster was originally described in the genus *Xiphomyrmex* by Clark (1938) from specimens collected on Reevesby Island, South Australia. Bolton (1976) synonymised *Xiphomyrmex* with *Tetramorium* in his revision of the smaller genera in the tribe Tetramoriini. In a brief note in the above work, Bolton expressed doubt as to the correct generic placement of the species *flavigaster*. On the advice of R. W. Taylor, he accepted a placement for this species in the genus *Chelaner*, which was synonymised with *Monomorium* by Bolton in 1987.

Monomorium flavigaster is clearly not related to *Tetramorium*. The species is also excluded from the Tetramoriini, the tribe to which *Tetramorium* belongs. Principally, this species lacks the lamellate appendage found on the sting of members of the Tetramoriini. Again, unlike

members of the Tetramoriini, the ant lacks a ridge or shield wall formed by the raised anterolateral portions of the clypeus, a diagnostic character for the tribe. The mandibular dentition of four teeth can also be contrasted with the dentition found in members of the Tetramoriini, which never have fewer than six teeth. Similarly, *M. flavigaster* lacks the median clypeal seta found in all members of the tribe Solenopsidini to which *Monomorium* belongs. The ant also possesses metapleural lobes produced as sharp spines, a feature not seen in any Australian *Monomorium*.

Correct generic placement of the ant is difficult. This matter has been given some thought, and it appears that this species is most closely related to the cluster of myrmecines associated with *Stenamma*. These genera share common characters such as reticulate or areolate body sculpture, propodeal spines or sharp denticles in most species, and an antennal club of two to four segments. However, the tribal boundaries of most of the Myrmicinae are ill defined and await a complete overhaul (Bolton 1994: 2).

Monomorium flavigaster does not belong to those genera among the Stenammini that possess a two-segmented club, or have spongiform tissue on the petiole. This excludes from consideration *Tetramorium*, *Daceton*, *Indomyrma*, *Mayriella* and *Adelomyrmex*. *Proatta* is a distinctive genus with easily recognisable autapomorphies. *Monomorium flavigaster* can also be excluded from *Calyptomyrmex* and *Dicroaspis*, on the basis that it lacks the median clypeal fork that the latter genera possess. The very narrow median clypeal sector of *Baracidris* and *Lachnomyrmex* is very distinctive, and not shared by *M. flavigaster*. Moreover, the absence of antennal scrobes also excludes *M. flavigaster* from *Lordomyrma*. (However, although antennal scrobes are well developed in most *Lordomyrma* they are vestigial in some Australian species examined.) Finally, *M. flavigaster* has a clearly defined three-segmented club, unlike the four-segmented club found in *Stenamma*.

Monomorium flavigaster's closest affinities appear to lie with *Rogeria* and *Lordomyrma*. The latter has some Australian representatives, and *Rogeria* includes several species found in the Pacific region, though this genus is not yet recognised among the Australian fauna. However, the shape of the mandible in *M. flavigaster* differs from that of the other two taxa, and the number of teeth is fewer than found in *Lordomyrma* and most *Rogeria*. An undescribed second species belonging to the *flavigaster*-group, but distinct from *M. flavigaster*, is confined to a narrow coastal strip between Perth and Geraldton, Western Australia. *Monomorium flavigaster* and its relative will probably eventually require placement in an endemic Australian genus. In this work *M. flavigaster* has been treated as *incertae sedis*.

Acknowledgments

I wish to thank Professor Gordon Gordh, formerly of the Entomology Department, University of Queensland, who

supervised my research. Dr David Yeates and Ms Margaret Schneider gave useful advice on areas of taxonomy, systematics and cladistics. Mr Greg Daniels patiently helped me to set up the DELTA program in the right format, and then assisted in running the program. Greg and Mr Andrew Noskoff also spent much time in helping me sort out general computer difficulties. Mr Tom MacRae tutored me in the use of the scanning electron microscope (SEM). Other staff and postgraduate students gave valuable suggestions. I would especially like to thank Dr Steve Shattuck of ANIC for his encouragement and greatly needed advice on current taxonomic practice among myrmecologists. My thanks also goes to two anonymous referees who offered helpful criticisms of my original manuscript, and to Ms Elizabeth Jeffreys of the Australian Museum who tested my revised key to the *Monomorium* species. Finally, I would like to express my gratitude to the following staff of Australian and overseas institutions who were prepared to loan their material: Dr Alan Andersen (ANAC), Dr C. R. F. Brandão (MZUSP), Dr M. Brancucci (NMBA), Mr Graham Brown (NTM), Dr R. Contreras-Lichtenberg (NMW), Mr Stefan Cover (MCZ), Ms Jan Forrest (SAM), Ms Jane Griffith (QVMT), Dr Terry Houston (WAM), Ms Annette Kleinemöhlhoff (ZMHB), Dr Jean Löbl (MHNB), Dr J. Longino (JTL), Mr Archie McArthur (SAM), Ms Catriona McPhee (MV), Prof. Jonathan Majer (JDM), Dr Geoff Monteith (QM), Mr Max Moulds (AMS), Mr C. O'Toole (Hope Entomological Collections, Oxford), Dr J. Papp (HNHM), Dr Valter Raineri (MSNM).

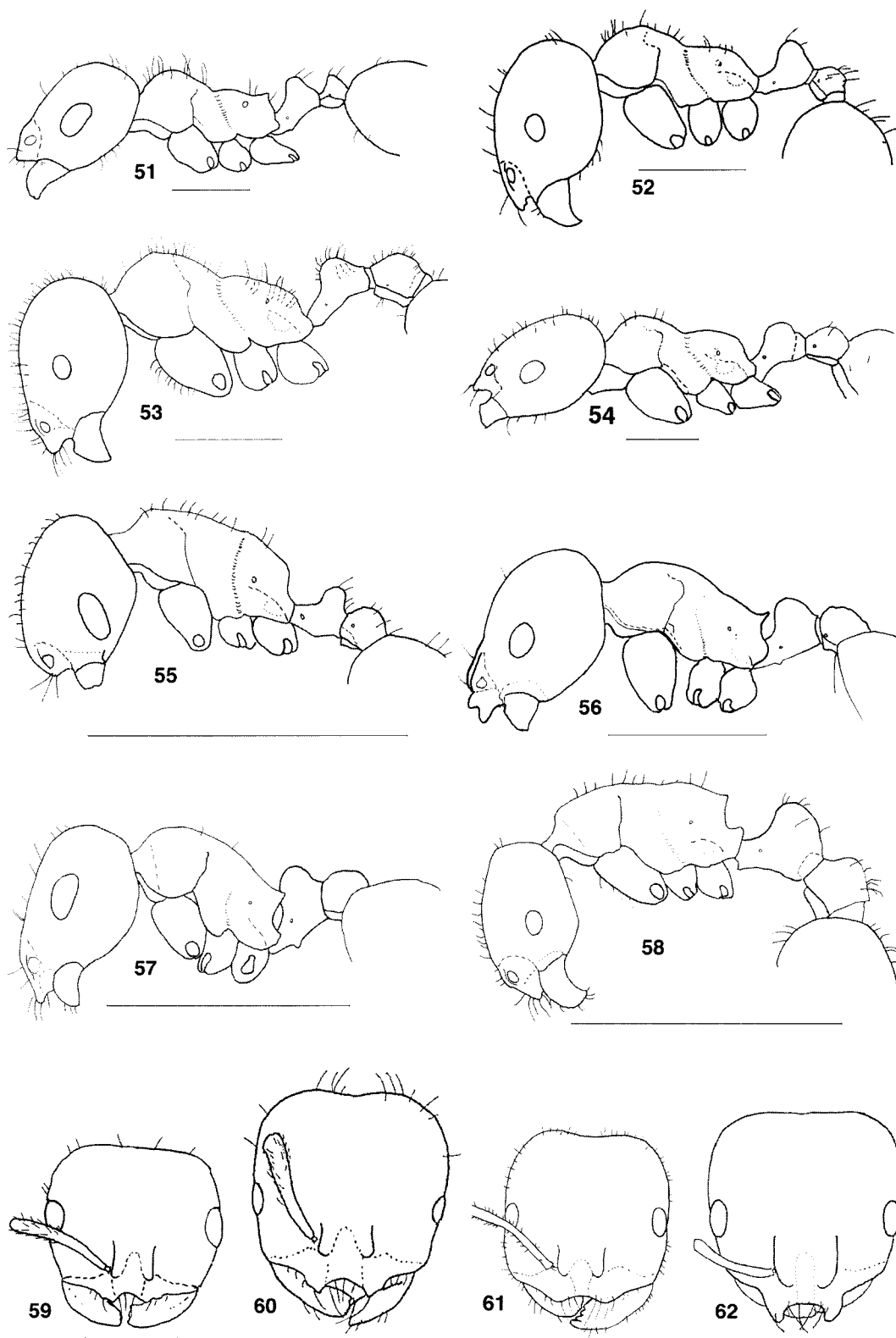
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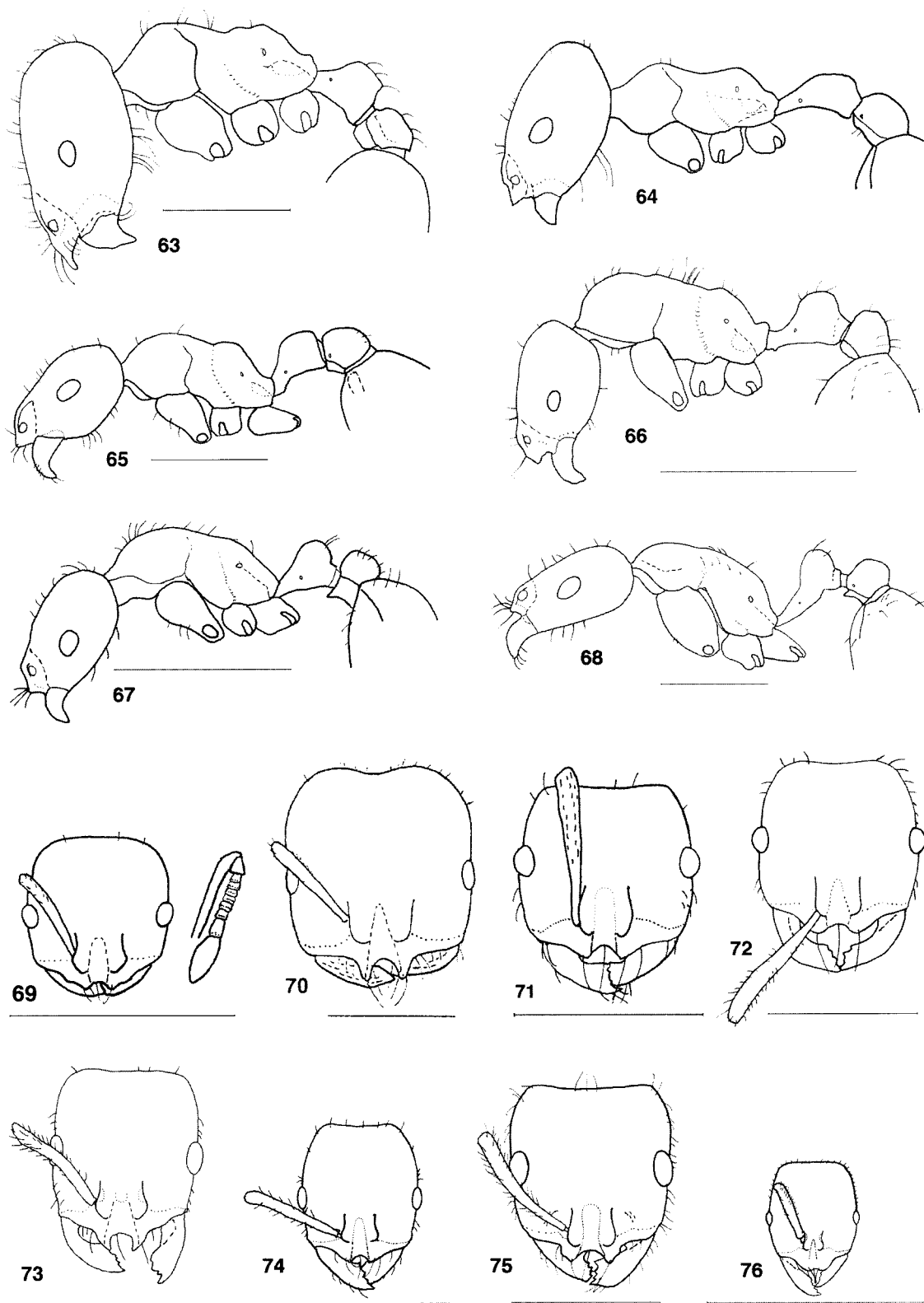
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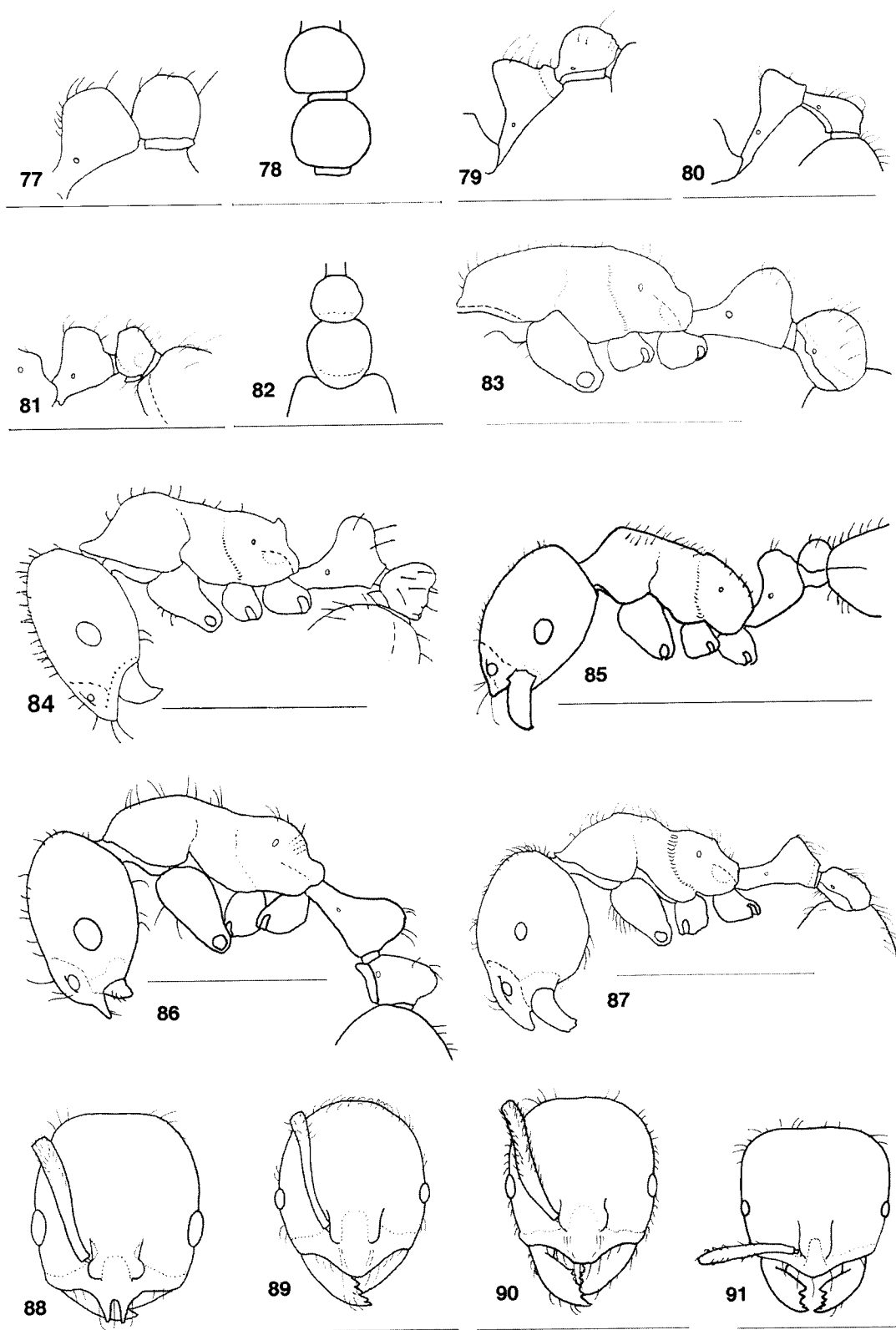
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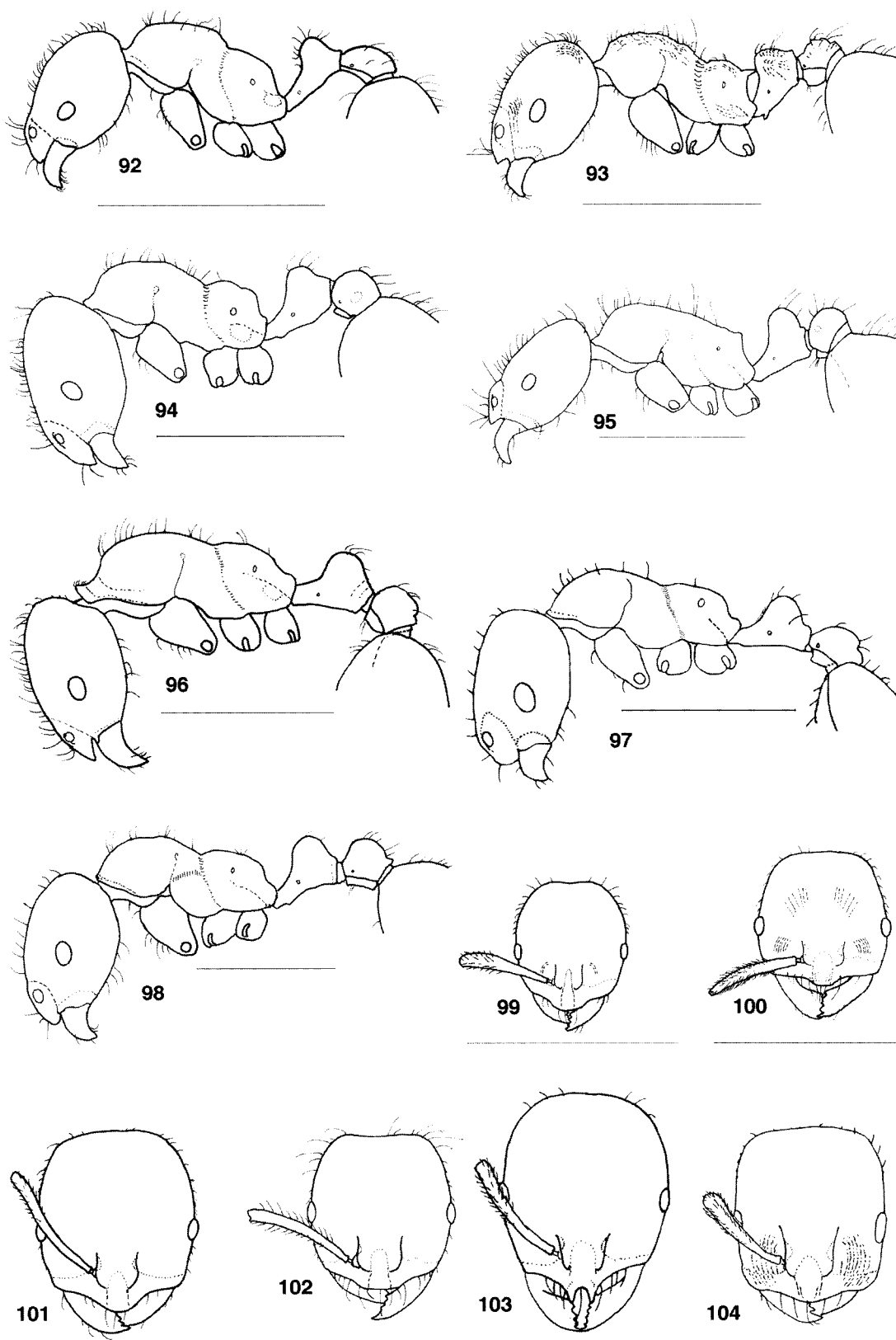
Figs 51–62. *Monomorium* workers: 51–58, profiles of 51, *M. whitei*; 52, *M. bicornis*; 53, *M. striatifrons*; 54, *M. majeri*; 55, *M. anthracinum*; 56, *M. falcatum*; 57, *M. elegantulum*; 58, *M. lacunosum*. 59–62, heads of 59, *M. whitei*; 60, *M. bicornis*; 61, *M. striatifrons*; 62, *M. falcatum*. Scale bars = 1 mm.



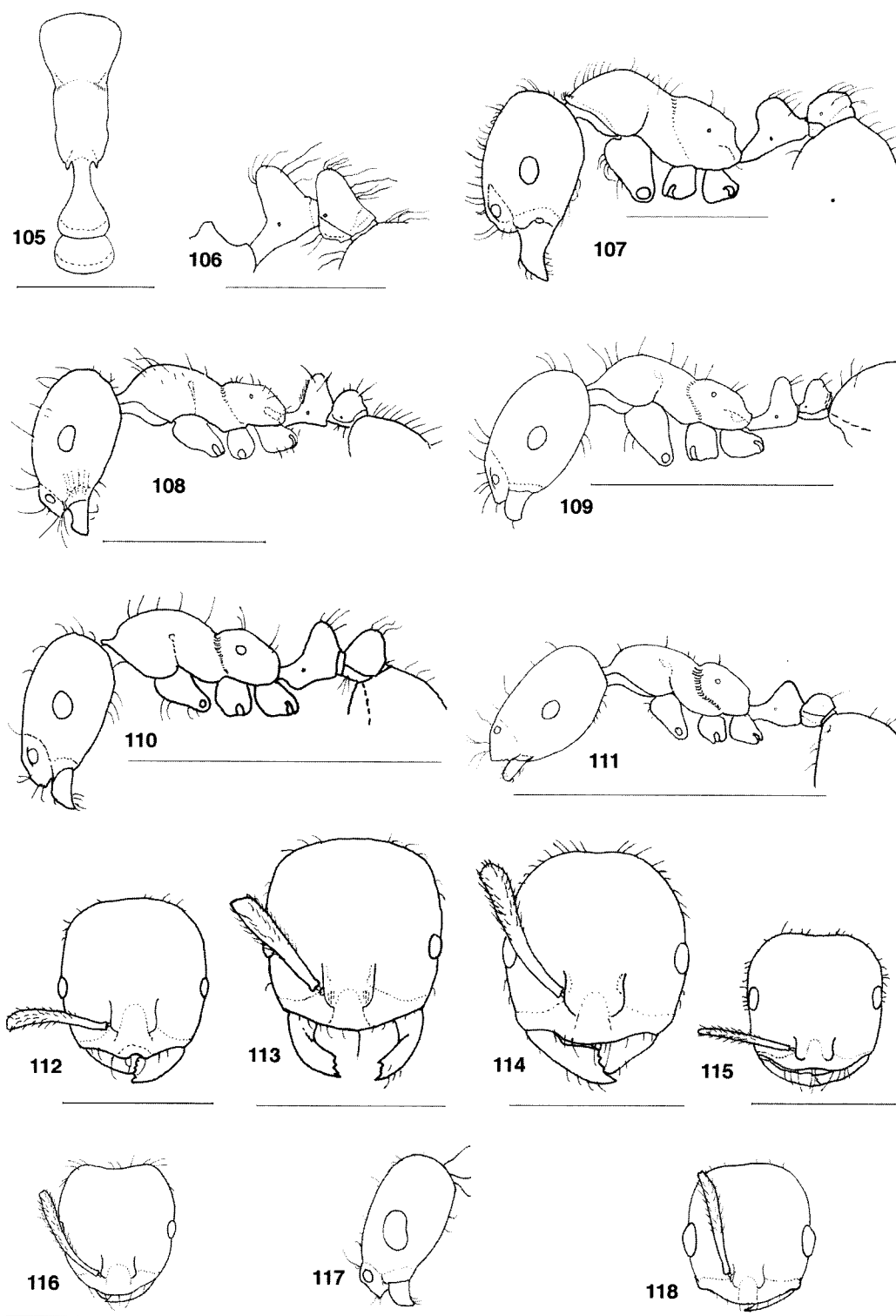
Figs 63–76. *Monomorium* workers: 63–68, profiles of 63, *M. bifidum*; 64, *M. capito*; 65, *M. flavonigrum*; 66, *M. xanthelemma*; 67, *M. insolescens* (small); 68, *M. insolescens* (large). 69–76, heads of 69, *M. decuria*; 70, *M. bifidum*; 71, *M. flavonigrum*; 72, *M. longinode*; 73, *M. bihamatum*; 74, *M. insolescens* (small); 75, *M. insolescens* (large); 76, *M. brachythrix*. Scale bars = 1 mm.



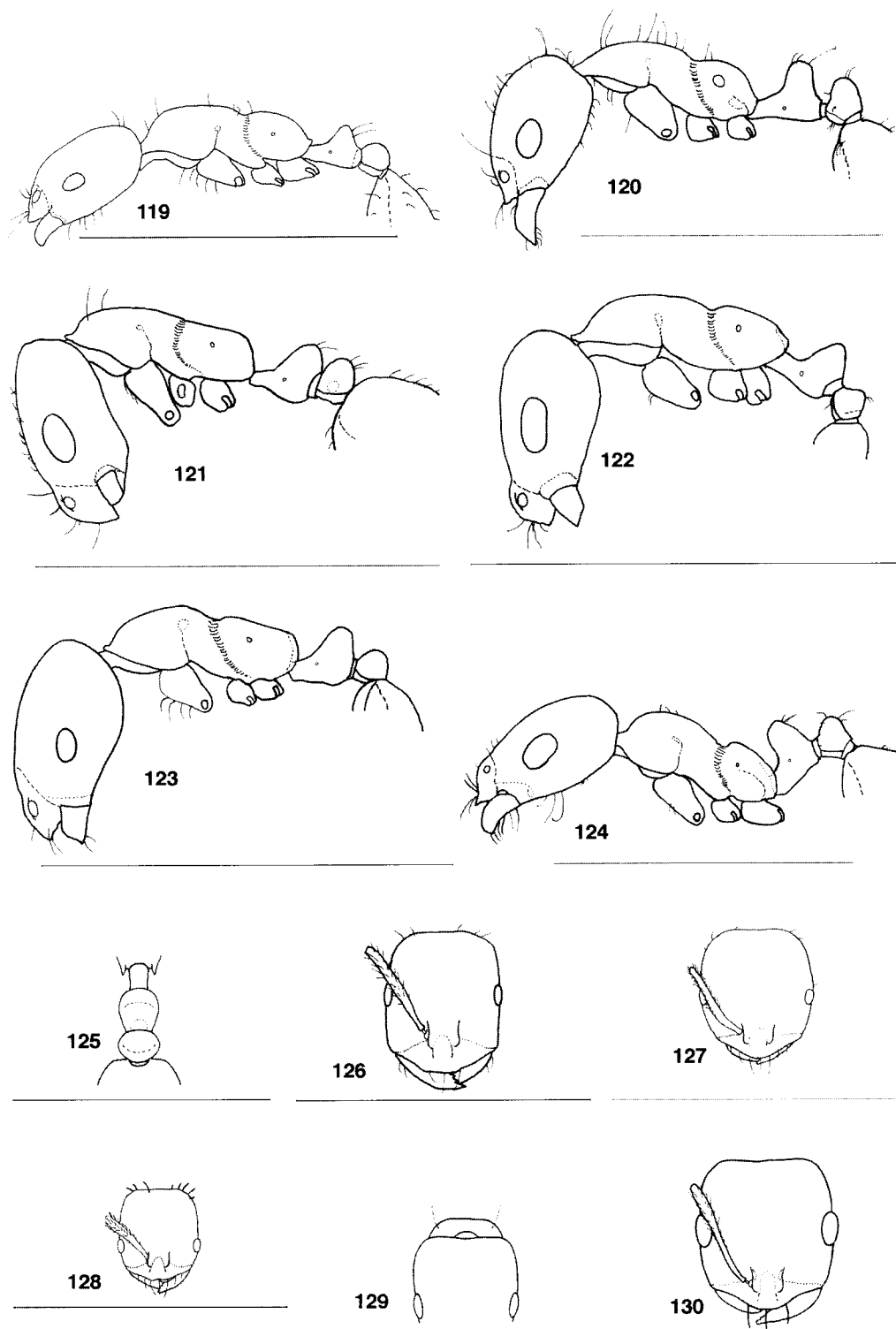
Figs 77–91. *Monomorium* workers: 77–78, lateral 77, and dorsal 78, views of petiole and post-petiole of *M. bihamatum*. 79–81, lateral view of petiole and post-petiole of 79, *M. shattucki*; 80, *M. petiolatum*; 81, *M. centrale*. 82, dorsal view of petiole and post-petiole of *M. macarthuri*. 83, profile of alitrunk of *M. macarthuri*. 84–87, profiles of 84, *M. longiceps*; 85, *M. brachythrix*; 86, *M. draculai*; 87, *M. crinitum*. 88–91, heads of 88, *M. draculai*; 89, *M. crinitum*; 90, *M. kilianii*; 91, *M. euryodon*. Scale bars = 1 mm.



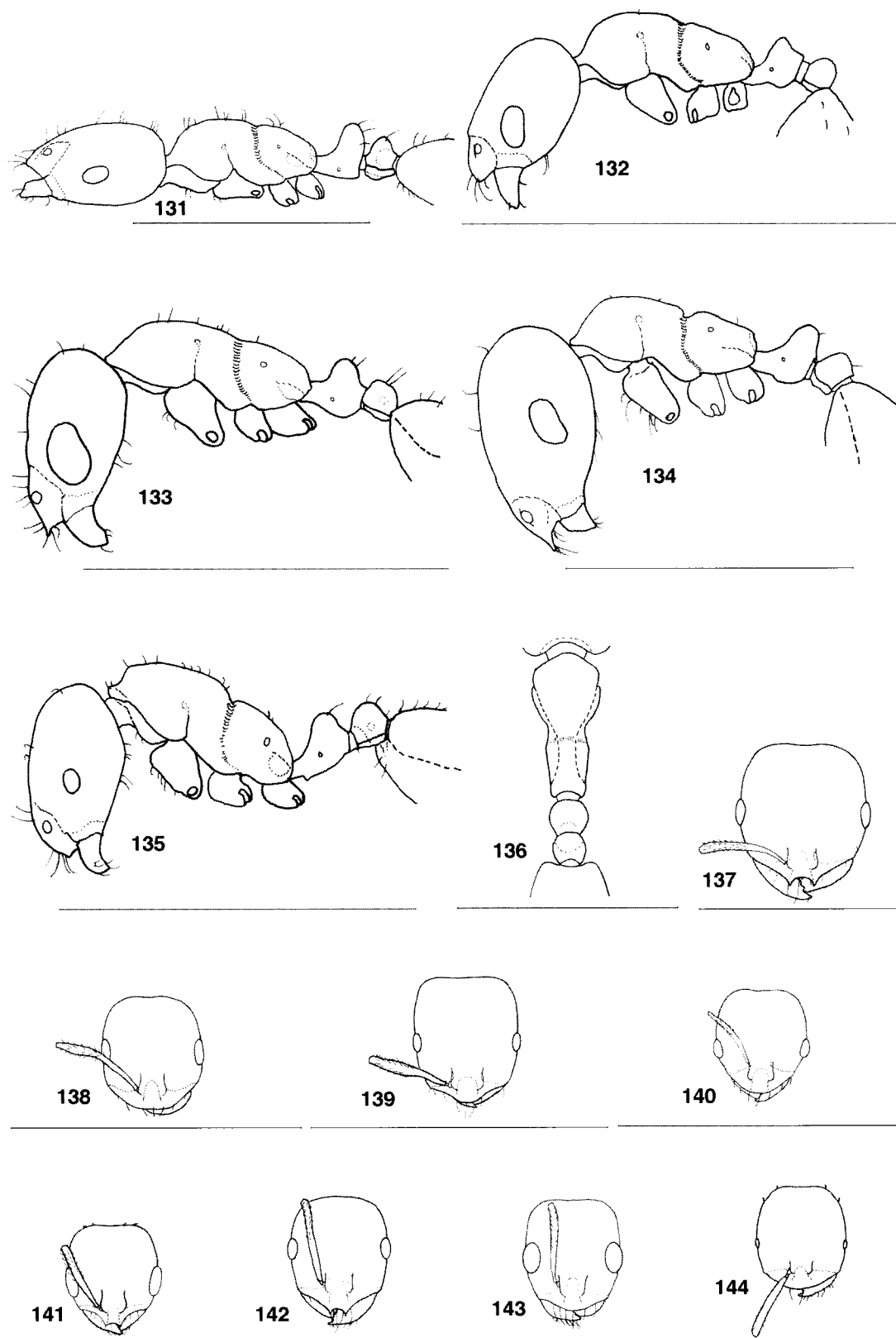
Figs 92–104. *Monomorium* workers: 92–98, profiles of 92, *M. tambourinense*; 93, *M. sculpturatum*; 94, *M. leae* ('leae'); 95, *M. leae* ('flavipes-insularis'); 96, *M. parantarcticum*; 97, *M. burchera*; 98, *M. gilberti*. 99–104, heads of 99, *M. tambourinense*; 100, *M. sculpturatum*; 101, *M. leae* ('leae'); 102, *M. leae* ('flavipes'-insularis'); 103, *M. parantarcticum*; 104, *M. burchera*. Scale bars = 1 mm.



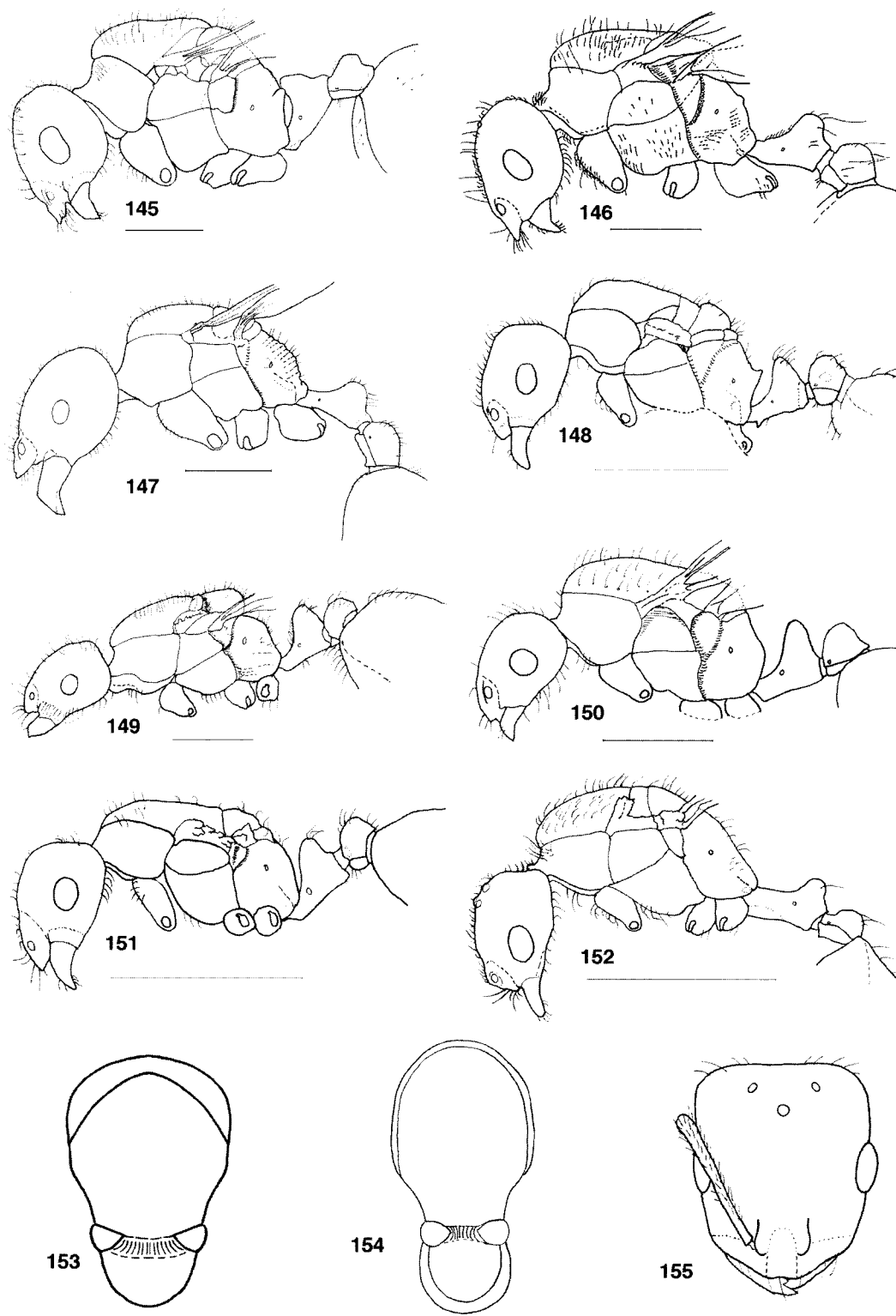
Figs 105–118. *Monomorium* workers: 105, *M. albipes* mesosoma (dorsal view); 106, *M. albipes* petiole and post-petiole (lateral view). 107–111, profiles of 107, *M. rubriceps*; 108, *M. rothsteini*; 109, *M. sordidum*; 110, *M. fieldi* ('donisthorpei'); 111, *M. fieldi* ('laeve nigrius'). 112–116, heads of 112, *M. gilberti*; 113, *M. rubriceps*; 114, *M. ravenshoeense*; 115, *M. rothsteini*; 116, *M. sordidum*. 117–118, *M. megalops* head 117 (profile); 118 (full-face view). Scale bars = 1 mm.



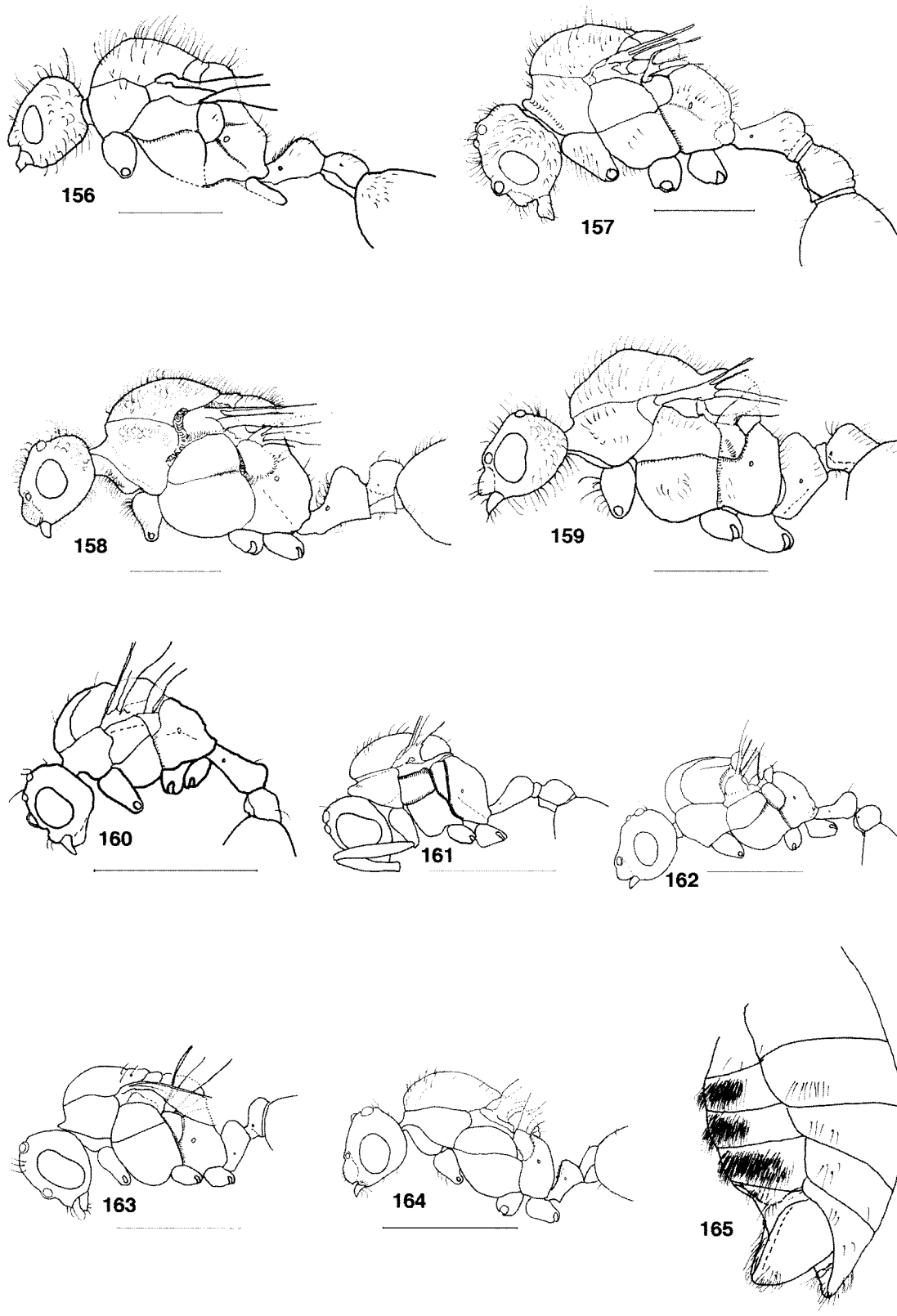
Figs 119–130. *Monomorium* workers: 119–124, profiles of 119, *M. laeve*; 120, *M. anderseni*; 121, *M. disetigerum*; 122, *M. micula*; 123, *M. sydneyense*; 124, *M. stictotum*. 125, *M. anderseni* petiole and post-petiole, dorsal view. 126–128, heads of 126, *M. fieldi* ('*donisthorpei*'); 127, *M. fieldi* ('*laeve nigrius*'); 128, *M. laeve*. 129, Full-face view of *M. disetigerum* showing prominent humeral setae. 130, head of *M. silaceum*. Scale bars = 1 mm.



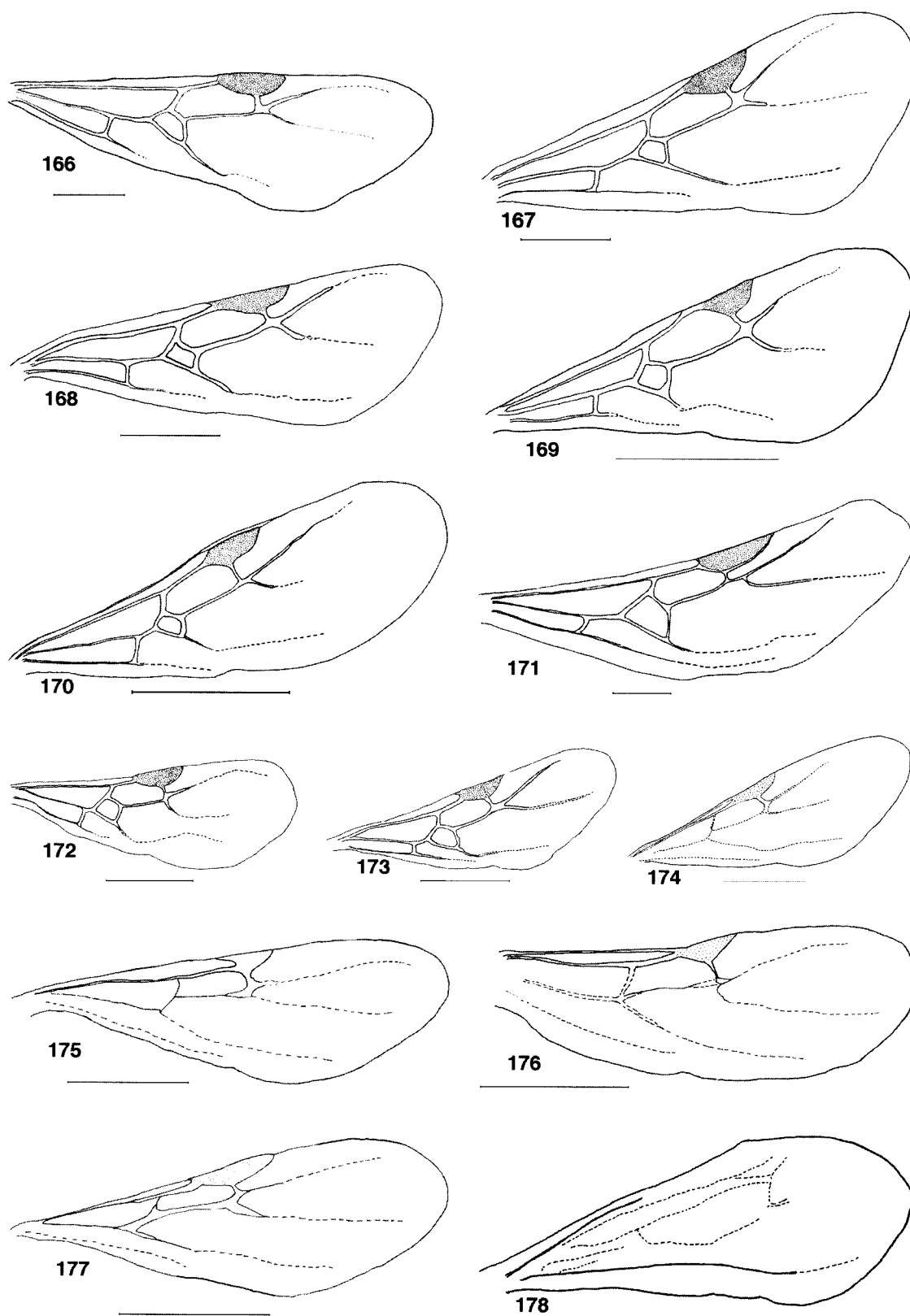
Figs 131–144. *Monomorium* workers. 131–135, profiles of 131, *M. aithoderum*; 132, *M. nanum* (smaller); 133, *M. nanum* (larger); 134, *M. eremophilum*; 135, *M. arenarium*. 136, dorsal view of *M. carinatum* propodeum. 137–144, heads of 137, *M. eremophilum*; 138, *M. micula*; 139, *M. sydneyense*; 140, *M. nanum* (smaller); 141, *M. nanum* (larger); 142, *M. stictonotum*; 143, *M. carinatum*; 144, *M. arenarium*. Scale bars = 1 mm.



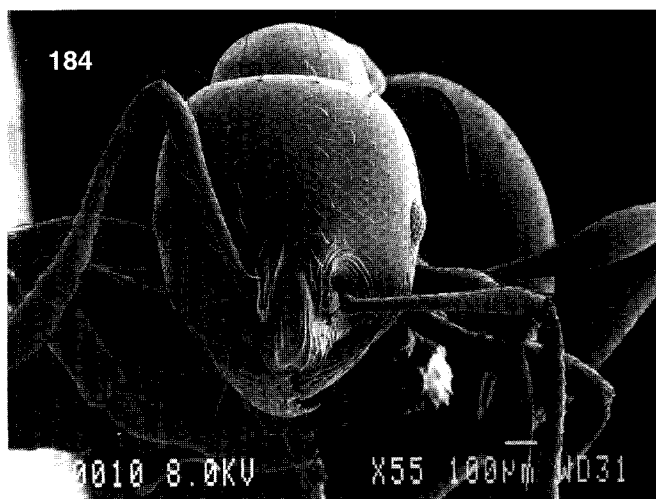
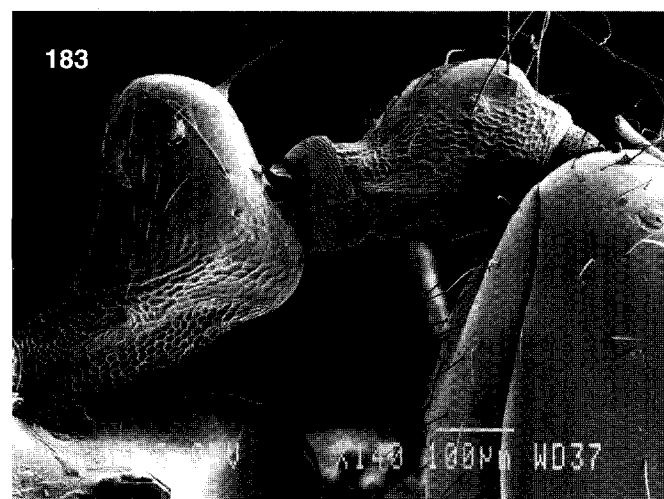
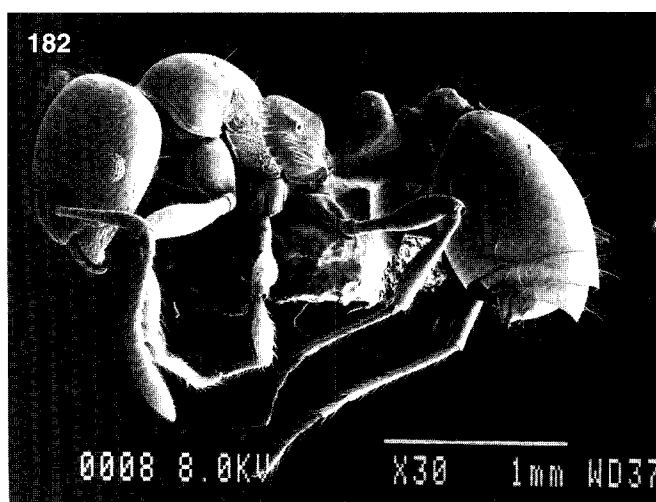
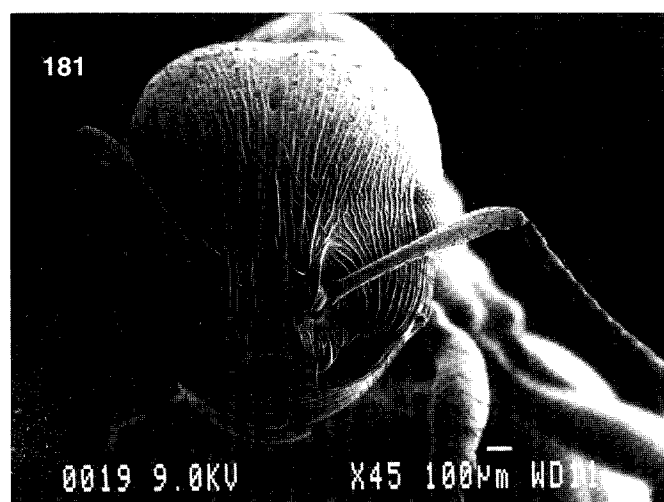
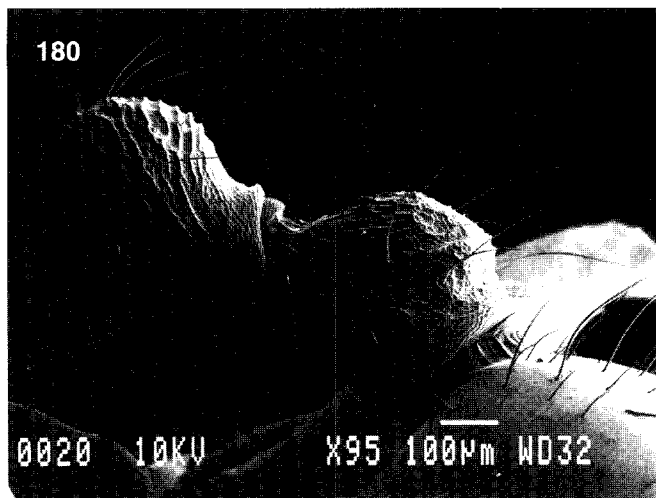
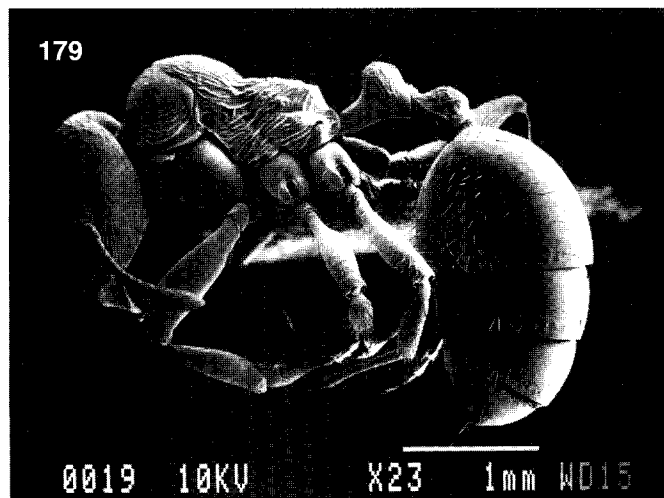
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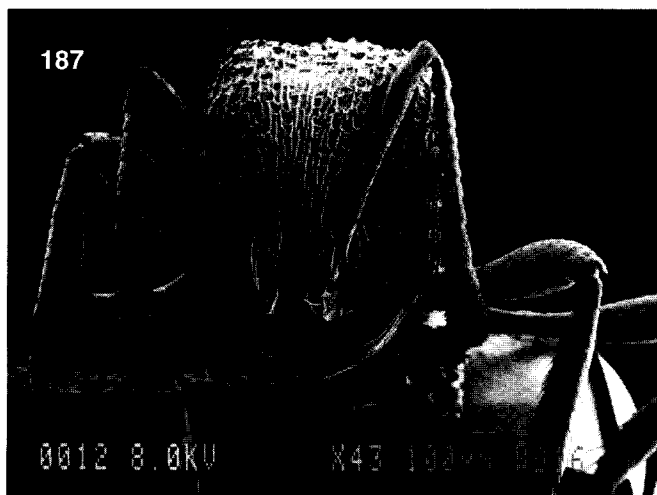
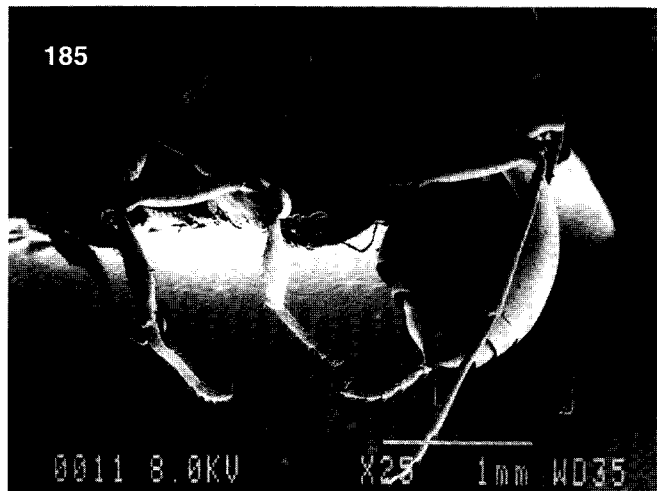
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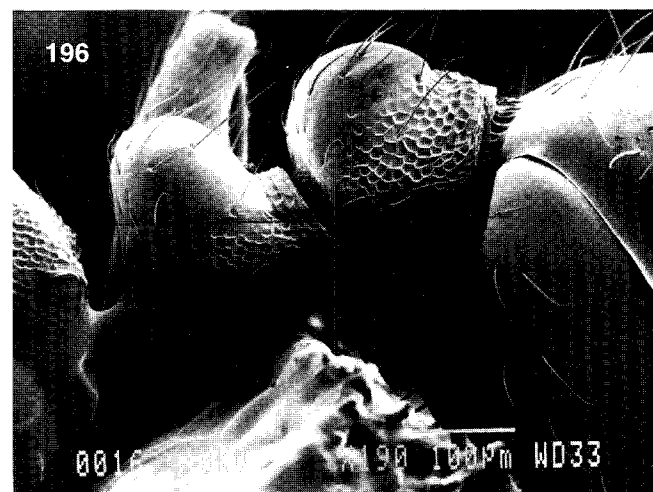
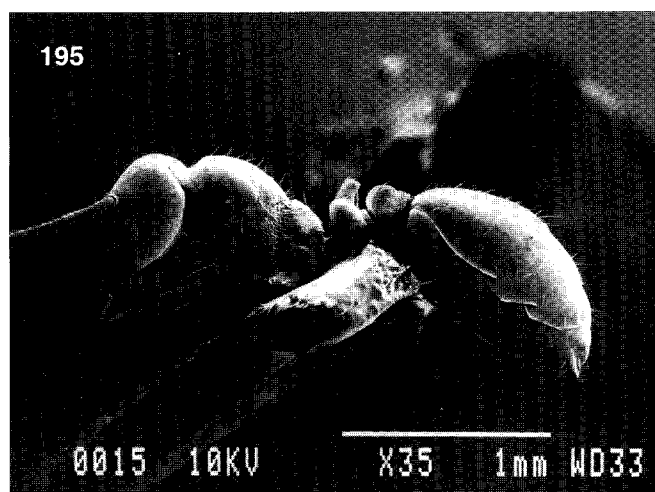
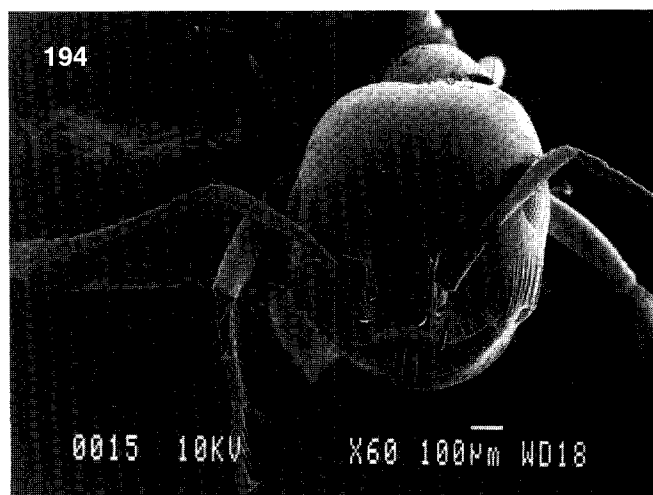
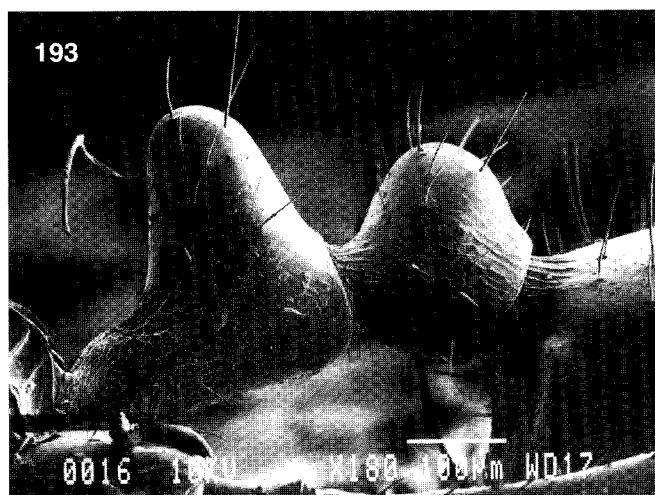
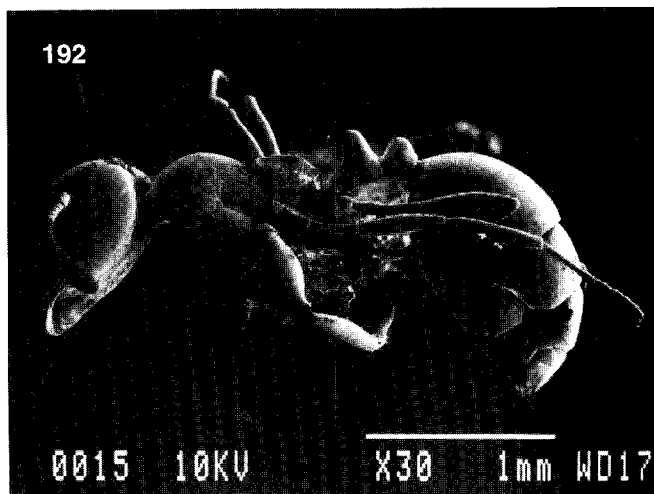
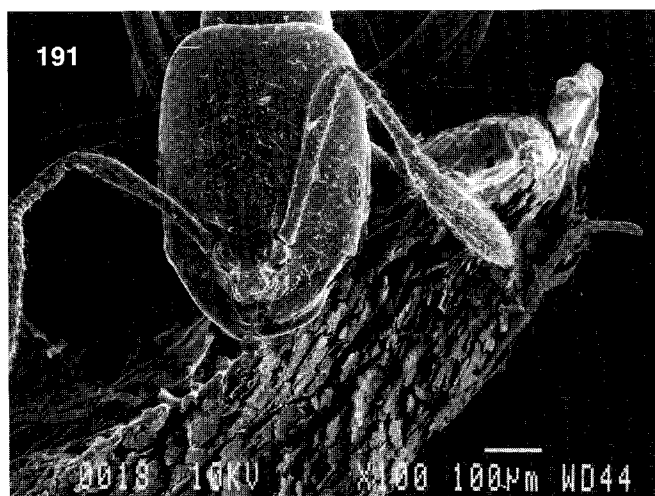
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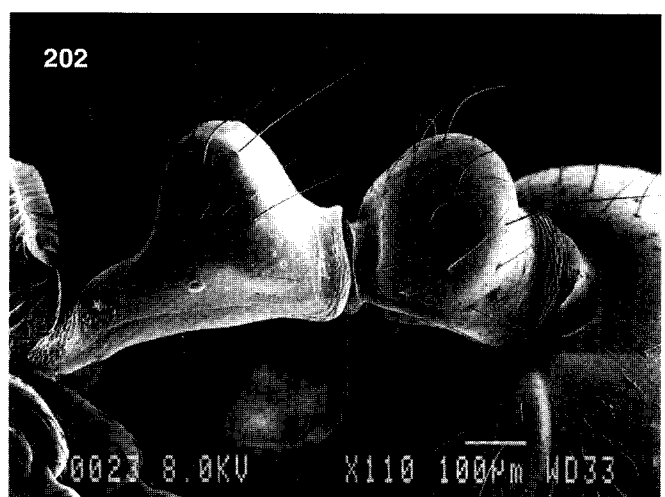
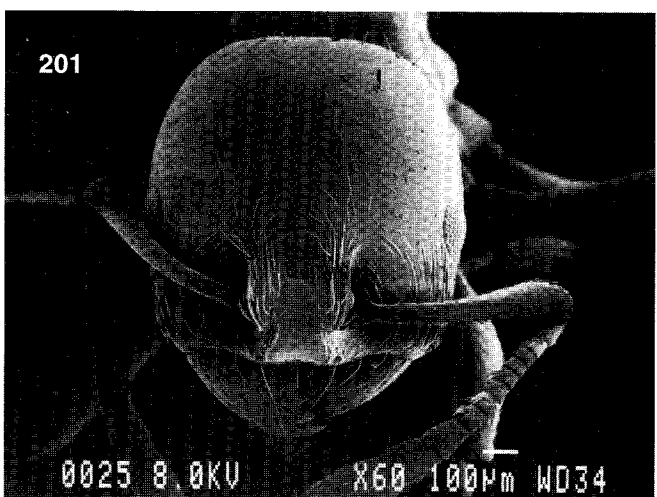
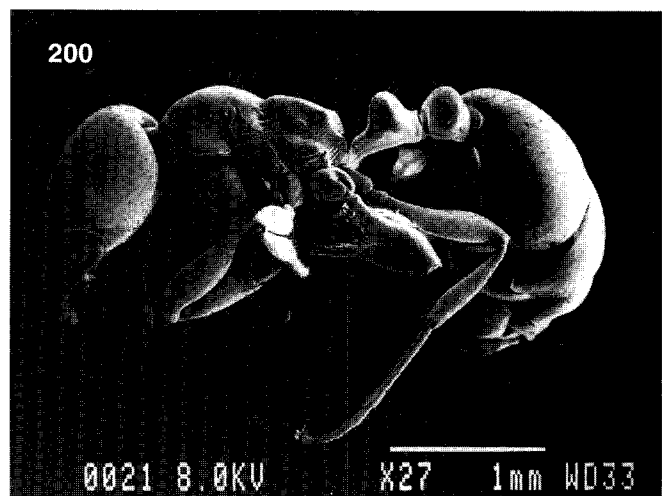
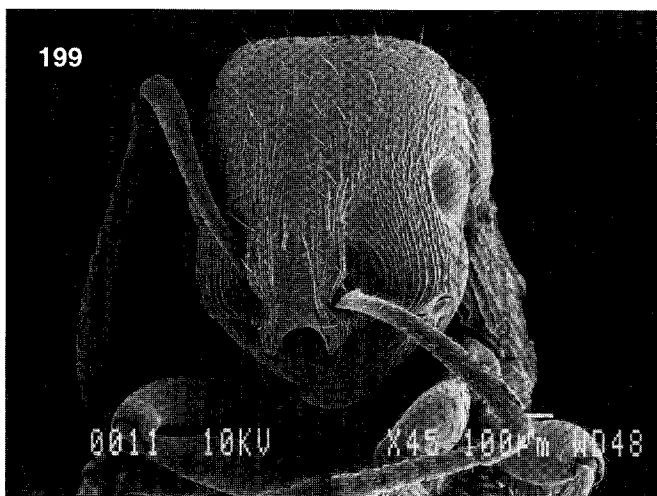
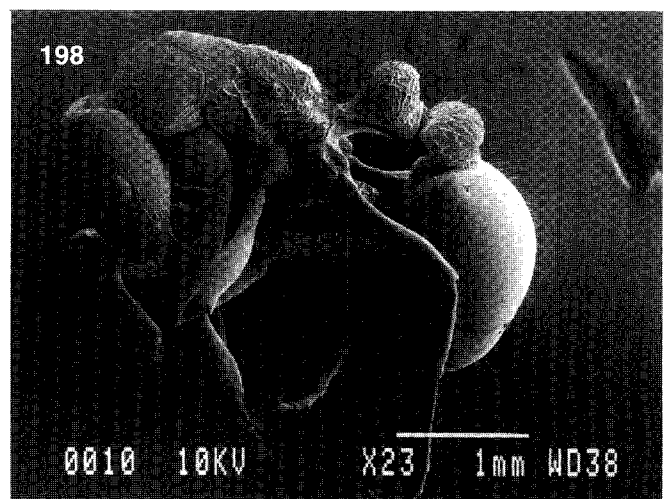
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Table 1. Data matrix showing characters and character states used in a cladistic analysis of *Monomorium*

Species	Character No.																																					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	
<i>Me. modestus</i>	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2	0	0	0	0	1	0	0	0	0	0	0	?	?	0	0	0	0	0	0	0	1	0	0
<i>An. denticulatus</i>	0	0	0	0	0	1	1	1	0	0	1	1	0	1	1	0	1	0	1	0&1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
<i>M. antarcticum</i>	1	0	0	1	0	2	1	0	1	0	1	1	1	0	1	0	1	0	0	1	0	0	0	1	0	0	0	0	1	1	0	0&1	0	0	0	1	0	0
<i>M. bicornie</i>	0&1	2	0	0	1	2	1	0	2	1	1	0	0	0	1&2	0	1	0	0	1	1	0&1	0	1	0	0	0	0	1	1	0	0&2	0	0	0	1	0	1
<i>M. centrale</i>	0	0	0	0	1	2	1	0	1	0	1	0	1	1&2	1	0	1	0	0	2	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0
<i>M. crinitum</i>	0	0	0	0	1	1	1	1	1	0	1	0&1	0&1	0	1&2	0	1	0	1	0	1	1	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0
<i>M. euryodon</i>	0	0	0	0	1	1	1	0	1	0	1	1	1	1	2	0	1	0	1	2	0	0	0	2	0	1	0	1	0	1	0	2	0	0	0	0	0	0
<i>M. fieldi</i>	0	0	1	0	1	3	2	1	2	1	1	0	1	0	2	1	1	0	1	2	1	0	0	0	1	1	1	1	1	1	1	2	1	0	1	1	0	0
<i>M. kilianii</i>	0	0	0	0	1	1	1	0	0	0	0	0	0&1	0	2	0	1	0	2	1	1	1	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0
<i>M. laeve</i>	0	0	1	0	1	3	2	1	2	1	1	0	1	0	2	1	1	0	1	2	1	0	0	0	1	1	1	1	1	1	1	2	1	1	1	1	0	0
<i>M. laeae</i>	0	0&1	0	0	1	1&3	1	0	1	0	1	0	1	0&1	0&1&2	0	1	0	0	1	0	0	1	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0
<i>M. robustusini</i>	0	0	0	0	1	2&3	1	1	3	1	0	0	0&1	0	2	0	1	0	1	2	1	0	0	0	1	1	1	1	1	1	1	2	1	0	0&1	1	0	0
<i>M. rubricaps</i>	0	0	0	0	1	1	1	0	1	0&1	0	0	1	0&1	0&1&2	0	1	0	1	1&2	0	0	0	0	1	0	0	0	1	1	0	0&1	0	0	0	0	1	0
<i>M. rufonigrum</i>	0	0&2	0	1	1	2	1	0	2	1	0	0	0&1	1	0&1&2	0	0	0	0	0	0	0&1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
<i>M. sordidum</i>	0	0	0	0	1	3	2	1	2	1	1	0	1	0	2	1	1	0	1	2	1	0	0	0	1	1	1	1	1	1	1	2	1	0	0	1	0	0
<i>M. stratifrons</i>	0	0	0	1	0	1	1	0	2	1	0	1	0	0	2	0	1	0	2	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0
<i>M. sydneyense</i>	0	0	1	0	1	2&3	2	1	2	1	0&1	0	1	0	2	1	1	1	1	2	1	0	0&1	0	1	1	1	1	1	1	1	2	1	0	1	1	0	0
<i>M. whitei</i>	1	2	0	1	0	2	1	0	2	1	0	0	0	0	0&1&2	0	1	0	0	0	1	0&1	0	1	0	1	0	0	1	1	0	0	0	0	0	1	0	1

Table 2. Synonymic list of Australian *Monomorium*
(Species recognised in this work are shown in bold; synonymised forms in regular font)

<i>bicorne</i> -group (7 spp.)	<i>falcatum</i> -group (4 spp.)	<i>insolens</i> -group (1 sp.)	<i>kilianii</i> -group (5 spp.)	<i>longinode</i> -group (4 spp.)	<i>monomorium</i> -group (17 spp.)	<i>rubriceps</i> -group (21 spp.)
<i>anthracinum</i> , sp. nov.	<i>decuria</i> , sp. nov.	<i>insolens</i> Wheeler	<i>crinitum</i> , sp. nov.	<i>bifidum</i> , sp. nov.	<i>athoderum</i> , sp. nov.	<i>albipes</i> , sp. nov.
<i>bicorne</i> Forel	<i>elegantulum</i> , sp. nov.		<i>kilianii</i> Forel	<i>capito</i> , sp. nov.	<i>anderseni</i> , sp. nov.	<i>bihamatum</i> , sp. nov.
<i>niger</i> McAreevey (unav.)	<i>falcatum</i> (McAreevey)		<i>kilianii</i> Forel	<i>flavonigrum</i> , sp. nov.	<i>arenarium</i> , sp. nov.	<i>brachythrix</i> , sp. nov.
<i>macaraveyi</i> Eitershank syn. nov.	<i>lacunosum</i> , sp. nov.		(misspelling)	<i>longinode</i> , sp. nov.	<i>carinatum</i> , sp. nov.	<i>burchera</i> , sp. nov.
<i>majeri</i> , sp. nov.			<i>kilianii</i> subsp. <i>obscurillum</i> Viehmeyer syn. nov.		<i>castaneum</i> , sp. nov.	<i>centrale</i> Forel
			<i>petiolatum</i> , sp. nov.		<i>diszigerum</i> , sp. nov.	<i>draculai</i> , sp. nov.
<i>pubescens</i> , sp. nov.			<i>shattucki</i> , sp. nov.		<i>eremophilum</i> , sp. nov.	<i>durskoppinense</i> , sp. nov.
<i>rufonigrum</i> , sp. nov.			<i>tambourinense</i> Forel		<i>fieldi</i> Forel	<i>euryodon</i> , sp. nov.
<i>striatifrons</i> , sp. nov.			<i>howense</i> Wheeler syn. nov.		<i>donisthorpei</i> Crawley syn. nov.	<i>gilberti</i> Forel
<i>whitiei</i> Wheeler					<i>laeve</i> <i>r. nigritus</i> Forel syn. nov.	<i>gilberti</i> var. <i>medianubra</i> Forel syn. nov.
<i>armstrongi</i> McAreevey syn. nov.					<i>luove</i> st. <i>fraterculus</i> Santschi syn. nov.	<i>turneri</i> (Forel) syn. nov.
					<i>laeve</i> Mayr	<i>leae</i> Forel
					<i>broomense</i> Forel syn. nov.	<i>flavipes</i> Clark syn. nov.
					<i>ilia</i> Forel syn. nov.	<i>hemiphacum</i> Clark
					<i>ilia</i> v. <i>lamingtonensis</i> Forel syn. nov.	<i>insularis</i> Clark syn. nov.
					<i>megaloops</i> , sp. nov.	<i>legulus</i> , sp. nov.
					<i>micula</i> , sp. nov.	<i>longiceps</i> Wheeler
					<i>nanum</i> , sp. nov.	<i>macarthuri</i> , sp. nov.
					<i>roltschkei</i> Forel	<i>nightcapense</i> , sp. nov.
					<i>roltschkei</i> v. <i>humilior</i> Forel syn. nov.	<i>nigriceps</i> , sp. nov.
					<i>roltschkei</i> v. <i>loda</i> Forel syn. nov.	<i>paranlarcticum</i> , sp. nov.
					<i>roltschkei</i> v. <i>doddi</i> Santschi syn. nov.	<i>ravenshoeense</i> , sp. nov.
					<i>subapterum</i> Wheeler syn. nov.	<i>rubriceps</i> Mayr
					<i>subapterum</i> var. <i>boggschi</i> Wheeler syn. nov.	<i>rubriceps</i> var. <i>rubrum</i> Forel syn. nov.
					<i>silaceum</i> , sp. nov.	<i>rubriceps</i> var. <i>cinctum</i> Wheeler syn. nov.
					<i>stictonotum</i> , sp. nov.	<i>sanguinolentum</i> Wheeler syn. nov.
					<i>sordidum</i> Forel	<i>rubriceps</i> var. <i>extreminigrum</i> Forel
					<i>foreti</i> Viehmeyer syn. nov.	<i>sculpturatum</i> Clark
					<i>microm</i> Crawley syn. nov.	<i>xantheklemma</i> , sp. nov.
					<i>roltschkei</i> var. <i>squamigena</i> Viehmeyer syn. nov.	(<i>incertae sedis</i>) <i>occidaneus</i> Crawley
					<i>roltschkei</i> var. <i>testum</i> Wheeler syn. nov.	
					<i>sordidum</i> subsp. <i>nigriventris</i> Forel syn. nov.	
					<i>sydneyense</i> Forel	
					<i>barretti</i> Santschi syn. nov.	
					<i>fraterculus</i> var. <i>barretti</i> Santschi syn. nov.	
					<i>sydneyense</i> subsp. <i>nigella</i> Emery syn. nov.	