

# THE ANT TRIBE TETRAMORIINI (HYMENOPTERA : FORMICIDAE)

## CONSTITUENT GENERA, REVIEW OF SMALLER GENERA AND REVISION OF *TRIGLYPHOTHRIX* FOREL

By B. BOLTON

### CONTENTS

	<i>Page</i>
SYNOPSIS . . . . .	284
INTRODUCTION . . . . .	284
MUSEUMS AND INSTITUTIONS . . . . .	285
MEASUREMENTS AND INDICES . . . . .	286
GENERIC COMPOSITION AND ORIGINS OF TETRAMORIINI . . . . .	286
TRIBE TETRAMORIINI WHEELER . . . . .	289
GENERA NEWLY EXCLUDED FROM TETRAMORIINI . . . . .	291
SPECIES NEWLY EXCLUDED FROM TETRAMORIINI . . . . .	293
KEYS TO GENERA OF TETRAMORIINI . . . . .	294
<i>Anergates</i> Forel . . . . .	296
<i>Decamorium</i> Forel . . . . .	297
Synonymic list of species . . . . .	298
Summary of the species . . . . .	298
<i>Rhoptromyrmex</i> Mayr . . . . .	298
Synonymic list of species . . . . .	300
Key to species (workers) . . . . .	301
Summary of the species . . . . .	301
<i>Strongylognathus</i> Mayr . . . . .	304
Synonymic list of species . . . . .	305
Summary of the species . . . . .	305
<i>Teleutomyrmex</i> Kutter . . . . .	309
<i>Triglyphothrix</i> Forel . . . . .	310
Species of the Ethiopian region . . . . .	312
Synonymic list of species . . . . .	312
The species-groups . . . . .	313
Key to species (workers) . . . . .	314
Treatment by species . . . . .	317
Species of the Oriental, Indo-Australian and Polynesian regions . . . . .	339
Synonymic list of species . . . . .	339
The species-groups . . . . .	340
Key to species (workers) . . . . .	341
Treatment by species . . . . .	344
<i>Tetramorium</i> Mayr . . . . .	359
Generic synonymy of <i>Tetramorium</i> . . . . .	360
<i>Xiphomyrmex</i> . . . . .	360
<i>Atopula</i> . . . . .	362
<i>Macromischoides</i> . . . . .	363
The subgenera <i>Lobomyrmex</i> and <i>Sulcomyrmex</i> . . . . .	364
ACKNOWLEDGEMENTS . . . . .	365
REFERENCES . . . . .	365
INDEX . . . . .	377



## SYNOPSIS

The generic composition of the myrmicine ant tribe Tetramoriini is revised and the tribe re-defined. Seven genera are recognized as valid, namely *Anergates* Forel, *Decamorium* Forel, *Rhoptromyrmex* Mayr, *Strongylognathus* Mayr, *Teleutomyrmex* Kutter, *Tetramorium* Mayr and *Triglyphothrix* Forel. The genus *Ireneella* Donisthorpe is synonymized with *Rhoptromyrmex*. The genera *Macromischoides* Wheeler and *Xiphomyrmex* Forel, and the subgenera *Lobomyrmex* Kratochvil and *Sulcomyrmex* Kratochvil are synonymized with *Tetramorium*. The genera *Eutetramorium* Emery, *Ireneopone* Donisthorpe and *Tetramyrma* Forel are excluded from the tribe. Keys to genera are given.

*Tetramorium* is defined and discussed as a preliminary to a world revision. The smaller genera are reviewed and a new species of *Rhoptromyrmex* described. *Triglyphothrix* is formally revised, 55 species being recognized as valid, of which 21 are new. Keys to species are provided for *Decamorium*, *Rhoptromyrmex* and *Triglyphothrix*. The species *Tetramorium opacum* (F. Smith) is transferred to genus *Romblonella* Wheeler (tribe Meranoplini), and *Xiphomyrmex flavigaster* Clark is transferred to genus *Chelaner* Emery (tribe Solenopsidini).

Genus *Atopula* is transferred from tribe Myrmecini and synonymized with *Tetramorium*. Of the former species of *Atopula*, *belti* (Forel) is transferred to *Brunella* Forel, *longispina* Stitz is transferred to *Paratopula* Wheeler, and *hortensis* Bernard is synonymized with *Tetramorium sericeiventris* Emery.

## INTRODUCTION

THIS paper is the first part of a projected revision of the ant tribe Tetramoriini and presents a review, with keys where possible, of all the smaller genera of the tribe and also gives a formal revision of the moderately sized genus *Triglyphothrix*. The genus *Tetramorium* is very large, larger than the rest of the tribe together, and will be dealt with separately in one or more papers which are now in preparation. The present paper only gives a definition and discussion of the genus and its synonyms.

The course of the study at the generic level has led to a number of interesting discoveries which make it possible to define the tribe accurately, but unfortunately it has also led to the conclusion that a number of quite well-known and old generic names have no validity. In this category come *Xiphomyrmex* and *Macromischoides*, both now relegated to the synonymy of *Tetramorium*. Other casualties include the spurious subgenera *Lobomyrmex* and *Sulcomyrmex* of *Tetramorium*, which are synonymized, and the monotypic *Ireneella*, based on a male, is sunk under *Rhoptromyrmex*. Three small and very poorly known genera which were formerly placed in the tribe, namely *Eutetramorium*, *Ireneopone* and *Tetramyrma*, are excluded from further consideration of the Tetramoriini and are assigned to different tribes elsewhere in the subfamily Myrmicinae.

In distribution most of the genera of the tribe Tetramoriini are primarily of the Old World tropics and subtropics, particularly the Ethiopian, Malagasy and Indo-Australian regions. A few Holarctic species of *Tetramorium* are known but only a single species is unquestionably endemic in the New World, *Tetramorium spinosum* (Pergande), which is found in the more arid regions of the southern U.S.A. and Mexico. The Palearctic region has three endemic genera, *Anergates*, *Teleutomyrmex* and *Strongylognathus*. The first two of these are monotypic genera and are permanent social parasites without a worker caste. The last named is a dulotic genus with falcate mandibles. All the species of these genera utilize species of the



*Tetramorium caespitum*-group as hosts. The small genus *Decamorium* is restricted to the Ethiopian region but the larger genera *Rhoptromyrmex* and *Triglyphothrix* are found throughout the Old World tropics although no endemic species of these are known from either Madagascar or Australia. Finally, the huge genus *Tetramorium* is based upon the Ethiopian region but is also very strongly represented throughout the Old World tropics and subtropics. One group of this genus, the *T. caespitum*-group, has colonized the more temperate and Mediterranean zones of the Palaearctic region and numerous *Tetramorium* species are widely distributed across the Pacific island systems.

The tribe also contains some of the world's more successful tramp species, spreading mainly or solely by means of human commerce. Such species are found in *Triglyphothrix* (*Tr. lanuginosa*, *Tr. kheperra*) and *Tetramorium* (*T. simillimum*, *T. guineense*, *T. pacificum*) and are more or less commonly encountered in the temperate zones of the world where they are capable of surviving in hothouses or permanently heated buildings, and over wide areas of the world tropics where they are quite at home in nests away from human habitation or in places where the ground has been disturbed by agriculture.

In the free-living genera the vast majority of species are terrestrial or subterranean, with very few arboreal forms. Ground nesting species characteristically nest directly in the earth, in rotten twigs, in or under rotten logs or in compressed leaf litter, and foraging is normally carried on at ground level. A few species which nest in the ground are not averse to foraging on the stems and leaves of plants or even on trees. Of the arboreal species the most common nest sites include rot-holes or rotten areas beneath the bark of otherwise healthy trees, but a few species build rough fibrous nests under leaves or in branch forks, such nests being constructed of vegetable fibres, small twigs and pieces of leaf. Colony size is usually moderate, with a few hundred workers, but in some *Rhoptromyrmex* the nests may be enormous.

Most tetramoriines are generalized predators or scavengers but a few are more specialized and tend homopterous insects or visit plant nectaries. A few species have very specialized diets, for example all members of the *Tetramorium sericeiventris*-group are suspected of feeding entirely on other ants, particularly *Pheidole* species.

Previous studies of the Tetramoriini as a tribe are confined to a few works on a regional basis, such as those of Forel (1902b) and Bingham (1903) of the Indian fauna, Arnold (1917; 1926) of the South African fauna, Creighton (1950) of the North American fauna and Mann (1919; 1921) of the species of the Solomon and Fiji Islands. Apart from these there have been a number of reviews or revisions of some of the smaller genera, and these are noted under the discussions of the genera in question.

#### MUSEUMS AND INSTITUTIONS

ANIC, Canberra	Australian National Insect Collection, Canberra City, Australia.
BMNH	British Museum (Natural History), London, U.K.
CAS, San Francisco	California Academy of Sciences, San Francisco, California, U.S.A.
IE, Bologna	Istituto di Entomologia dell'Università, Bologna, Italy.
MCSN, Genoa	Museo Civico di Storia Naturale 'Giacomo Doria', Genoa, Italy.



MCSN, Verona	Museo Civico di Storia Naturale, Verona, Italy.
MCZ, Cambridge	Museum of Comparative Zoology, Cambridge, Mass., U.S.A.
MHN, CdF	Muséum d'Histoire Naturelle, La Chaux-de-Fonds, Switzerland.
MHN, Geneva	Muséum d'Histoire Naturelle, Geneva, Switzerland.
MNHN, Paris	Muséum National d'Histoire Naturelle, Paris, France.
MNHU, Berlin	Museum für Naturkunde der Humboldt-Universität, Berlin, Germany (D.D.R.).
MRAC, Tervuren	Musée Royal de l'Afrique Centrale, Tervuren, Belgium.
NM, Basle	Naturhistorisches Museum, Basle, Switzerland.
NM, Bulawayo	National Museum, Bulawayo, Rhodesia.
NM, Hamburg	Naturhistorisches Museum, Hamburg, Germany.
NM, Vienna	Naturhistorisches Museum, Vienna, Austria.
UM, Oxford	University Museum, Oxford, U.K.
ZM, Munich	Zoologisches Sammlung des Bayerischen Staates, Munich, Germany.

#### MEASUREMENTS AND INDICES

Total Length (TL). The total outstretched length of the individual, from the mandibular apex to the gastral apex.

Head Length (HL). The length of the head proper, measured in a straight line from the anterior clypeal margin to the mid-point of the occipital margin, in full-face view.

Head Width (HW). The maximum width of the head behind the eyes, measured in full-face view.

Cephalic Index (CI).

$$\frac{HW \times 100}{HL}$$

Scape Length (SL). The straight-line length of the antennal scape excluding the basal constriction or neck.

Scape Index (SI).

$$\frac{SL \times 100}{HW}$$

Pronotal Width (PW). The maximum width of the pronotum in dorsal view.

Alitrunk Length (AL). The diagonal length of the alitrunk in lateral view from the point at which the pronotum meets the cervical shield to the base of the metapleural lobes or teeth.

All measurements are expressed in millimetres.

#### GENERIC COMPOSITION AND ORIGINS OF TETRAMORIINI

The earliest attempts at defining a tribe Tetramoriini were quite vague as to its limits and a number of unrelated genera which were excluded later were originally grouped together. The situation as it had been reached in the first decade of this century was summarized by Wheeler (1910) under a tribal name of Tetramorii. Beside the presently-included genera this agglomeration also contained the genera *Mayriella* Forel, *Calyptomyrmex* Emery, *Meranoplus* F. Smith, *Wasmannia* Forel and *Ochetomyrmex* Mayr.



A serious attempt to define the tribe more accurately was made by Emery (1914a) in a paper which gave a preview of his later massive works in the *Genera Insectorum* series. He presented a key to the myrmicine tribes as he defined them, and further restricted the Tetramoriini by removing disparate genera such as those noted above. A number of other genera were listed as tetramoriine by Forel (1917) and the genera thus included were more or less stabilized in the dual classifications of Emery and Wheeler, both of which appeared in 1922.

The only difference between these two systems as regards the tetramoriines lay in the treatment of *Tetramorium aculeatum*, which was treated under *Tetramorium* by Emery but which had been removed by Wheeler (1920) to a separate genus, *Macromischoides*. Later Wheeler (1922) defined this genus and placed it in tribe Leptothoracini where it has been retained by most authors (myself included; Bolton, 1973) despite the proof by Santschi (1924) that *Macromischoides* belongs in the Tetramoriini.

As the Emery-Wheeler classification was emerging, Forel (1922) described *Tetramorium* subgenus *Cephalomorium*, the single species of which was shown later by Santschi (1925) to be a member of genus *Pheidole*.

Despite these works the limits of tribe Tetramoriini were still rather vague, and subsequent to the Emery-Wheeler classification various authors added genera and subgenera to the tribe until by 1950 (after the addition of the last generic name but before any critical studies were undertaken) the generic composition of the tribe was as follows.

<i>Decamorium</i> Forel	<i>Strongylognathus</i> Mayr
<i>Dyomorium</i> Donisthorpe	= <i>Myrmus</i> Schenk
<i>Eutetramorium</i> Emery	<i>Teleutomymex</i> Kutter
<i>Ireneella</i> Donisthorpe	<i>Tetramorium</i> Mayr
<i>Ireneopone</i> Donisthorpe	= <i>Tetrogmus</i> Roger
<i>Lundella</i> Emery	T. subgen. <i>Lobomyrmex</i> Kratochvil
<i>Macromischoides</i> Wheeler	T. subgen. <i>Sulcomymex</i> Kratochvil
<i>Rhoptromymex</i> Mayr	<i>Tetramyrma</i> Forel
R. subgen. <i>Acidomyrmex</i> Emery	<i>Triglyphothrix</i> Forel
	<i>Xiphomyrmex</i> Forel

Since 1950 a number of modifications to this system have been suggested. Brown (1953) showed that *Lundella* was synonymous with *Hylomyrma* (tribe Myrmicini) and thus removed the Neotropical region's only claim to endemic tetramoriines (see also Kempf, 1973) and later Brown (1964) synonymized *Acidomyrmex* to *Rhoptromymex*. Ettershank (1966) showed that *Dyomorium* was a synonym of *Vollenhovia* and thus outside the Tetramoriini and he also pointed out that *Anergates* should be included in the tribe and not treated as a member of Solenopsidini or of a subtribe thereof, as had previously been the case (Emery, 1914a; 1922; Forel, 1917; Wheeler, 1922).

At generic level the results of the present study have confirmed the above suggestions and shown that *Eutetramorium*, *Ireneopone* and *Tetramyrma* are not tetramoriines; that *Ireneella* is a synonym of *Rhoptromymex* and that *Xiphomyrmex*, *Macromischoides*, *Lobomyrmex*, *Sulcomymex* and *Atopula* (from outside the tribe)



are all synonyms of *Tetramorium*. These results are discussed in detail elsewhere in this study.

Thus the generic composition of the tribe is now as follows.

<b><i>Anergates</i></b> Forel	<b><i>Tetramorium</i></b> Mayr
<b><i>Decamorium</i></b> Forel	<i>Tetrogmus</i> Roger
<b><i>Rhoptromyrmex</i></b> Mayr	<i>Xiphomyrmex</i> Forel <b>syn. n.</b>
<i>Acidomyrmex</i> Emery	<i>Atopula</i> Emery <b>syn. n.</b>
<i>Ireneella</i> Donisthorpe <b>syn. n.</b>	<i>Macromischoides</i> Wheeler <b>syn. n.</b>
<b><i>Strongylognathus</i></b> Mayr	<i>T.</i> subgen. <i>Lobomyrmex</i> Kratochvil <b>syn. n.</b>
<i>Myrmus</i> Schenck	<i>T.</i> subgen. <i>Sulcomyrmex</i> Kratochvil <b>syn. n.</b>
<b><i>Teleutomyrmex</i></b> Kutter	<b><i>Triglyphothrix</i></b> Forel

Amongst these seven genera *Tetramorium* is by far the largest, exceeding all the other genera combined in number of species. This is also the genus showing the least number of specialised characteristics and is most probably the stem from which the other genera originally radiated. It is difficult to make generalizations about such highly specialized forms as *Anergates* and *Teleutomyrmex*, but the other four genera cluster closely around *Tetramorium* and are obvious derivations from it, mainly through a process of reduction in characters (lower palp formula and antennomere count, reduced dentition, loss of cephalic and clypeal median carinae etc.) and only more rarely by the development of characters not seen in *Tetramorium* itself, such as branched hairs in *Triglyphothrix* and falcate mandibles in *Strongylognathus*.

Concerning the age of the tribe, Brown (1973) points out that the Tetramoriini may well be a recent group as it is unrepresented in any mid-Tertiary or earlier fossil deposits, whereas most other large myrmicine tribes, including nearly all those which have numerous living genera and species, are well represented or abundant in these deposits. Also, Tertiary fossil forms of numerous small myrmicine tribes are present in the deposits.

It can be argued that as the major Tertiary deposits which yield properly identifiable ants (as opposed to fragments or impressions) are in the form of amber, then only arboreal or subarboreal forms would be expected to occur in such locations, and as most tetramoriines are terrestrial or subterranean they would be excluded from such fossiliferous systems.

However, it is also true that the number of arboreal/subarboreal species of modern *Myrmica*, *Leptothorax* etc. are few when compared with the sizes of the genera as a whole but tree-dwelling forms have been represented throughout the history of these genera, and it is most probable that *Tetramorium* at least of the tetramoriines has as many arboreal/subarboreal forms as the other genera mentioned at the present time. It is difficult to envisage that if such forms were present in mid-Tertiary times they would not have been attracted to the resin oozing from the trees to the same extent as species from other genera. One is left with two possibilities: either the tetramoriines were scarce or absent at that time or they had not then developed arboreal species. In either case there remains the conclusion that the vast radiation of this tribe must have occurred since mid-Tertiary times as its members are now numerous or abundant throughout the Old World



tropics and subtropics in all ecosystems, and are well represented in the southern Palaearctic region.

Wheeler (1914) was of the opinion that the members of the extinct Baltic amber genus *Nothomyrmica* resembled some species of *Tetramorium* but he did not include it in his section devoted to Tetramoriini, in which he actually placed *Parameranoplus*, *Stigmomyrmex* and *Enneamergus*, none of which are tetramoriine ants. I examined a Wheeler-determined specimen of *Nothomyrmica rudis* (Mayr) in MCZ, Cambridge and have reached the conclusion that the resemblances between this genus and the tetramoriines are superficial and do not indicate relationship. All this reinforces my belief that the tetramoriine radiation occurred after the formation of the Baltic amber deposits was concluded (i.e. post-Oligocene) and it is interesting to speculate upon whether the rise of the Tetramoriini was in any way responsible for the disappearance of earlier genera which originally occupied the environments now dominated by *Tetramorium* and its allies in the Old World tropics.

Concerning the relationships and derivation of the tribe as a whole it seems most probable, on grounds of habitus and morphology, that *Tetramorium* and *Myrmica* are descended from the same ancestral stock, and the more generalized leptothoracines also show similarities to these forms in construction of the body. Particularly interesting is the ease with which the relatively specialized dentitions of the leptothoracines and tetramoriines can be derived from the relatively generalized dentition of *Myrmica* in forms in which the general construction of the head and body are basically similar. In *Myrmica* the mandible has a long series of teeth which decrease in size from the apical to the basal and appear relatively unspecialized. In *Tetramorium* the number of teeth is usually less than in *Myrmica*, but not much less, and specialization has been achieved by reducing the basal series in size whilst maintaining the more apical 2–3 teeth as large. In generalized leptothoracines the trend has been towards a reduction in number of teeth rather than towards specialization of what is available, and the number of teeth has been reduced to a consistent count of five, in a decreasing size series from apex to base of the masticatory margin.

I consider the three tribes Myrmicini, Leptothoracini and Tetramoriini to be closely related and ultimately to have been derived from the same ancestral stock, which was most probably a creature closely resembling the modern genus *Myrmica*, but evidence proving or disproving this opinion is still very much incomplete.

### Tribe **TETRAMORIINI** Wheeler

Tetramorii Wheeler, 1910 : 141. Type-genus: *Tetramorium* Mayr.

Tetramoriini Wheeler; Emery, 1914a : 38.

The definition of the tribe is rendered difficult by the presence in it of two degenerate, workerless parasitic species which occupy two monotypic genera and exhibit many of the changes listed by Wilson (1971) as the 'inquiline syndrome'.



Disregarding these two species for the moment the remaining vast majority may be diagnosed by the possession in combination of the characters noted below.

*Diagnosis of worker and female Tetramoriini.* Myrmicine ants in which:

- 1, either dentition of 2-3 teeth apically, followed by a row of 3-7 denticles; never with a graded series of teeth and never with fewer than 6 teeth; *or* mandibles edentate and falcate;
- 2, palp formula never exceeding 4, 3;
- 3, sting with an apical or apicodorsal lamelliform appendage of varying shape;
- 4, anterolateral portions of clypeus raised into a ridge or shield-wall in front of the antennal insertions.

*Diagnosis of male Tetramoriini.* Myrmicine ants in which:

- 1, antennae with second funicular segment an elongate fusion-segment usually consisting of 3-4 antennomeres;
- 2, mandible dentate or falcate and edentate.

DEFINITION. The following formal definition includes all members of the tribe.

*Workers and females.* Ants belonging to the subfamily Myrmicinae with thick, usually strongly sculptured integument. Mandibles usually triangular or subtriangular, the masticatory margin with 2-3 large teeth apically, followed by a series of 3-7 denticles, the most frequent dental arrangement being 3 teeth plus 4 denticles, but never with less than 6 in all. Exceptions to this occur in *Strongylognathus* where the mandibles are falcate and edentate, and in the workerless parasitic genera *Anergates* and *Teleutomyrmex* where the mandibles are edentate and reduced. Palp formula 4,3 at maximum, the vast majority of the tribe with this PF value but reductions to 4,2; 3,3; and 3,2 are known and in parasitic forms the PF is 1,1. Anterolateral portions of clypeus in front of the antennal insertions raised into an acute ridge or shield-wall which is confluent with the sides of the broad median portion of the clypeus as a ridge or sharp edge. This feature is a modification of the clypeus itself and is not merely the result of the impression of the head immediately posterior to the lateral parts of the clypeus. The ridge is eroded in *Decamorium* and reduced in *Anergates*.

Antennae 10, 11 or 12-segmented, the three apical antennomeres forming a club. Antennal scrobes often present, situated above the eyes. Ocelli present in females, absent in workers. Anterior lobes of frontal carinae widely separated, the distance across the lobes in a straight line up to twice the distance from the edge of the lobe to the genal margin in full-face view.

Most free-living species with a longitudinal cephalic carina running down the midline of the dorsum of the head and continued on the clypeus as a median clypeal carina. This character is reduced or absent in parasitic or dulotic forms and in some free-living species either the cephalic or the clypeal part of the carina may be absent, but it is rarely completely absent.

In workers the alitrunk without dorsal sutures although the metanotal groove is generally impressed (not in *Triglyphothrix*). Females always winged when virgin, the alitrunk with a full complement of flight sclerites. Wing venation as in males, discussed below. Propodeal spiracle circular or subcircular, the propodeum itself usually armed with a pair of spines or teeth but exceptions to this occur in most genera. Metapleural lobes present, often acute or dentiform but by no means universally so. Legs generally with the femora more or less swollen, and often with a single simple spur on each of the middle and hind tibiae, but these are reduced or absent in many species.

Petiole pedunculate, the node either squamiform or nodiform, subsessile only in the workerless parasitic forms; the node never armed with spines or teeth, never with a massive antero-ventral process. Postpetiole very variable in shape. Sting well developed, with a lamelliform and translucent apical or apicodorsal appendage which may be spatulate, triangular, dentiform



or pennant-shaped. Absent only in *Anergates* and *Teleutomyrmex* where the sting is reduced and non-functional.

*Males.* Amongst the Myrmicinae the tetramoriine males are defined by the following combination of characters.

Antennae 9-, 10- or 11-segmented, the second funicular an elongate fusion-segment composed of 3-5 segments fused together. The usual antennomere count in the tribe is 10, the fusion-segment thus containing 4. Mandibles dentate except in *Strongylognathus* (falcate) and the workerless permanent social parasites where they are edentate and generally reduced. Palp formula as in worker/female. Eyes and ocelli present. Alitrunk with flight sclerites, all males winged except in *Anergates* where the male is pupoidal. Wing venation is remarkably stable throughout the tribe and marked reduction is shown only in *Teleutomyrmex* and *Anergates* female. The usual vein-pattern is illustrated in Text-figs 8, 16, 30, 41 and the reductions in Text-figs 23, 26. In *Anergates* female and *Teleutomyrmex*, *m-cu* cross-veins are variably present, usually being weak, incomplete or absent, but in the former *m-cu* is generally visible. In most species *cu-a* has shifted well back along *Cu* towards the wing-roots, but in *Anergates* female this shift is not so well marked as elsewhere in the tribe.

Mesoscutum and scutellum strongly developed, in profile the former overhanging the pronotum. Notauli usually present, at least with the anterior arms of the Y-shape visible, more rarely the notauli very reduced or absent. Parapsidal grooves present or absent. Genitalia usually partially retractile, more rarely apparently fully retractile. Gonopalmi present.

#### GENERA NEWLY EXCLUDED FROM TETRAMORIINI

##### **TETRAMYRMA** Forel

*Tetramyrma* Forel, 1912d : 766 [as subgenus of *Dilobocondyla*]. Type-species: *Dilobocondyla*

(*Tetramyrma*) *braunsi* Forel, op. cit.: 767; by monotypy.

*Tetramyrma* Forel; Forel, 1913a : 122. [Raised to genus.]

*Tetramyrma* Forel; Emery, 1914a : 42. [Transferred to Tetramoriini.]

There is little doubt that Forel's original placement of *Tetramyrma* outside the Tetramoriini was more accurate than Emery's (1914a) later transfer of this genus into the tribe, although it has since been retained there without question by later authors such as Wheeler (1922). On the present evidence the genus is certainly to be excluded from any further consideration of tetramoriine ants as both the included species lack all the basic tetramoriine characteristics. The palp formula is 5,3; the mandibles have five teeth in a decreasing-size series from apex to base; the sting lacks a lamelliform appendage apically and the clypeus is not raised into a ridge in front of the antennal insertions.

On the present evidence *Tetramyrma* shows affinities with the Ethiopian region species of *Leptothorax* in the construction of the head in general and the clypeus in particular, as this has a projecting, arcuate anterior margin which overlaps the base of the mandibles. On the other hand the metanotal groove is deeply impressed, a feature not encountered in other African *Leptothorax*. However, in overall appearance *T. braunsi* bears a striking resemblance to members of the *Leptothorax anacanthus*-group. I have examined a syntype of *L. maximus* (in MCZ, Cambridge) and compared it directly to the specimens of *T. braunsi* available; the similarities are obvious and it may be necessary to ask whether *Tetramyrma* can retain its identity or must be sunk as a synonym of *Leptothorax*.



In view of the above *Tetramyrma* is transferred for the time being into the tribe Leptothoracini, until its relationships can be studied in more detail. The species affected are as follows.

***Tetramyrma braunsi* (Forel)**

*Dilobocondyla* (*Tetramyrma*) *braunsi* Forel, 1912d : 767. Holotype worker, SOUTH AFRICA: Cape Colony, Willowmore (*Brauns*) (BMNH) [examined].  
*Tetramyrma braunsi* (Forel); Forel, 1913a : 122 et auctt.

***Tetramyrma simoni* (Emery)**

*Tetramorium simoni* Emery, 1895a : 35, pl. 2 fig. 22. LECTOTYPE worker, SOUTH AFRICA: Transvaal, Makapan (*E. Simon*) (MCSN, Genoa), here designated [examined].  
*Tetramyrma simoni* (Emery); Emery, 1922 : 291.

The two species are very closely related but in *simoni* the propodeum is armed with a pair of teeth which are absent in *braunsi*.

**IRENEOPONE Donisthorpe**

*Ireneopone* Donisthorpe, 1946b : 242. Type-species: *Ireneopone gibber* Donisthorpe, loc. cit; by original designation.

One of the seven ant species known to be endemic on the island of Mauritius (Brown, 1974), this odd monotypic genus was placed in the Tetramoriini by Donisthorpe without him giving any reasons for the placement. In fact many of the characters cited in the original description militate against the inclusion of *Ireneopone* in this tribe.

The mandibles have five teeth, regularly decreasing in size from apex to base (not three as stated in the original description; the two basals are concealed by the clypeus in the holotype but are visible in the single surviving paratype). Palp formula 5,3 (as opposed to 4,3 maximum in tetramoriines). Clypeus and head capsule without median longitudinal carinae. Lateral portions of clypeus not raised into a shield in front of the antennal insertions but the area below the insertions locally depressed behind the lateral parts of the clypeus. Sting without a lamelliform appendage apically.

***Ireneopone gibber* Donisthorpe**

*Ireneopone gibber* Donisthorpe, 1946b : 242, figs 1, 2. Holotype and paratype workers, MAURITIUS: Calebasses Mt., 22.x.1944, no 72 (*R. Mamet*); and Le Pouce Mt., 7.xii.1940 (*J. Vinson*) (BMNH) [examined].

Having shown that *Ireneopone* does not belong in the Tetramoriini, the problem is now to find its correct tribal placement. For the present I propose to transfer this genus to the tribe Myrmecini, close to the complex of small genera centring on *Terataner*. The reason for this is that, besides having the characters given



above, *Ireneopone* has the antennal insertions widely separated, the clypeus strongly inserted between them. The mesonotum is delimited by a raised portion in front and an impressed metanotal groove behind. The propodeum is unarmed and rounded metapleural lobes are present. The petiole has a long anterior peduncle and a low, narrow node which is rounded-subconical in profile and with a short posterior peduncle.

It is by no means claimed that this is the last word on the placement of this peculiar species; the final decision must await a revisionary study of the myrmecine genera.

### ***EUTETRAMORIUM* Emery**

*Eutetramorium* Emery, 1899 : 280. Type-species: *Eutetramorium mocquersyi* Emery, op. cit.: 281; by subsequent designation of Wheeler, 1911 : 163.

Since its description *Eutetramorium* has apparently always been treated as a *bona fide* member of tribe Tetramoriini, throughout all the varying concepts of this tribe (Wheeler, 1910; 1922; Emery, 1914a; 1922; Forel, 1917). The only reason for this appears to be the fact that the clypeus is raised laterally, in front of the antennal insertions. Other tetramoriine characters are lacking excepting the palp formula which has a typically tetramoriine count of 4.3. However, the basal segments of both palpi are very long and appear to be the result of the fusion of several shorter palpomeres (paralectotype of *E. mocquersyi* dissected). The critical lamelliform sting appendage is lacking, as is the differentiated tetramoriine dentition. I am presently of the opinion that *Eutetramorium* is better placed in the tribe Myrmicini as, beside the fact that the tibial spurs of the middle and hind legs are minutely barbulate or serrated, the general appearance of the head capsule, alitrunk and pedicel is very close to the *rugosa*-like species of *Myrmica* of the Oriental and south-eastern Palaearctic regions, some of which also have the lateral portions of the clypeus raised into a shield in front of the antennal insertions.

Both known species of this small genus are from Madagascar.

### ***Eutetramorium mocquersyi* Emery**

*Eutetramorium mocquersyi* Emery, 1899 : 281, fig. LECTOTYPE and paralectotype workers, MADAGASCAR: Antongil, 1897-1898 (*A. Mocquersyi*) (MCSN, Genoa), here designated [examined].

### ***Eutetramorium monticellii* Emery**

*Eutetramorium monticellii* Emery, 1899 : 283. Syntype worker and female, MADAGASCAR: Antongil, 1897-1898 (*A. Mocquersyi*) (MCSN, Genoa) [examined].

## **SPECIES NEWLY EXCLUDED FROM TETRAMORIINI**

### ***ROMBLONELLA* Wheeler**

*Romblonella* Wheeler, 1935 : 5. Type-species: *Romblonella grandinodis* Wheeler, op. cit.: 7 [= *Myrmica opaca* F. Smith, 1861 : 47]; by original designation.



A small and somewhat obscure genus of ants belonging to the tribe Meranoplini, which contains some seven species. On original description the genus was monotypic and, during the course of this study, it was discovered that *Tetramorium opacum* is in fact the senior synonym of the type-species of *Romblonella*. What is known of the genus is summarised in M. R. Smith (1953 : 1956), and this remains unchanged except for the following, which is now confirmed.

***Romblonella opaca* (F. Smith) comb. n.**

*Myrmica opaca* F. Smith, 1861 : 47. Holotype worker, SULAWESI: Tondano (*A. R. Wallace*) (UM, Oxford) [examined].

*Tetramorium opacum* (F. Smith); Donisthorpe, 1932 : 469

*Romblonella grandinodis* Wheeler, 1935 : 7, fig. 2. Syntype workers, PHILIPPINES: Romblon I., 6.v.1928 (*L. Marato*) (MCZ, Cambridge) [examined]. **Syn. n.**

**CHELANER** Emery

*Chelaner* Emery, 1914b : 410 [as subgenus of *Monomorium*]. Type-species: *Monomorium* (*Chelaner*) *forcipatum* Emery, loc. cit.; by subsequent designation of Emery, 1922 : 168.

*Chelaner* Emery; Ettershank, 1966 : 93. [Raised to genus.]

***Chelaner flavigaster* (Clark) comb. n.**

*Xiphomyrmex flavigaster* Clark, 1938 : 366, fig. 5. Syntype workers, AUSTRALIA: Sir Joseph Banks Islands, Reevesby I. (ANIC, Canberra.)

From Clark's original description it is obvious that *flavigaster* is not a tetramoriine, but its correct generic placement is difficult. For the identification of this species as a member of genus *Chelaner* I am indebted to Dr R. W. Taylor of ANIC, Canberra, who kindly examined the relevant type-material for me.

KEYS TO GENERA OF TETRAMORIINI

Workers

- 1 Mandibles narrow and falcate, edentate or at most with a single minute denticle close to the apex (Text-figs 13, 14) (Palaeartic) . . . **STRONGYLOGNATHUS** (p. 304)
- Mandibles triangular or subtriangular, dentate, with two or three enlarged teeth apically followed by a series of 3–7 denticles . . . . . 2
- 2 Some or all dorsal surfaces of head and body equipped with branched hairs which may be bifid, trifid or quadrifid, simple hairs often also present. Metanotal groove in profile not impressed. (Old World Tropics, but no known endemics in Australia or Madagascar) . . . . . **TRIGLYPHOTHRIX** (p. 310)
- Dorsal surfaces of head and body without bifid, trifid or quadrifid hairs; simple hairs usually present but some species with bizarre pilosity and some hairless. Metanotal groove often impressed . . . . . 3
- 3 Antennae with 10 segments (Ethiopian) . . . . . **DECAMORIUM** (p. 297)
- Antennae with 11 or 12 segments . . . . . 4
- 4 Palp formula 3,2. Head roughly heart-shaped (Text-figs 1–3) with sides convex and



- occiput concave, the head narrowing anteriorly. Median portion of clypeus with a prominent, arcuate anterior margin which overlaps the basal angle of the mandible. Median clypeal and median cephalic carinae vestigial or absent. (Old World Tropics) . . . . . **RHOPTROMYRMEX** (p. 298)
- Palp formula usually 4,3, very rarely reduced (one species known with PF 3,2). Head not heart-shaped. Median portion of clypeus with anterior margin not prominent, not overlapping the basal angle of the mandible. Usually both the median clypeal and median cephalic carinae present, more rarely with one or the other absent, very rarely with both absent. (Worldwide but with no Neotropical endemics, one Nearctic endemic). . . . . **TETRAMORIUM** (p. 359)

## Females (Queens)

- 1 Mandibles dentate, armed with 2-3 enlarged apical teeth followed by a row of 3-7 denticles . . . . . 2
- Mandibles edentate, either falcate or reduced . . . . . 5
- 2 Branched hairs present on some or all surfaces of the head, alitrunk, pedicel and gaster, either bifid, trifid or quadrifid . . . . . **TRIGLYPHOTHRIX** (p. 310)
- Branched hairs absent, simple hairs usually present although in some species pilosity is bizarre or absent . . . . . 3
- 3 Antennae with 10 segments . . . . . **DECAMORIUM** (p. 297)
- Antennae with 11 or 12 segments . . . . . 4
- 4 Palp formula 3,2. Median portion of clypeus with a prominent, arcuate anterior margin which overlaps the basal angle of the mandible. Median clypeal and median cephalic carinae vestigial or absent . . . . . **RHOPTROMYRMEX** (p. 298)
- Palp formula usually 4,3, rarely less. Median portion of clypeus without a prominent, arcuate anterior margin which overlaps the basal angle of the mandible. Median clypeal and median cephalic carinae usually present, sometimes one or the other absent, rarely with both absent . . . . . **TETRAMORIUM** (p. 359)
- 5 Anterior clypeal margin deeply emarginate or notched medially (Text-fig. 19). (Palearctic, Nearctic) . . . . . **ANERGATES** (p. 296)
- Anterior clypeal margin entire, not deeply emarginate or notched medially . . . . . 6
- 6 Mandibles falcate; palp formula 4,3. Postpetiole not broadly attached to first gastral tergite, gaster not dorsoventrally flattened. Sting present, with an apicodorsal appendage. Worker caste present . . . . . **STRONGYLOGNATHUS** (p. 304)
- Mandibles blade-like (Text-fig. 24); palp formula 1,1. Postpetiole very broadly attached to first gastral tergite, gaster strongly dorsoventrally flattened. Sting reduced and non-functional, without apicodorsal appendage. Worker caste absent. (Palearctic). . . . . **TELEUTOMYRMEX** (p. 309)

## Males

- 1 Mandibles edentate, either reduced or reduced-falcate . . . . . 2
- Mandibles dentate . . . . . 4
- 2 Pupoidal and apterous. Anterior clypeal margin deeply emarginate or notched medially . . . . . **ANERGATES** (p. 296)
- Winged, body fully developed or somewhat pupoidal. Anterior clypeal margin not emarginate or notched medially . . . . . 3
- 3 Mandibles short-falcate; palp formula 4,3. Gaster not downcurved, not reflexed anteriorly at the apex . . . . . **STRONGYLOGNATHUS** (p. 304)
- Mandibles blade-like and very reduced; palp formula 1,1. Gaster downcurved and somewhat reflexed anteriorly at the apex. . . . . **TELEUTOMYRMEX** (p. 309)



- 4 Some or all dorsal surfaces of head, alitrunk, pedicel and gaster with branched bifid, trifid or quadrifid hairs . . . . . **TRIGLYPHOTHRIX** (p. 310)  
 – Branched hairs absent; simple hairs usually present but bizarre pilosity present in some species . . . . . 5  
 5 Antennae basically 9-segmented, the three apical funicular segments enlarged or definitely incrassate. Palp formula 3,2 . . . . . **RHOPTROMYRMEX** (p. 298)  
 – Antennae 10 or 11-segmented, the funicular segments filiform, not incrassate apically. Palp formula usually 4,3 . . . . . **TETRAMORIUM** (p. 359) and **DECAMORIUM** (p. 297)

### **ANERGATES** Forel

(Text-figs 19–23)

*Anergates* Forel, 1874 : 32. Type-species: *Myrmica atratula* Schenck, 1852 : 91; by monotypy.

**DIAGNOSIS.** *Female.* Mandibles reduced, edentate except for the apical tooth. Palp formula 1,1 (Ettershank, 1966, here confirmed), the palps reduced. Clypeus with its median anterior margin broadly and deeply emarginate. Antennae 10- or 11-segmented with a variable degree of fusion of the second to fourth funicular antennomeres (at arrow in Text-fig. 19). Ocelli present (Text-fig. 19). Alitrunk with full set of flight sclerites, the virgin females winged (Text-fig. 23). Postpetiole strongly expanded, broadly attached to gaster (Text-fig. 21). Gaster in virgin females with a broad and deep longitudinal furrow or impression; mature females strongly physogastric. Sting strongly reduced, non-functional.

*Male.* Pupoidal and apterous. Mandibles lobiform, edentate, not capable of full closure (Text-fig. 20). Palp formula 1,1 as in female. Median anterior clypeal margin broadly and deeply emarginate. Antennae 10- or 11-segmented, the third funicular antennomere variably fused with the fourth (Text-fig. 20). Second funicular segment usually quite long when compared to those just distal to it and apparently is a shortened fusion-segment. Ocelli present. Alitrunk with flight sclerites but wings never developed. Petiole and post-petiole strongly anteroposteriorly compressed, roughly thick-disciform in shape and each very broadly attached to the following segment (Text-fig. 22). Apex of gaster reflexed ventrally. Genitalia large, strongly extruded.

The single species belonging to this genus, *A. atratulus*, is a degenerate, workerless, permanent social parasite in nests of *Tetramorium caespitum*. Emery (1922) placed *Anergates* in a subtribe Anergatini of tribe Solenopsidini, but Ettershank (1966), in his revision of the solenopsidine genera, excluded *Anergates* and suggested that the genus should be transferred to Tetramoriini on the grounds of its reduced antennal segmentation, wing venation and close parasitic association with *Tetramorium*. I am in agreement with this suggestion and believe that *Anergates* is developed from a *T. caespitum*-like ancestor although its origins can probably never be traced with certainty because of the many morphological adaptations made by this species in response to its parasitic lifeway. Wilson (1971) has listed 19 such characteristic adaptations of parasitic ants which he terms the 'inquiline syndrome', many of which apply to *Anergates*.

What is known of the biology of *Anergates* is summarised in Wheeler (1910), Creighton (1950), Kutter (1969), Wilson (1971) and their included references.

### *Anergates atratulus* (Schenck)

*Myrmica atratula* Schenck, 1852 : 91. Syntype female, male, GERMANY (WEST): Nassau distr., NW. of Frankfurt (*Schenck?*) (types possibly in MNHU, Berlin).

*Anergates atratulus* (Schenck); Forel, 1874 : 32.



*Anergates friedlandi* Creighton, 1934 : 193. Holotype female, U.S.A.: New Jersey, side of U.S. Highway 9, 3 miles N. of Englewood, 31.v.1932 (*S. Friedland*) (probably in MCZ, Cambridge, originally in Creighton private coll.). [Synonymy by Creighton, 1950.]

*A. atratulus* is distributed throughout Europe within the range of its host species and is also known from Ukraine and the U.S.A. from Connecticut to N. Virginia. To the best of my knowledge it has never yet been recorded outside the nests of its host although there is little doubt that the alate females fly when searching for new host colonies.

## DECAMORIUM Forel

(Text-figs 27-31)

*Decamorium* Forel, 1913a : 121 [as subgenus of *Tetramorium*]. Type-species: *Tetramorium* (*Decamorium*) *decem* Forel, loc. cit.; by monotypy.

*Decamorium* Forel; Emery, 1914a : 42. [Raised to genus.]

**DIAGNOSIS.** *Worker.* Mandibles armed with three teeth plus a series of 4-5 denticles; alternate members of the denticle series enlarged, in some cases with denticles doubled (Text-fig. 28). Palp formula 4,3 (dissections of *decem* and *uelense*). Antennae with 10 segments. Median longitudinal carina of clypeus absent, but present on dorsum of head capsule. Lateral raised portions of clypeus eroded and very reduced. Antennal scrobes strongly developed, with a marked dorsal margin but very poorly demarcated ventrally, median carina of scrobes absent (Text-fig. 27). Metanotal groove impressed; propodeum armed with a pair of short spines (Text-fig. 31). Apical lamelliform appendage of sting triangular, situated apicodorsally.

*Female.* As worker but with ocelli and flight sclerites; winged when virgin (Text-fig. 30).

*Male.* As *Tetramorium*.

This small genus contains only two species, is restricted to the Ethiopian region, and is but dubiously maintained as separate from *Tetramorium* on the grounds of the reduced antennal segmentation, reduced clypeal shield and the modified dentition in workers and females. In the long run none of these characters may be sufficient to keep *Decamorium* as a genus, for as can be seen, other genera in this tribe show variation in antennomere count; but at present no linking species between *Decamorium* and *Tetramorium* are known.

Of the two species, *decem* is reported by Arnold (1917) as forming quite large colonies in sandy soil, whereas *uelense* nests in twigs in leaf litter and humus and appears to form only small colonies. The habits of *decem* are not known but I have observed *uelense* in western Nigeria raiding a small subterranean termite colony in open woodland. The workers of *uelense* were leaving their nest (in a rotten twig) early in the morning and progressing in single file to the termite colony which was a few yards away. They moved through the leaf-litter and over a rotten branch in single file, almost nose to tail.

The two species of *Decamorium* are separated in the worker cast as follows.

- |   |   |                |
|---|---|----------------|
| 1 | Dorsum of promesonotum strongly and distinctly longitudinally striate, usually with scattered punctures also. (Ghana, Nigeria, Guinea, Zaire) | <i>uelense</i> |
| - | Dorsum of promesonotum smooth and shining, with scattered punctures. (Rhodesia, Gabon, Ghana)   | <i>decem</i>   |



## SYNONYMIC LIST OF SPECIES

*decem* (Forel).

*decem* var. *ultor* Forel **syn. n.**

*uelense* Santschi **stat. n.**

*decem* subsp. *nimba* Bernard **syn. n.**

## SUMMARY OF THE SPECIES

*Decamorium decem* (Forel)

(Text-figs 27-31)

*Tetramorium* (*Decamorium*) *decem* Forel, 1913a : 121. Syntype workers, RHODESIA: Redbank, 7.iv.1912 (G. Arnold) (BMNH; MHN, Geneva) [examined].

*Decamorium decem* (Forel); Emery, 1914a : 42. [Implied in text.]

*Tetramorium* (*Decamorium*) *decem* var. *ultor* Forel, 1913b : 217. Syntype workers, RHODESIA: Shiloh, 12.v.1913 (G. Arnold) (BMNH; MHN, Geneva) [examined]. **Syn. n.**

*Decamorium uelense* (Santschi) **stat. n.**

*Tetramorium* (*Decamorium*) *decem* st. *uelense* Santschi, 1923 : 285. Syntype worker, female, ZAIRE: Uelé, Vankerkhovenville (*Degreef*) (NM, Basle; MRAC, Tervuren) [examined].

*Decamorium decem* subsp. *nimba* Bernard, 1952 : 250. Holotype worker, GUINEA: Savane de Kéoulenta, st. 1 (*Lamotte*) (MNHN, Paris) [examined]. **Syn. n.**

*RHOPTROMYRMEX* Mayr

(Text-figs 1-12)

*Rhoptromyrmex* Mayr, 1901 : 18. Type-species: *Rhoptromyrmex globulinodis* Mayr, op. cit.: 20; by subsequent designation of Wheeler, 1911.

*Acidomyrmex* Emery, 1915b : 191 [subgenus of *Rhoptromyrmex*]. Type-species: *Rhoptromyrmex wroughtonii* Forel, 1902a : 231; by original designation. [Synonymy by Brown, 1964.]

*Ireneella* Donisthorpe, 1941 : 175. Type-species: *Ireneella papuensis* Donisthorpe, loc. cit.; by original designation. **Syn. n.**

DIAGNOSIS. *Worker*. Head including mandibles roughly heart-shaped in full-face view (Text-figs 1-3), with the sides strongly convex, the occipital margin concave and the head capsule much broader behind than in front. Anterior margin of median portion of clypeus projecting and broadly arcuate. Antennal scrobes absent. Median longitudinal cephalic carina vestigial (indistinguishable from surrounding sculpture) or absent. Antennae 11- or 12-segmented, the apical three forming a club. Mandibles with two apical teeth, a much smaller third tooth and a row of 4-6 denticles. Palp formula 3,2 (dissections of *melleus*, *wroughtonii*, *critchleyi*, *globulinodis*, *opacus*, *transversinodis*; see also Brown, 1964). Metanotal groove impressed, but only very feebly so in some specimens. Propodeum armed with a pair of spines in Oriental and Indo-Australian species, unarmed in those from the Ethiopian region (Text-figs 9, 10) except in *critchleyi* (Text-fig. 12). Ventral surface of petiole generally longitudinally keel-like and convex. Sting with a triangular or dentiform lamelliform appendage apicodorsally.

*Female*. Adapted for a (presumed) temporary social-parasitic lifeway. Generally details of antennal segmentation, palp formula, dentition and sting structure as in worker but in one or two species the mandibles modified towards a falcate condition or otherwise reduced.



Alitrunk usually compressed from side to side, narrow and deep in dorsal view but retaining a full set of flight sclerites, and winged when virgin (Text-figs 4, 5).

*Male.* Antennae basically nine-segmented, the second funicular being an elongate fusion-segment (Text-figs 6, 7). Partial freeing of the apical member of this fusion-series or partial fusion of the next antennomere may give an ambiguous count of 8, 9 or 10 segments in some specimens. Rarely the limits of the fused segments are all visible. The three apical antennomeres tend to be enlarged and are distinctly incrassate in Oriental and Indo-Australian species. Palp formula 3,2 as in worker (dissections of *melleus*, *globulinodis*, *transversinodis*). Notauli weakly developed or absent. Radial cell in forewing open or closed.

*Rhoptromyrmex* is a small genus of tetramoriine ants containing only six species, four of which occur in the Ethiopian region and the other two distributed in the Oriental and Indo-Australian regions. The workers are typically tetramoriine in most of their characters but have developed away from their basal stock (believed to be in *Tetramorium*) by developing the characteristic head shape seen in this genus and by the accompanying loss of antennal scrobes, reduction of palp segmentation and virtual or complete disappearance of the cephalic median carina.

Emery (1915b; 1922) separated a subgenus *Acidomyrmex* to include the two Oriental and Indo-Australian species, solely on the grounds that the propodeum is armed in the workers of these two species, whereas it was unarmed in the then-known workers of Ethiopian region species. Brown (1964) pointed out that the size of the propodeal spines was very variable in *wroughtonii* and that the female of *melleus* has the propodeum unarmed, whereas in the African species the propodeal armament is strongly developed in females of *transversinodis* (and in workers of the new species, *critchleyi*). To define a subgenus on a character which only the worker shows, and which is demonstrably variable in one species, seemed unrealistic and *Acidomyrmex* was placed in synonymy. The discovery of *critchleyi*, a species from Nigeria which has propodeal spines present, further validates Brown's conclusion.

The females of *Rhoptromyrmex* (Text-figs 4, 5) are either aberrant or very aberrant, and Brown (1964) points out that many of their modifications resemble those shown in other species which are known to be temporary social parasites. Whether this theory is correct still remains to be seen as *Rhoptromyrmex* plus host colonies remain unknown.

The males are again typically tetramoriine, being specialised only in their reduced palp formula and antennal segmentation, which is basically of nine antennomeres here as opposed to ten in the remainder of the tribe (Text-figs 6, 7). The males of five species are now known as the single member of the monotypic genus *Ireneella* appears to be the male of *melleus*. Donisthorpe (1941) distinguished his genus *Ireneella* from other tetramoriines on the following characters:

- 1, antennae with nine segments;
- 2, palp formula 3,2 (confirmed in present study);
- 3, notauli absent;
- 4, mesonotum not overhanging pronotum;
- 5, ocelli smaller;
- 6, antennae not filiform apically (i.e. they are clavate);



- 7, petiole is 'differently formed';
- 8, radial cell in forewing is open.

Disregarding those characters which are known to be variable within this tribe (numbers 5, 7, 8), what remains is virtually a characterisation of the males of genus *Rhoptromyrmex*. Comparison of the types of *I. papuensis* with males of other *Rhoptromyrmex* species confirmed the synonymy of *Ireneella* within *Rhoptromyrmex*. Further, the very close resemblance between the males constituting the type-series of *I. papuensis* and those of *wroughtonii* (the two are separated only on details of sculpture) leads me to believe that *papuensis* is in fact the male of *melleus*, previously unknown. Circumstantial evidence in favour of this assumption and weighing against *papuensis* being merely a more heavily sculptured male of *wroughtonii* than was previously known lies in the fact that *melleus* is known mainly from New Guinea, the locality of *papuensis*, whilst the range of *wroughtonii* is not known to extend to that island. I feel sure that the association of *papuensis* with *melleus* is valid, and that further collections of worker-associated *melleus* males will confirm this synonymy.

Nests of *Rhoptromyrmex* species may be very large and are made directly into the soil or under stones. Brown (1964) gives biological notes on some species and states that they are 'general feeders, the ants collect living and dead arthropods, tend homopterous insects for their honeydew both above and below ground, and feed at plant nectaries'.

#### SYNONYMIC LIST OF SPECIES

##### ***critchleyi* sp. n.**

##### ***globulinodis* Mayr**

*globulinodis* st. *alberti* Forel

*globulinodis* var. *obscurus* Santschi

##### ***melleus* (Emery)**

*papuensis* Donisthorpe **syn. n.**

##### ***opacus* Emery**

*opacus* var. *esta* Forel

*opacus* var. *laeviceps* Santschi

*opacus* subsp. *monodi* Bernard

##### ***transversinodis* Mayr**

*steini* Forel

*transversinodis* var. *pretoriae* Arnold

##### ***wroughtonii* Forel**

*wroughtonii* st. *rothneyi* Forel

*wroughtonii* st. *rothneyi* var. *longi* Forel

*rothneyi* var. *intermedia* Forel

*rothneyi* st. *sumatrensis* Forel

*rothneyi* subsp. *leno* Viehmeyer

*rothneyi* var. *taivanensis* Wheeler

All the above synonymy, with the exception of *melleus* = *papuensis*, is from the recent revision of *Rhoptromyrmex* by Brown (1964). Besides the above Brown



also removed a number of species originally described in *Rhoptromyrmex* and transferred them as follows.

*Rhoptromyrmex tessmanni* Forel, 1910b : 421; transferred to *Macromischoides* as a synonym of *M. africanus* (Mayr) [now in *Tetramorium*].

*Rhoptromyrmex solleri* Forel, 1910b : 430; transferred to *Monomorium* Mayr.

*Rhoptromyrmex mayri* Forel, 1912c : 57; transferred to *Hagioxenus* Forel.

#### KEY TO SPECIES

(Workers)

(based on Brown, 1964)

- 1 Propodeum armed with a pair of spines or teeth (Text-figs 11, 12) . . . . . 2
- Propodeum rounded, unarmed (Text-figs 9, 10) . . . . . 4
- 2 Antennae with eleven segments (Nigeria) . . . . . *critchleyi* (p. 303)
- Antennae with twelve segments (Indo-Australian and Oriental regions) . . . . . 3
- 3 Propodeal spines very long, about twice as long as the distance between the centres of their bases (Text-fig. 11) and just about as long as the maximum width of the pronotum. Sculpture of head predominantly finely and densely reticulate-punctate, longitudinal costulae obsolete or few and weak. (New Guinea; Australia: N. Cape York Peninsula) . . . . . *melleus*
- Propodeal spines variable in length but less than twice as long as the distance between the centres of their bases, and shorter than the pronotal width. Head and usually also the alitrunk with fine, close longitudinal costulation prominent in the sculpture. (Nepal, India, Burma, Thailand, S. China, Taiwan, Philippines, Borneo, Malaya, Sumatra, Java, Sumba, Australia: Cape York peninsula) . . . . . *wroughtonii*
- 4 Alitrunk and usually also the head with dense, opaque reticulate-punctate sculpture throughout. (Guinea, Uganda, Cameroun, Zaire) . . . . . *opacus*
- Head and alitrunk in large part smooth and shining (mainly southern Africa). . . . . 5
- 5 Postpetiole subglobular, in dorsal view up to about 1.5 times broader than long (Text-fig. 9); in profile with a prominent rounded ventral protuberance. (Zaire, Rhodesia, South Africa). . . . . *globulinodis*
- Postpetiole transversely subrectangular, about twice broader than long (Text-fig. 10); in profile without a prominent ventral protuberance. (Rhodesia, South Africa) . . . . . *transversinodis*

#### SUMMARY OF THE SPECIES

As the genus has been fully revised (Brown, 1964) full descriptions are not included here, but a summary of the species, their distribution and synonymy is given.

#### INDO-AUSTRALIAN AND ORIENTAL REGIONS.

##### THE *MELLEUS*-GROUP

##### *Rhoptromyrmex melleus* (Emery)

(Text-figs 2, 11)

*Tetramorium melleum* Emery, 1897 : 586, pl. 15, figs 29, 30. Holotype worker, NEW GUINEA: Belaio Island, near Friedrich-Wilhelmshafen (= Madang) (*L. Biro*) (HNM, Budapest).



*Rhoptromyrmex (Acidomyrmex) melleus* (Emery); Emery, 1922 : 290.

*Ireneella papuensis* Donisthorpe, 1941 : 175. Holotype and paratype males, NEW GUINEA: Papua, Mafula, 4000 ft, xii.1933 (L. E. Cheesman) (BMNH) [examined]. **Syn. n.** [See under discussion of genus.]

Distribution. New Guinea and Cape York Peninsula, Australia.

### ***Rhoptromyrmex wroughtonii* Forel**

(Text-fig. 7)

*Rhoptromyrmex wroughtonii* Forel, 1902a : 231. Syntype workers, male, INDIA: Kanara (Wroughton) (MHN, Geneva).

*Rhoptromyrmex wroughtonii* st. *rothneyi* Forel, 1902a : 232. Syntype workers, INDIA: Bangalore (Rothney) (MHN, Geneva). [Synonymy by Brown, 1964.]

*Rhoptromyrmex wroughtonii* st. *rothneyi* var. *longi* Forel, 1902a : 232. INDIA: Assam, Garo Hills (MHN, Geneva). [Synonymy by Brown, 1964.]

*Rhoptromyrmex rothneyi* var. *intermedia* Forel, 1913c : 80. Syntype workers, SUMATRA: Beras Tagi, 4500 ft (Buttel-Reepen) (MHN, Geneva). [Synonymy by Brown, 1964.]

*Rhoptromyrmex rothneyi* st. *sumatrensis* Forel, 1913c : 80, fig. W. Syntype workers, SUMATRA: Kampong Keling, near Beras Tagi, 4500 ft (Buttel-Reepen) (MHN, Geneva). [Synonymy by Brown, 1964.]

*Rhoptromyrmex* [sic] *rothneyi* subsp. *leno* Viehmeyer, 1914 : 113. Holotype worker, WEST MALAYSIA: Perak (E. Streesemann) (location of type not known). [Synonymy by Brown, 1964.]

*Rhoptromyrmex (Acidomyrmex) rothneyi* var. *taivanensis* Wheeler, 1930 : 103. Syntype workers, TAIWAN: Hakumo (R. Takahashi) (MCZ, Cambridge). [Synonymy by Brown, 1964.]

Distribution. India, Thailand, S. China, Philippines, Taiwan, Malaya, Indonesia to Sumba, Australia: Cape York Peninsula.

## ETHIOPIAN REGION.

### THE GLOBULINODIS-GROUP

### ***Rhoptromyrmex globulinodis* Mayr**

(Text-figs 1, 4, 6, 9)

*Rhoptromyrmex globulinodis* Mayr, 1901 : 20. Syntypes workers, female, male, SOUTH AFRICA: Port Elizabeth (NM, Vienna; BMNH) [examined].

*Rhoptromyrmex globulinodis* st. *alberti* Forel, 1916 : 419. Syntype workers, ZAIRE (Kohl) (MHN, Geneva). [Synonymy by Brown, 1964.]

*Rhoptromyrmex globulinodis* var. *obscurus* Santschi, 1932 : 339. Syntype workers, male, RHODESIA: Vumba Mts, Cloudland, 6000 ft, iv. 1923 (G. Arnold) (NM, Basle). [Synonymy by Brown, 1964.]

Distribution. Zaire, Rhodesia, South Africa.

### ***Rhoptromyrmex opacus* Emery**

*Rhoptromyrmex opacus* Emery in Forel, 1909 : 59 (footnote). Syntype workers, CAMEROUN (Conradt) (MCSN, Genoa).



*Rhoptromyrmex opacus* var. *esta* Forel, 1909 : 59. Syntype workers, females, males, ZAIRE: Bas Congo (BMNH; MHN, Geneva) [examined]. [Synonymy by Brown, 1964.]

*Rhoptromyrmex opacus* var. *laeviceps* Santschi, 1916 : 504. Holotype worker, ZAIRE: Boma (Bondroit) (NM, Basle). [Synonymy by Brown, 1964.]

*Rhoptromyrmex opacus* subsp. *monodi* Bernard, 1952 : 251, fig. 14F. Holotype worker, GUINEA: Mt Nimba, Ziéla, st. F 32, savane (*Lamotte*) (location of holotype not known). [Synonymy by Brown, 1964.]

Distribution. Guinea, Uganda, Cameroun, Zaire.

### *Rhoptromyrmex transversinodis* Mayr

(Text-figs 5, 8, 10)

*Rhoptromyrmex transversinodis* Mayr, 1901 : 22. Syntype workers, SOUTH AFRICA: Port Elizabeth (NM, Vienna; BMNH) [examined].

*Rhoptromyrmex steini* Forel, 1913a : 122. Syntype workers, SOUTH AFRICA: Cape Prov., Ladismith (*H. Brauns*) (MHN, Geneva). [Synonymy by Brown, 1964.]

*Rhoptromyrmex transversinodis* var. *pretoriae* Arnold, 1926 : 282. Syntype workers, female, male, SOUTH AFRICA: Pretoria, 21.iv.1915 (*C. K. Brain*) (BMNH) [examined]. [Synonymy by Brown, 1964.]

Distribution. Rhodesia, South Africa.

### *Rhoptromyrmex critchleyi* sp. n.

(Text-figs 3, 12)

*Holotype worker.* TL 2.7, HL 0.66, HW 0.64, CI 97, SL 0.42, SI 66, PW 0.42, AL 0.74. With the following combination of characters within the genus:

- 1, antennae with eleven segments;
- 2, propodeum armed with a pair of spines;
- 3, head, alitrunk and pedicel densely reticulate-punctate;
- 4, postpetiole in dorsal view subglobular, somewhat broader than long.

*Paratypes:* two workers. As holotype but measuring: TL 2.4–2.6, HL 0.60–0.64, HW 0.58–0.64, CI 97–100, SL 0.38–0.40, SI 63–65, PW 0.36–0.42, AL 0.66–0.72 (2 measured).

Holotype worker, NIGERIA: Ibadan, I.I.T.A. no. 34 G, 23–27.xi.1973 (*B. R. Critchley*) (BMNH).

Paratypes. 2 workers, as holotype but collected on 11–16.x.1973 (BMNH; MCZ, Cambridge).

Within the genus this species is very easy to distinguish as it is the only known species of the Ethiopian region in which propodeal spines are present in the worker caste, and it is the only member of the genus as a whole in which the antennae have eleven segments (as opposed to twelve in all other species).

Apart from its reduced antennomere count, *critchleyi* is a quite ordinary member of genus *Rhoptromyrmex* and tends to substantiate the synonymy of *Acidomyrmex* within this genus (see discussion above). It also shows again that the use of antennal segment number to diagnose the genera of Tetramoriini is unsatisfactory.



As in other genera the number of antennal segments varies in *Rhoptromyrmex* whilst other characters of diagnostic value at generic level remain constant. This is also seen to be true in *Tetramorium* and *Triglyphothrix*, where counts of 11 or 12, and 10, 11 or 12 respectively, have been recorded.

## ***STRONGYLOGNATHUS* Mayr**

(Text-figs 13–18)

*Strongylognathus* Mayr, 1853 : 389. Type-species: *Eciton testaceum* Schenck, 1852 : 117 [= *Myrmus emarginatus* Schenck, 1853]; by monotypy.

*Myrmus* Schenck, 1853 : 188. Type-species: *Myrmus emarginatus* Schenck, loc. cit.; by monotypy. [Junior homonym of *Myrmus* Hahn, 1832 : 81.]

**DIAGNOSIS.** *Worker.* Mandibles falcate, edentate or with a minute denticle which may occur near the apex in some individuals. Mandibular blades elongate, tapering, and curved from base to apex so that when their tips cross a space is enclosed between their inner margins and the anterior clypeal margin (Text-figs 13, 14). Palp formula 4,3 (dissections of *testaceus*, *afer*, *huberi*, *destefanii*). Median longitudinal carina of clypeus and head capsule absent. Antennal scrobes absent. Antennae 12-segmented, the three apical antennomeres forming a club. Metanotal groove feebly impressed; propodeum usually with a pair of very small teeth or denticles (Text-figs 17, 18), in some these are so reduced that the propodeum is virtually unarmed. Apicodorsal lamelliform appendage of sting triangular or pennant-shaped.

*Female.* As worker but with alitrunk possessing a full complement of flight sclerites, the queens winged when virgin. Ocelli present.

*Male.* Mandibles falcate and edentate as in worker and female, but relatively much smaller. Antennae 10-segmented, the second funicular forming an elongate fusion-segment as is usual in the tribe (Text-fig. 15).

Amongst the Tetramoriini *Strongylognathus* is easily distinguished by its remarkable falcate mandibles. The genus is restricted, as far as is known, to the Palaearctic region, ranging from North Africa to northern U.S.S.R., and from the British Isles to Korea and Japan. All species of the genus live in a dulotic, a rather degenerate obligate dulotic association, or as inquilines, in nests of *Tetramorium caespitum* (L.) and its close relatives. Information on the biology of the species may be found in Wheeler (1910), Stumper (1950), Kutter (1923; 1969), Wilson (1971), and the references included in these publications.

The taxonomy of the *huberi*-group species of western Europe has recently been worked out by Baroni Urbani (1969), and some species of eastern Europe and U.S.S.R. have been reviewed by Pisarski (1965), but a formal revision of the genus in its entirety has not yet been undertaken.

Roughly, the genus falls into two species-groups. The first of these includes only *testaceus* (Text-figs 13, 17) and *karawajewi*, in which the occipital angles are strongly produced, whilst the second includes all the remaining forms described to the present in which the occipital angles are not produced (Text-fig. 14). In the list and summary given below, no infraspecific taxa are recognized as throughout the other genera of this tribe they have proved illusory and in all cases have turned out to be either good species or synonyms of some other named form. In the light of these findings the infraspecific names remaining in *Strongylognathus*, after



the partial revisions of Pisarski (1965) and Urbani (1969) have been taken into account, are here all raised provisionally to the rank of species until a formal revision of the entire genus can be undertaken. This action applies to the names *foreli*, *ruzskyi*, *bulgaricus* and *italicus*, but is not to be taken as the last word on the subject. In fact, the variation shown between series constituting what are presently termed species in the *huberi*-group are in many cases extremely trivial and no greater than that found between different populations or nests of what are unquestionably the same species elsewhere in the tribe. I think that many of the species-level names in the genus may merely be localized populations and I am convinced that further collections and study will reduce the number of species in *Strongylognathus* to a much lower figure.

## SYNONYMIC LIST OF SPECIES

**testaceus**-group***karawajewi*** Pisarski***testaceus*** (Schenck)*emarginatus* (Schenck)*diveri* Donisthorpe**huberi**-group***afer*** Emery***alboini*** Finzi***alpinus*** Wheeler***bulgaricus*** Viehmeyer **stat. n.***kratochvili* Šilhavy***caeciliae*** Forel***ceconii*** Emery***christophi*** Emery***dalmaticus*** Baroni Urbani***destefanii*** Emery*huberi* st. *ceconii* var. *kutteri* Santschi***emeryi*** Menozzi***foreli*** Emery **stat. n.*****huberi*** Forel*huberi* var. *gallica* Emery***insularis*** Baroni Urbani***italicus*** Finzi **stat. n.*****kervillei*** Santschi***koreanus*** Pisarski***palaestinensis*** Menozzi***rehbinderi*** Forel***ruzskyi*** Emery **stat. n.*****silvestrii*** Menozzi

## SUMMARY OF THE SPECIES

THE *TESTACEUS*-GROUP***Strongylognathus karawajewi*** Pisarski

*Strongylognathus karawajewi* Pisarski, 1965 : 521, figs 40–43. Holotype and paratype workers,



U.S.S.R.: Crimea, Magaratsch 26.iii.1903 (*Rjasantev*) (MNHU, Berlin; Institute of Zoology, Kiev; Institute of Zoology, Warsaw).

Distribution. U.S.S.R.: Crimea.

***Strongylognathus testaceus* (Schenck)**

(Text-figs 13, 15, 16, 17)

*Eciton testaceum* Schenck, 1852 : 117. Syntype worker, female, male, GERMANY (WEST): Nassau distr., NW. of Frankfurt (coll. *Schenck*?) (location of types not known, perhaps in MNHU, Berlin).

*Strongylognathus testaceus* (Schenck); Mayr, 1853 : 389.

*Myrmus emarginatus* Schenck, 1853 : 188. Syntype workers, GERMANY (WEST): Nassau distr., NW. of Frankfurt (*Schenck*) (location of types not known, perhaps in MNHU, Berlin). [Synonymy by Mayr, 1853.]

*Strongylognathus diveri* Donisthorpe, 1936 : 113, figs 1, 2, 7. Holotype and paratype workers, ENGLAND: Dorset, Studland, Curlew Dyke, 5.v.1935 (*C. Diver*) (BMNH). [Synonymy by Brown, 1955.]

Distribution. Europe from Britain to the Caucasus and Ukraine, and from northern Europe to Italy.

THE *HUBERI*-GROUP

***Strongylognathus afer* Emery**

*Strongylognathus afer* Emery, 1884 : 380, footnote. Holotype female, ALGERIA: Daya (*Bedel*) (probably in MCSN, Genoa).

Distribution. Algeria, Tunisia.

***Strongylognathus alboini* Finzi**

*Strongylognathus huberi* subsp. *alboini* Finzi, 1924b : 121. Syntype workers, ITALY: Venezia Giulia, Monte Nanos, 28.v.1923 (*Finzi*) (MCZ, Cambridge).

*Strongylognathus alboini* Finzi; Urbani, 1969 : 141. [Raised to species.]

Distribution. Italy, Switzerland.

***Strongylognathus alpinus* Wheeler**

*Strongylognathus huberi* subsp. *alpinus* Wheeler, 1909 : 178, figs 1c, d. Syntype workers, females, males, SWITZERLAND: Zermatt, Matter Valley, 1,620 m, 13.viii.1909; same loc. 14.viii.1909; Zermatt, bank of Triftbach R., 18.viii.1909 (*W. M. Wheeler*) (MCZ, Cambridge).

*Strongylognathus alpinus* Wheeler; Urbani, 1969 : 140. [Raised to species.]

Distribution. Switzerland.

***Strongylognathus bulgaricus* Viehmeyer stat. n. (provisional)**

*Strongylognathus huberi* subsp. *rehbinderi* var. *bulgarica* Viehmeyer, 1922 : 211. Syntype workers, female, male, BULGARIA: Tirnowa (*F. Schimmer*) (probably in MNHU, Berlin).



*Strongylognathus rehbinderi* subsp. *bulgaricus* Viehmeyer; Pisarski, 1965 : 515. [Raised to subspecies.]

*Strongylognathus kratochvili* Šilhavy, 1937 : 5, figs 1-6. Syntype workers, female, CZECHOSLOVAKIA: W. Moravia, near Mohelno, 21.iii.1936 (*V. Šilhavy*) (location of types not known). [Synonymy by Pisarski, 1965.]

Distribution. Bulgaria, Czechoslovakia.

### *Strongylognathus caeciliae* Forel

*Strongylognathus caeciliae* Forel, 1897 : 132. Holotype female, SPAIN: central Spain, Pozuelo (*M. Cabrera y Diaz*) (probably in MHN, Geneva). [See also Urbani, 1969.]

Distribution. Spain.

### *Strongylognathus ceconii* Emery

*Strongylognathus huberi* subsp. *rehbinderi* var. *ceconii* Emery, 1908 : 24. Syntype workers, ITALY: Isole Tremiti, S. Nicola, Caprara (MCZ, Cambridge; probably also in MCSN, Genoa).

*Strongylognathus ceconii* Emery; Urbani, 1969 : 153. [Raised to species.]

Distribution. Italy.

### *Strongylognathus christophi* Emery

*Strongylognathus christophi* Emery, 1889a : 439. Lectotype female, U.S.S.R.: Volga, Sarepta (MCSN, Genoa), by designation of Pisarski, 1965.

Distribution. U.S.S.R.: N. shores of Caspian Sea northwards to Urals and vicinity of Kazan.

### *Strongylognathus dalmaticus* Urbani

*Strongylognathus dalmaticus* Urbani, 1969 : 154, figs 2F, 3F, 4F. Holotype and paratype workers, YUGOSLAVIA: Isola Busi (Archipelago Dalmata), 24.vii.1968 (*C. Baroni Urbani*) (NM, Basle; MCSN, Verona).

Distribution. Yugoslavia.

### *Strongylognathus destefanii* Emery

(Text-figs 14, 18)

*Strongylognathus destefanii* Emery, 1915c : 263. Holotype female, SICILY: Dintorni di Palermo (*De Stefani*) (probably in MCSN, Genoa).

*Strongylognathus huberi* st. *ceconii* var. *kutteri* Santschi, 1927 : 58. Holotype female, SICILY: Segesta (*H. Kutter*) (probably in NM, Basle). [Synonymy by Urbani, 1969.]

Distribution. Sicily.



***Strongylognathus emeryi* Menozzi**

*Strongylognathus emeryi* Menozzi, 1921 : 30, fig. 3. Holotype female, ITALY: Calabria, Sambiasse (probably in IE, Bologna).

Distribution. Italy; Calabria.

***Strongylognathus foreli* Emery stat. n. (provisional)**

*Strongylognathus huberi* var. *foreli* Emery, 1909 : 709, fig. 4. Holotype (?) worker, ALGERIA (probably in MCSN, Genoa). [See also Urbani, 1969 : 138; *foreli* may be worker of *afer*.]

Distribution. E. Algeria.

***Strongylognathus huberi* Forel**

*Strongylognathus huberi* Forel, 1874 : 71. Syntype workers, SWITZERLAND: Fully (MHN, Geneva; BMNH; MCZ, Cambridge).

*Strongylognathus huberi* var. *gallica* Emery, 1909 : 709. Syntype workers, FRANCE: Marseilles (probably in MCSN, Genoa). [Synonymy by Urbani, 1962.]

Distribution. S. France, Switzerland, N. Italy.

***Strongylognathus insularis* Urbani**

*Strongylognathus insularis* Urbani, 1968 : 470, figs 38, 39. Holotype and paratype workers, MALTA: Comino I., 24.iv.1965 (*C. Baroni Urbani*) (NM, Basle; MCZ, Cambridge; MCSN, Verona).

Distribution. Malta.

***Strongylognathus italicus* Finzi stat. n. (provisional)**

*Strongylognathus huberi* subsp. *italica* Finzi, 1924a : 14. Holotype female, ITALY: Isle of Elba, iv. 1921 (*Finzi*) (MCZ, Cambridge).

Distribution. Isle of Elba.

***Strongylognathus kervillei* Santschi**

*Strongylognathus kervillei* Santschi, 1921 : 113. Syntype workers, TURKEY: Angora prov. (*H. G. de Kerville*) (probably in NM, Basle).

Distribution. Turkey: Angora prov.

***Strongylognathus koreanus* Pisarski**

*Strongylognathus koreanus* Pisarski, 1965 : 519, figs 36–39. Holotype and paratype workers, KOREA: Myohyang Mts, 9.viii.1959 (*B. Pisarski* & *J. Proszynski*) (Institute of Zoology, Warsaw; MCZ, Cambridge).

Distribution. Korea.



***Strongylognathus palaestinensis* Menozzi**

*Strongylognathus palaestinensis* Menozzi, 1933 : 75, fig. 5. Holotype female, 'PALESTINE': Gebata (*Bodenheimer*) (probably in IE, Bologna).

Distribution. Palestine.

***Strongylognathus rehbinderi* Forel**

*Strongylognathus christophi* var. *rehbinderi* Forel, 1904 : 2. Syntype workers, U.S.S.R.: Caucasus, Neu Athos (= Novyj Afon) (*Rehbinderi*) (MHN, Geneva; MNHU, Berlin).

*Strongylognathus rehbinderi* Forel; Pisarski, 1965 : 512. [Raised to species.]

Distribution. Caucasus, E. shores of Black Sea.

***Strongylognathus ruzskyi* Emery stat. n. (provisional)**

*Strongylognathus huberi* subsp. *ruzskyi* Emery, 1909 : 711, fig. 6. Holotype worker, U.S.S.R.: Ural, Inderskaia-Gebirge (probably in MCSN, Genoa).

Distribution. Urals.

***Strongylognathus silvestrii* Menozzi**

*Strongylognathus silvestrii* Menozzi, 1936 : 292, fig. 14. Syntype workers, female, GREECE: Isole Rodi (= Rhodes), Mt Attairo, 800 m (= Mt Attaviros); Cattavia (probably in IE, Bologna).

Distribution. Rhodes I.

**TELEUTOMYRMEX Kutter**

(Text-figs 24-26)

*Teleutomyrmex* Kutter, 1950 : 82. Type-species: *Teleutomyrmex schneideri* Kutter, loc. cit.; by original designation.

**DIAGNOSIS.** *Female.* Mandibles blade-like, edentate except for the acute apical tooth. Palp formula 1,1; the maxillary palp with a second prominence standing beside it, resembling a second one-segmented palp. Antennae 10- or 11-segmented, the second to fourth funicular segments showing a variable degree of fusion. In specimens where antenna is distinctly 10-segmented then the second funicular is an elongate fusion-segment. Clypeus shallowly transversely concave. Ocelli present. Alitrunk with flight sclerites, winged in virgins; the alitrunk compressed from side to side; metapleural glands absent. Petiole sessile, postpetiole very broadly attached to first gastral segment. Gaster very strongly dorsoventrally flattened, the ventral surface concave; mature females physogastric. Sting very reduced, non-functional.

*Male.* Mandibles as female but much smaller. Palp formula 1,1. Antennae 10-segmented, the second funicular antennomere an elongate fusion-segment. Ocelli present; wings present but the remainder of the body appearing pupoidal. Gaster downcurved, somewhat reflexed anteriorly.

This genus contains a single species, *T. schneideri*, a degenerate workerless, permanent social parasite in nests of *Tetramorium caespitum*. The females of



*schneideri* are to be found riding upon the queen of the host colony, which is not killed. The males, as in *Anergates*, are pupoidal but unlike that genus the males of *schneideri* possess wings. As yet the species has not been recorded outside the nests of its host-species.

Apart from the original description, which contains a good deal of information, studies dealing with the biology, behaviour and anatomy of *T. schneideri* include those of Stumper (1950), Gösswald (1952), Kutter (1969), and a summary in Wilson (1971).

### *Teleutomyrmex schneideri* Kutter

*Teleutomyrmex schneideri* Kutter, 1950 : 82, figs 1-23. Syntype females, males, SWITZERLAND: Saas-Fee, 25.vii.1949 (*H. Kutter*) (in coll. Kutter; BMNH).

The species is known only from the type-locality and from a second collection made near Briançon in the French Alps (Collingwood, 1956).

## TRIGLYPHOTHRIX Forel

(Text-figs 32-73)

*Triglyphothrix* Forel, 1890 : cvi. Type-species: *Triglyphothrix walshi* Forel, op. cit.: cvii; by monotypy.

DIAGNOSIS. *Worker*. Mandibles with three teeth apically, the third smaller than the second, and followed by a row of three or four small or minute denticles; the arrangement 3 teeth + 4 denticles predominating (Text-fig. 36). Palp formula 4,3 (dissections of *lanuginosa*, *walshi*, *fulviceps*, *meshena*, *kheperra*, *brevispinosa*, *arnoldi*, *constanciae*, *eminii*, *gabonensis*, *rothschildi*, *inezulae*), often reduced to a 3,3 formula in minute species (dissections of *cryptica*, *muscorum*, *gestroi*, *furtiva*). Antennae with 10, 11 or 12 segments, the apical three forming a distinct club. The 12-segment count predominates, only three species are known with 11 and only one species (*decamera*) has 10 antennal segments, but this is known only in the female caste at present. Eyes present, at or in front of the middle of the sides of the head, usually large, rarely reduced. Frontal carinae very broad, the maximum span of the lobes often being more than twice the distance from the edge of the lobe to the side of the head in a straight line. Clypeus convex or angled in profile, with a median longitudinal carina extending its length (weak in some species). Median carina present along length of cephalic dorsum, a continuation of the median clypeal carina and usually very distinct, only in some heavily sculptured species is its track vague. Antennal scrobes usually present, broad and divided into upper and lower compartments by a longitudinal carina or ridge. In a few species the scrobes are reduced but very rarely are they completely absent (Text-figs 42, 44, 45). Alitrunk fusiform, without sutures; metanotal groove absent, the outline of the alitrunk unbroken in profile (Text-figs 52-72). Propodeum usually armed with a pair of spines or teeth, unarmed only in a very few species. Metapleural lobes present, often acute or dentiform. Petiole pedunculate, without a large ventral process. In species of the Ethiopian region there is a marked tendency for the petiole and postpetiole to be expanded laterally, transverse in dorsal view. Apicodorsal appendage of sting triangular, dentiform or pennant-shaped. A simple tibial spur is generally present on the middle and hind legs in large species, absent in smaller forms. Sculpture is usually coarse on head and alitrunk, the predominant sculpture being a dense rugoreticulum, but this differs in some species. Pilosity dense, at least some part of the head or body bearing regularly branched (bifid, trifid or quadrid) hairs, either with or without simple hairs also being present (Text-figs 32-35). Branched hairs are absent in only one species, which is suspected of a cleptobiotic lifeway.



*Female.* Generally as worker but virgin females fully alate, with flight sclerites and ocelli.

*Male.* Known for only a few species. With the general tetramoriine characters and also with branched hairs as in the workers and females. Antennae 10-segmented, the second funicular forming an elongate fusion-segment (Text-fig. 40). Palp formula 4,3 in the two species dissected (*constanciae*, *inezulae*), as worker. Whether the smaller species show the reduced palp formula of 3,3 in males as well as workers remains to be seen.

*Triglyphothrix* is a moderately sized genus containing some 55 presently recognized species, of which 33 occur in the Ethiopian region and the remaining 22 are distributed throughout the rest of the Old World tropics and subtropics, with the exception of Australia and Madagascar where only *lanuginosa* is present. This species is well known throughout the world as a very successful tramp species, and on occasion it is reported from hothouses or constantly heated buildings in temperate zones, as well as from localities in the tropics which are outside the range of the genus as a whole.

As far as is known, most species are predominantly cryptic foragers of the forest floor, although some have extended their range into savannah or open grass or woodland. One species, *arnoldi*, is apparently cleptobiotic in nests of large ponerine ants, nesting in the walls of their galleries and tunnels, and *microps* has also been recorded from a similar locality (Arnold, 1917). Apart from these the remaining species nest either directly into the soil, when a small crater-entrance may be produced, or under stones and logs, or in twigs or rotten wood in the leaf-litter layer. In some species the nests are made in twigs anywhere in the litter, but in others a definite site at the base of a standing tree appears to be preferred. No species are known to be arboreal or subarboreal in habits.

Most, if not all, species forage singly and move slowly, the more densely hairy species presenting a furry appearance to the naked eye. They are general predators and scavengers, collecting fresh or dead arthropods, but are not known to tend homopterous insects nor to visit plant nectaries.

Previous studies of the genus have dealt only with a limited number of species, on a regional basis. These include the work of Arnold (1917; 1926) on the South African fauna, Emery (1893), Forel (1902b) and Bingham (1903) on the Indo-Malayan fauna, and Mann (1919) on the New Guinea and Solomon Islands species.

The main outstanding feature of the genus as a whole is the possession of numerous or abundant branched hairs. These may be bifid, trifid or quadrifid and in a few species a mixture of two or more of these may be present. In many species simple hairs are also present on the dorsal surfaces, generally far fewer in number than their branched counterparts and in some species seeming to serve a specialized function as they occur only upon the leading edges of the antennal scapes or the dorsal surfaces of the upper margins of the antennal scrobes in a spaced row. The majority of species, however, have simple hairs upon the mouth-parts and around the gastral apex, although in a few these are absent. Only one species in the genus has lost its branched hairs (*arnoldi*) and I am sure that in this case it is a secondary development as branched hairs are present in the closest relatives.



## SPECIES OF THE ETHIOPIAN REGION

## SYNONYMIC LIST OF SPECIES

**paupera-group**

- antrema** sp. n.
- cryptica** sp. n.
- distincta** sp. n.
- menkaura** sp. n.
- minima** sp. n.
- muscorum** (Arnold)
- paupera** Santschi
- ericae* (Arnold) **syn. n.**

**osiris-group**

- osiris** sp. n.
- reptana** sp. n.
- yarthiella** sp. n.

**inezulae-group**

- arnoldi** Forel
- desertorum** Forel
- furtiva** Arnold
- gestroi** Menozzi
- imbellis** Emery
- inezulae** Forel
- hepburni* (Arnold) **syn. n.**
- hepburni* subsp. *mashonana* Arnold **syn. n.**
- microps** Mayr
- auropunctatus* Forel **syn. n.**
- auropunctatus* var. *pallens* Forel **syn. n.**
- auropunctatus* var. *fusciventris* Forel **syn. n.**
- auropunctatus* var. *rhodesiana* Forel **syn. n.**
- auropunctatus* var. *bulawayensis* (Arnold) **syn. n.**

- talpa** sp. n.
- tenebrosa** (Arnold) **stat. n.**
- trimeni** Emery

**rothschildi-group**

- rothschildi** Forel

**gabonensis-group**

- agna** Santschi
- baufra** sp. n.
- brevispinosa** Stitz **stat. n.**
- nion* Bernard **syn. n.**
- constanciae** (Arnold)
- longispinosa* Arnold **syn. n.**
- dedefra** sp. n.
- emenii** Forel
- marthae* Forel **syn. n.**
- marleyi* Forel **syn. n.**
- marleyi* var. *akermani* (Arnold) **syn. n.**
- guillodi* Santschi **syn. n.**
- guillodi* var. *mus* Santschi **syn. n.**
- cinereus* Weber **syn. n.**
- gabonensis** André
- gabonensis* st. *soyauxi* Forel **syn. n.**



*mucida* Forel **syn. n.**

*areolata* Stitz **syn. n.**

*gabonensis* var. *boulognei* Forel **syn. n.**

*gabonensis* var. *kamerunensis* Santschi **syn. n.**

*areolata* var. *burgeoni* Santschi **syn. n.**

**monardi** Santschi

**pulcherrima** Donisthorpe

**sericea** (Arnold) **stat. n.**

**silvestrii** Emery

**thoth** sp. n.

### THE SPECIES-GROUPS

**THE *paupera*-GROUP.** This group contains seven very small to minute species, all of which possess elongate simple hairs which project in a row along the anterior edges of the scapes and along the upper borders of the frontal carinae which form the dorsal margins of the scrobes. Hairs on the first gastral tergite are predominantly a mixture of simple and bifid, sometimes with a few trifid, hairs present but never with dense trifid or quadrifid pilosity.

Three of the species of this group (*antrema*, *cryptica*, *muscorum*) have only 11 antennomeres and have the palp formula reduced to 3,3 from its normal 4,3 value. The other four species have the normal antennomere count of 12. Most of the species are of west and central African origin, more or less confined to the rain forest zones, but *muscorum* occurs virtually throughout Africa where there is wet or riverine forest, and *paupera* is known only from Rhodesia. All seven species are denizens of the leaf-litter layer in forests.

**THE *osiris*-GROUP.** The three species of this small group show relationship to the *paupera*-group in that they possess a row of elongate simple hairs both on the leading edges of the antennal scapes and on the upper surfaces of the frontal carinae. They are, however, considerably larger than *paupera* and its allies and have the first gastral tergite covered with a dense mat of branched hairs which are predominantly or universally quadrifid.

The members of the group are only known from their type-localities, but the group as a whole shows a wide distribution, with *osiris* from Ghana, *reptana* from Uganda and *yarthiella* from Zambia.

**THE *inezulae*-GROUP.** Ten species are known in this group; they are characterised by the lack of long simple hairs on the antennal scapes and their presence in a row on the upper margins of the frontal carinae. Also in this group there is a tendency for the node of the petiole to be strongly compressed antero-posteriorly so that it is transverse in dorsal view.

This group is predominantly of eastern and southern Africa, with only a few species extending their range into the central and west African forest zones. A number of complexes of closely related species can be discerned within the group. One complex, consisting of *arnoldi*, *imbellis* and *microps*, has the eyes very reduced, their maximum diameter being distinctly less than the maximum width of the scape (in all other African species the eyes are larger than the maximum scape



width). This complex occurs mainly in southern Africa but *imbellis* is found in Ethiopia. The species *desertorum*, *inezulae*, *talpa* and *trimeni* possess sculpture on the basal portion of the first gastral tergite, and these species range from Zaire to South Africa. The two smallest species of the group, *furtiva* and *gestroi*, occur in forested areas in deep leaf-litter.

THE *rothschildi*-GROUP. Only a single species, *rothschildi*, is placed in this group and it is certainly the most aberrant member of the genus yet known from the Ethiopian region. The species is large, antennal scrobes are completely absent, and the anterior clypeal margin has a deep median emargination. *T. rothschildi* is widely but sporadically distributed in dry or semi-desert localities in Africa and appears to be the only African species in this genus to be adapted to such conditions.

THE *gabonensis*-GROUP. The largest species-group in the Ethiopian region, with 12 members, it also contains two of the most common species of the region. All members of this group are characterised by the lack of elongate simple hairs both on the scapes and on the upper surfaces of the frontal carinae. The body is usually stocky and abundantly covered with branched trifold or quadrifold hairs, giving the ant an urry appearance to the naked eye. Members of this group occur throughout the Ethiopian region, the preferred nesting sites of the species being in rotten wood or directly into the earth.

The species *agna* and *eminii* are closely related and have the antennal scrobes reduced and non-functional. Of the remainder *baufra*, *brevispinosa*, *constanciae* and *gabonensis* are quite large, active, relatively conspicuous species; the rest are smaller and tend to be more cryptic, inhabiting leaf-litter or, in the case of *pulcherrima*, sandy areas.

## KEY TO SPECIES

### (Workers)

*Note.* The worker of *desertorum* is not known but the queen is very close to that of *inezulae*. The worker, when found, would therefore be expected to key out at couplet 17.

- |   |  |                          |
|---|--|--------------------------|
| 1 | Antennae with 11 segments . . . . .  | 2                        |
| — | Antennae with 12 segments . . . . .  | 4                        |
| 2 | Dorsum of head and alitrunk finely but distinctly reticulate-regulose . . . . .  | 3                        |
| — | Dorsum of head with a few fine, scattered longitudinal rugulae with shining interspaces, alitrunk with scattered fine longitudinal rugulae, not reticulate-rugulose (Cameroun) . . . . .   | <i>antrema</i> (p. 318)  |
| 3 | Clypeus with a raised transverse carina at the level of the extreme anterior portions of the frontal carinae, the transverse carina as strongly developed as the median longitudinal carina which it crosses. Head and alitrunk yellow or yellow-brown. (Ivory Coast, Ghana, Cameroun, Uganda, Zaire, Gabon, C. African Repub., Angola, S. Africa, Mozambique) . . . . . | <i>muscorum</i> (p. 331) |
| — | Clypeus without a transverse carina crossing the median longitudinal carina. Head and alitrunk black or blackish brown. (Ghana) . . . . .  | <i>cryptica</i> (p. 321) |
| 4 | With the head in profile the antennal scrobe is either very short and shallow, without a sharp dorsal margin and not divided into upper and lower portions by a longitudinal carina, or is completely absent (Text-figs 42, 44, 45). The area  |                          |



- of the scrobe is generally as strongly sculptured as the remainder of the head and always has hairs arising within the scrobal area . . . . . 5
- With the head in profile the antennal scrobe developed, long and deep, reaching well beyond the posterior margin of the eye and with a sharp dorsal margin. Scrobe less strongly sculptured than the remainder of the head (except when head itself is unsculptured); without hairs arising within the scrobal area and generally divided into upper and lower portions by a median carina, at least anteriorly (Text-figs 43, 46-51) . . . . . 7
- 5 Propodeum unarmed, without spines or teeth. (Zaire) . . . . . **agna** (p. 317)
- Propodeum armed with a pair of spines or teeth . . . . . 6
- 6 Anterior border of clypeus broadly and deeply emarginate medially (Text-fig. 42). Basal portion of first gastral tergite finely, closely and densely longitudinally striate. Very large species, HW > 0.95, SL > 0.60. (Arid zones of Ghana, Ethiopia, Kenya) . . . . . **rothschildi** (p. 334)
- Anterior border of clypeus transverse, not emarginate medially (Text-fig. 44). Basal portion of first gastral tergite unsculptured or with a few pits from which hairs arise, not densely striate. Smaller species, HW < 0.85, SL < 0.60. (Ethiopia, Sudan, Nigeria, Kenya, Tanzania, Angola, S. Africa) . . . **emini** (p. 324)
- 7 Head, alitrunk, pedicel and gaster without branched hairs, all hairs simple and short. Dorsum of alitrunk finely and very densely reticulate-punctate, matt. [Presumed cleptobiont in nests of large ponerine ants.] (Rhodesia) . . . **arnoldi** (p. 318)
- At least part of head or body with branched hairs, bifid, trifid or quadrifid; additional simple hairs may be absent or present. Dorsum of alitrunk not densely reticulate-punctate . . . . . 8
- 8 Dorsal margins of frontal carinae which form the upper borders of the antennal scrobes behind the antennal insertions with a spaced row of elongate simple hairs which are distinctly longer than the surrounding (usually branched) hairs (Text-fig. 37). These long hairs are often erect but in some species are directed laterally; rarely similar long hairs may be present elsewhere on the dorsum of the head also . . . . . 9
- Dorsal margins of frontal carinae which form the upper borders of the antennal scrobes behind the antennal insertions either without a spaced row of elongate simple hairs or very rarely with a few simple hairs which are very short and do not project above the level of the surrounding branched hairs, not easily seen . . . 23
- 9 Propodeum without spines or teeth, with a pair of minute blunt tubercles which are much shorter than the metapleural lobes (Text-fig. 55) . . . . . 10
- Propodeum armed with a pair of spines or acute teeth which are usually longer than the metapleural lobes . . . . . 11
- 10 Dorsal surfaces of head and alitrunk unsculptured apart from the median carina on the head and a few scattered punctures. (Ghana) . . . . . **menkaura** (p. 328)
- Dorsal surfaces of head and alitrunk distinctly rugulose. (Ethiopia) . . . **imbellis** (p. 327)
- 11 Hairs on anterior (leading) edge of antennal scape of varying length, the longest being simple and at least as long as the maximum width of the scape. If the longest hairs are subequal to the maximum scape width then elongate simple hairs are present on the dorso-lateral pronotal margins which are distinctly longer and more conspicuous than the neighbouring branched hairs . . . . . 12
- Hairs on anterior (leading) edge of antennal scape of uniform length and generally branched, all distinctly much shorter than the maximum width of the scape, often less than half the maximum scape width and sometimes closely applied to the surface . . . . . 17
- 12 Strongly bicoloured species: head, gaster and usually also pedicel black; alitrunk, legs, antennae and mandibles clear yellow. (Ghana) . . . . . **distincta** (p. 323)
- Either uniformly coloured species or with the gaster somewhat darker than the head and alitrunk, but not bicoloured black and yellow as above . . . . . 13



- 13 Clypeus with a raised transverse carina at the level of the extreme anterior portions of the frontal carinae, the transverse carina as strongly developed as the median longitudinal clypeal carina which it crosses. (Ivory Coast, Ghana, Nigeria) *minima* (p. 330)
- Clypeus without a transverse carina crossing the median longitudinal carina. 14
- 14 First gastral tergite basally with a broad belt of coarse punctate sculpture which extends approximately over the basal one-third of the sclerite. (Zambia) *yarthiella* (p. 338)
- First gastral tergite basally without a belt of punctate sculpture, smooth and shining 15
- 15 Longest hairs on dorsum of head behind clypeus (discounting those on upper scrobe margins) distinctly shorter than the maximum vertical width of the eye with the head in profile. Small species,  $HW < 0.50$ ,  $SL < 0.35$ . (Rhodesia) *paupera* (p. 333)
- Longest hairs on dorsum of head behind clypeus (discounting those on upper scrobe margins) distinctly longer than the maximum vertical width of the eye with the head in profile. Larger species,  $HW > 0.50$ ,  $SL > 0.35$ . 16
- 16 Apical halves of mandibles longitudinally striate. First gastral tergite with a mixture of simple and bifid hairs, quadrifid hairs absent. Propodeal spines in profile not downcurved along their length. (Cosmopolitan tramp species) *lanuginosa* (p. 350)
- Apical halves of mandibles smooth and shining, with scattered small pits. First gastral tergite with hairs predominantly quadrifid. Propodeal spines in profile narrow and slightly downcurved along their length (Text-fig. 61). (Ghana) *osiris* (p. 332)
- 17 Eyes very small, their maximum diameter distinctly less than the maximum width of the antennal scape (Text-fig. 43). (Angola, Rhodesia, S. Africa) *microps* (p. 329)
- Eyes larger, their maximum diameter at least equal to the maximum width of the antennal scape, usually distinctly greater 18
- 18 Base of first gastral tergite immediately behind the postpetiole with a transverse band of dense and quite coarse punctate sculpture; this area distinctly more coarsely sculptured than the remainder of the tergite 19
- Base of first gastral tergite without a band of dense punctate sculpture immediately behind the postpetiole. Usually this area as smooth as the remainder of the tergite but if some faint shagreening is present then the species is large, with  $SL > 0.50$ . 21
- 19 Hairs on first gastral tergite almost entirely simple, with only one or two bifid or trifid hairs present. Colour uniform pale yellow-brown. (Zaire) *talpa* (p. 336)
- Hairs on first gastral tergite universally branched, bifid, trifid, without simple hairs present. Colour uniform medium to dark brown 20
- 20 Lower portion of antennal scrobe sculptured above the eye. The longitudinal carina which divides the scrobe into upper and lower portions indistinct, appearing only as a boundary to or continuation of the sculptured area beneath it. Smaller species,  $SL 0.34$  or less. (S. Africa) *trimeni* (p. 338)
- Lower portion of antennal scrobe not or only very faintly sculptured above the eye, the longitudinal carina dividing the scrobe into upper and lower portions sharp and distinct. Larger species,  $SL 0.38$  or more. (Zaire, Tanzania, Rhodesia, S. Africa) *inezulae* (p. 327)
- 21 Large species,  $HW 0.80$  or more,  $SL 0.50$  or more,  $PW 0.60$  or more. (Kenya, Mozambique) *tenebrosa* (p. 337)
- Small species,  $HW < 0.65$ ,  $SL < 0.45$ ,  $PW < 0.50$  22
- 22 Full adult colour black or blackish brown. Sculpture of dorsal alitrunk predominantly of quite coarse longitudinal rugulae which may be wavy or meandering. (Ghana, Cameroun, Gabon, Angola, Rhodesia) *furtiva* (p. 325)
- Full adult colour yellow or light yellow-brown. Sculpture of dorsal alitrunk a



- reticulum of fine rugulae, not predominantly longitudinal in direction (Uganda, Angola, Gabon) . . . . . **gestroi** (p. 326)
- 23 Propodeum without spines or teeth, in profile with only a pair of low, minute, obtuse tubercles (Text-fig. 56). (Uganda, Angola) . . . . . **dedefra** (p. 322)
- Propodeum armed with a pair of spines or acute teeth . . . . . 24
- 24 Head bright golden-yellow; alitrunk, pedicel and gaster blackish brown. Basal one-third to one-half of first gastral tergite with relatively coarse, regular longitudinal striation. (Uganda, Zaire). . . . . **pulcherrima** (p. 333)
- Unicolourous or the head, gaster or both darker in colour than the alitrunk, never as above. Basal one-third to one-half of first gastral tergite not regularly striate although in some species there is a band of punctate sculpture basally . . . . . 25
- 25 Anterior (leading) edge of antennal scape with a row of very long simple hairs, the longest of which are distinctly much longer than the maximum width of the antennal scape. (Uganda) . . . . . **reptana** (p. 334)
- Anterior (leading) edge of antennal scape with short, curved, usually branched hairs which are distinctly shorter than the maximum width of the scape . . . . . 26
- 26 Branched hairs on dorsal surfaces of head, alitrunk, pedicel and gaster strongly appressed, lying flat or nearly so against the surface of the sclerite from which they arise. (Rhodesia) . . . . . **sericea** (p. 335)
- Branched hairs on dorsal surfaces of head, alitrunk, pedicel and gaster erect or suberect on some or all of these surfaces . . . . . 27
- 27 Petiole node thickly crescentic in dorsal view. (Angola) . . . . . **monardi** (p. 331)
- Petiole node transverse, not crescentic in dorsal view . . . . . 28
- 28 Branched hairs on disc of first gastral tergite predominantly or universally trifid (Text-fig. 34) . . . . . 29
- Branched hairs on disc of first gastral tergite predominantly or universally quadrifid (Text-fig. 35) . . . . . 32
- 29 Lower portion of antennal scrobe below the median carina densely reticulate or rugulose throughout its length. (Rhodesia) . . . . . **baufra** (p. 319)
- Lower portion of antennal scrobe below the median carina mostly smooth and shining, not reticulate or rugulose throughout its length . . . . . 30
- 30 Mandibles smooth and shining with scattered small pits, not striate. Minute species, HW ca 0.54 at maximum. (S. Africa) . . . . . **thoth** (p. 337)
- Mandibles strongly longitudinally striate. Larger species, HW ca 0.68 at minimum 31
- 31 Petiole node in dorsal view with its anterior face convex. Larger species, HW ca 0.74 at minimum. Basal portion of first gastral tergite usually with punctures, generally sparse but sometimes coarse. (Guinea, Ivory Coast, Ghana, Togo, Nigeria, Cameroun, Uganda, Kenya, Sudan, C. African Repub., Gabon, Zaire) **brevispinosa** (p. 320)
- Petiole node in dorsal view with its anterior face flat and transverse. Smaller species, HW ca 0.68. Basal portion of first gastral tergite unsculptured. (Ethiopia.) . . . . . **silvestrii** (p. 336)
- 32 Median clypeal carina weak or petering out anteriorly. Postpetiole smooth or with only faint traces of sculpture. Larger species, HW 0.90 at minimum, SL 0.68 at minimum. (Sudan, Uganda, Cameroun, Gabon, Zaire) . . . . . **gabonensis** (p. 325)
- Median clypeal carina strongly developed. Postpetiole strongly sculptured. Smaller species, HW 0.84 at maximum, SL 0.54 at maximum. (Rhodesia, Tanzania) . . . . . **constanciae** (p. 321)

## TREATMENT BY SPECIES

*Triglyphothrix agna* Santschi

*Triglyphothrix agna* Santschi, 1935 : 264, figs 7–9. Syntype workers, ZAIRE: Bikoro, 28.ii.1921 (*H. Schouteden*); Eala, 12.i.1921 (*H. Schouteden*) (NM, Basle) [examined].



*Worker.* TL 3.5, HL 0.80, HW 0.76, CI 95, SL 0.60, SI 79, PW 0.58, AL 0.92.

Antennal scrobes absent, the area occupied by the scrobe in other species narrow in *agna*, strongly sculptured, and with numerous hairs arising from it. In full-face view the frontal carinae strongly marked only to the level of the eye, behind this becoming indistinguishable from the other sculpture. Anterior pronotal corners in dorsal view broadly rounded. Propodeal spines completely absent, the metapleural lobes reduced to low, rounded structures. Petiole and postpetiole transverse in dorsal view, broader than long. Dorsal surfaces of head, alitrunk and petiole finely and quite densely reticulate-rugose, the postpetiole retaining traces of this sculpture but mostly smooth. Gaster unsculptured. Entirely covered with a thick coat of fine, branched hairs. Elongate simple hairs completely absent from appendages and dorsum of head and body. Hairs on first gastral tergite almost universally trifid, with a few quadrifid hairs in the apical half. Colour brown.

Very distinct through its lack of both propodeal spines and antennal scrobes, *agna* is apparently known only from the type-collection. Two other species in the Ethiopian region lack scrobes, *rothschildi* and *eminii*, but in both these species propodeal armament is retained.

### *Triglyphothrix antrema* sp. n.

*Holotype worker.* TL 1.8, HL 0.48, HW 0.42, CI 89, SL 0.28, SI 67, PW 0.34, AL 0.48.

Antennae with 11 segments. Antennal scrobes strongly developed, deep, with an acute dorsal margin and well defined posteriorly and ventrally behind the eye. Median carina of scrobe distinct, reaching almost to the posterior margin of the eye. Clypeus with a very weak transverse carina crossing the median longitudinal carina and with a very strongly developed pair of lateral carinae. Propodeal spines short and acute, slightly longer than the metapleural lobes. Sculpture everywhere sparse, much of the integument smooth. Mandibles smooth with scattered small pits. Dorsum of head with median carina and with only 3-4 short, fine longitudinal rugulae on each side of it, without reticulation, the wide spaces between the rugulae shining. Dorsal alitrunk with sparse, widely spaced fine longitudinal rugulae, the spaces between them showing a faint trace of superficial sculpture but mostly shining. Pedicel segments finely and closely reticulate-rugulose, the gaster smooth and shining. Branched hairs present on all dorsal surfaces of head and body, predominantly bifid but with some trifid and even a few quadrifid hairs present, these last are best developed on the sides of the pedicel segments. Hairs on first gastral tergite predominantly simple but with a few bifid present. Dorsum of head with a row of elongate simple hairs spaced out along the upper margins of the antennal scrobes, and the antennal scapes with elongate simple hairs on the leading edge; the longest of these hairs are as long as the maximum width of the scape at least. Colour black, the antennae and femora dark brown, the tibiae of the legs yellowish white, contrasting strongly with the femora.

Holotype worker, CAMEROUN: WY [forest reserve of Ototomo, ca 40 km S. of Yaoundé] (G. Terron) (BMNH).

As can be seen from the description this minute species shares many characters with *muscorum* and *cryptica*, but the strongly reduced sculpture immediately isolates *antrema*.

### *Triglyphothrix arnoldi* Forel

*Triglyphothrix arnoldi* Forel, 1913b : 220. Syntype workers, RHODESIA: Shiloh, 10.v.1913 (G. Arnold) (MHN, Geneva; BMNH) [examined].

*Worker.* TL 2.4-2.9, HL 0.58-0.68, HW 0.54-0.64, CI 90-97, SL 0.32-0.40, SI 59-65, PW 0.42-0.50, AL 0.66-0.76 (12 measured).



Antennal scobes strongly developed, with an acute, flange-like upper margin and a well-marked median longitudinal carina. Eyes reduced, very small, their maximum diameter distinctly less than the maximum width of the scape. Propodeal spines short but acute, at least as long as the metapleural lobes. Dorsum of head with a few reduced, longitudinal rugulae, the spaces between which are reticulate-punctate. Mandibles striate, the antennal scobes reticulate-punctate. Dorsal surfaces of alitrunk and pedicel very finely and very densely reticulate-punctate, occasionally also with a few very faint rugulae which are almost completely effaced. Gaster usually completely smooth and shining but in a few individuals with a trace of sculpturation basally, very faint and weak. Branched hairs absent. Simple hairs numerous upon all dorsal surfaces, elongate on the dorsal surface of the upper scrobe margins. Colour yellow-brown, varying in shade, often with the gaster slightly darker than the head and alitrunk.

The only species in the Ethiopian region to lack branched hairs. This character, coupled with the reduced eyes and fine reticulate-punctate sculpturation on the alitrunk renders *arnoldi* very easily recognisable. Its closest relative is *microps*, but this species differs in its possession of numerous branched hairs and coarser, rugulose sculpture on the alitrunk. The similarities of the two species are striking, possibly through convergence due to lifeways, as both species have been recorded by Arnold (1917) as apparent plesibionts or cleptobionts, building their nests in the walls of galleries constructed by the much larger ponerine species *Platythyrea lamellosa* (Roger) and *Ophthalmopone berthoudi* Forel in the case of *arnoldi*, and *Platythyrea cribrinodis* (Gerstaecker) in the case of *microps*. In distribution both species are apparently restricted to southern Africa.

#### MATERIAL EXAMINED.

RHODESIA: Bulawayo, Hillside (G. Arnold); Bulawayo, Waterworks (G. Arnold); Bulawayo (G. Arnold).

### *Triglyphothrix baufra* sp. n.

(Text-figs 49, 57)

*Holotype worker.* TL 3.4, HL 0.80, HW 0.76, CI 95, SL 0.54, SI 71, PW 0.62, AL 0.92.

Upper portion of antennal scrobe strongly developed, deep; this upper section of the scrobe bordered below by a weakly developed median longitudinal carina. Below this carina the lower portion of the scrobe is virtually undeveloped and is sculptured throughout. Eyes large, their maximum diameter ca 0.22. (It is possible that the eyes are secondarily enlarged and have impinged upon the space formerly occupied by the lower portion of the scrobe.) Head in full face view with the sides distinctly convex, the eyes hemispherical and prominent. Propodeal spines short and acute. Mandibles smooth with scattered pits and a few small, longitudinally directed impressions, but not striate. Dorsum of head, alitrunk and petiole finely and densely reticulate-rugose, the postpetiole much more weakly sculptured, with superficial punctures or shagreening only. Gaster unsculptured. All dorsal surfaces with abundant branched hairs, those on the first gastral tergite universally trifid. Elongate simple hairs absent.

*Paratype workers.* As holotype, with dimensions TL 3.1–3.4, HL 0.78–0.82, HW 0.74–0.78, CI 94–96, SL 0.48–0.54, SI 65–71, PW 0.58–0.62, AL 0.88–0.94 (5 measured).

Holotype worker, RHODESIA: Somabula forest, 25.viii.1918 (G. Arnold) (BMNH),  
Paratypes. 8 workers, same data as holotype (BMNH; MCZ, Cambridge; NM, Bulawayo).



These nine specimens were placed amongst the Arnold collection material in the BMNH and NM, Bulawayo close to *constanciae*, with a small label stating '*constanciae* var.'. These specimens are now recognised as a distinct species, closely related to *constanciae* but separable by the different form of the scrobe, the markedly convex sides of the head, larger eyes, shorter propodeal spines and trifold gastral hairs (quadrifold in *constanciae*).

***Triglyphothrix brevispinosa* Stitz stat. n.**

(Text-figs 50, 58)

*Triglyphothrix gabonensis* var. *brevispinosus* Stitz, 1910 : 144. LECTOTYPE worker, Togo: Bismarckburg (*Conradt*) (MNHU, Berlin), here designated [examined].

*Triglyphothrix nion* Bernard, 1952 : 248, fig. 14B. Syntype workers, GUINEA: Crête Nion, 1300 m, st. B6-26. 19/4 (*Lamotte*) (MNHN, Paris) [examined]. **Syn. n.**

*Worker*. TL 3.2-3.9, HL 0.74-0.90, HW 0.74-0.90, CI 98-103, SL 0.50-0.60, SI 65-73, PW 0.50-0.62, AL 0.80-0.94 (12 measured).

Antennal scrobes strongly developed, with an acute dorsal margin and generally with the lower margin well defined behind the eye. Median longitudinal carina of scrobe distinct, in some populations the carina broken, branched or doubled above the eye. This condition is caused by the presence of a secondary carina arising below the median and running towards it posteriorly. The two meet or nearly meet above the eye and sometimes run parallel for a short distance. The development of this secondary carina varies amongst individuals of the same series, and in a number of workers is completely absent. Propodeal spines of moderate length, tapering apically and acute; metapleural lobes rounded. Head usually irregularly finely longitudinally rugulose, generally with faint reticulation posteriorly, more rarely strongly reticulate posteriorly and yet more rarely with the sculpture almost effaced so that the cephalic median carina forms the only distinct marking on the dorsum. Alitrunk and petiole usually finely reticulate-rugose, longitudinally rugose in some due to the suppression of transverse rugulae. Postpetiole usually less strongly sculptured than petiole. First gastral tergite generally with a band of punctate sculpture basally; this is often best developed in West African samples but may be reduced, faint or absent in different populations. Mandibles striate. Head, body and appendages densely coated with fine, branched hairs; elongate simple hairs absent from dorsal surfaces and appendages. Hairs on first gastral tergite universally trifold. Colour brown, of varying shades.

A widely distributed forest-inhabiting species, reasonably common in West Africa. I have found this species both in primary forest and more open woodland in Nigeria and Ghana and the nests in these localities have been made directly into the soil below any leaf-litter layer which may be present. The ants are slow-moving and have a distinctly furry appearance to the naked eye. Individual workers forage in the leaf-litter and on or in any rotten wood which is partially embedded in the litter layer. Specimens have been collected by Leston in Ghana by the pyrethrum knockdown technique, which implies that *brevispinosa* workers occasionally ascend trees, though I have never observed this behaviour myself.

The closest related species to *brevispinosa* is the dubiously separated *silvestrii* (see there), but other allies include *gabonensis* and related forms. Wheeler (1922) recorded *brevispinosa* from the stomachs of toads in Zaire under the name *T. mucidus*. This is just one of many misidentifications of *gabonensis*-group species which have occurred in the past, and earlier distribution records of these species should be treated with caution until the actual specimens can be checked.



## MATERIAL EXAMINED.

IVORY COAST: Banco Forest (*W. L. Brown*). GHANA: Bunso (*D. Leston*); Tafo (*Strickland*); Tafo (*B. Bolton*); Mt Atewa (*B. Bolton*). NIGERIA: Gambari (*B. Bolton*). CAMEROUN: no loc. (*G. Terron*). GABON: Ile aux Singes (*J. A. Barra*). ZAIRE: Ituri Forest (*T. Gregg*); Boyulu (*H. O. Lang*); W. side Ruwenzori (*N. A. Weber*). UGANDA: Archip. Sesse (*E. Bayon*); Jinja (*G. Arnold*). SUDAN: Imatong Mts (*N. A. Weber*). CENTRAL AFRICAN REPUBLIC 'Ubangi Shari': Haut Mbomu (*N. A. Weber*). KENYA: Kaimosi Mission, NE. of Kisumu (*E. S. Ross & R. E. Leeck*).

*Triglyphothrix constanciae* (Arnold)

*Tetramorium* (*Triglyphothrix*) *constanciae* Arnold, 1917 : 339, pl. 7, figs. 94, 94a. Syntype workers, RHODESIA: Matopo Hills, World's View, 23.v.1915 (*G. Arnold*) (BMNH; NM, Bulawayo; MCZ, Cambridge) [examined].

*Triglyphothrix longispinosa* Arnold, 1956 : 68, fig. 17. Paratype workers, RHODESIA: Chirinda Forest, 5.xi.1955 (*G. Arnold*) (NM, Bulawayo; BMNH) [examined]. **Syn. n.**

*Worker*. TL 3.0–3.6, HL 0.72–0.86, HW 0.70–0.84, CI 97–100, SL 0.48–0.54, SI 63–68, PW 0.52–0.64, AL 0.78–0.96 (12 measured).

Antennal scrobes strongly developed, with an acute dorsal margin and a distinct median, longitudinal carina. Propodeal spines long and acute, in profile two or more times longer than their basal width. Cephalic median carina well developed on the clypeus. Mandibles striate. Dorsal surfaces of head, alitrunk and petiole reticulate-rugulose, the postpetiole similarly but somewhat more faintly sculptured. Branched hairs dense everywhere, generally universally quadrifid on first gastral tergite, much more rarely with a few trifid hairs present. Elongate simple hairs absent from dorsal surfaces of head and body, and from appendages. Colour uniform mid-brown, the appendages lighter.

Closely resembling *gabonensis*, this species is distinguished by its smaller size, more strongly sculptured postpetiole and distinctly developed median clypeal carina. In *gabonensis* the postpetiole is generally smooth or with only vestigial sculpture and the median clypeal carina is poorly developed, or incomplete anteriorly, or more rarely absent. More distantly *constanciae* is related to *baufra* and *brevispinosa* but in these species the hairs on the first gastral tergite are universally trifid.

## MATERIAL EXAMINED.

TANZANIA: Zanzibar, Mdo (*M. J. Way*).

*Triglyphothrix cryptica* sp. n.

*Holotype worker*. TL 1.9, HL 0.52, HW 0.46, CI 88, SL 0.32, SI 70, PW 0.34, AL 0.52.

Antennae with 11 segments. Antennal scrobes strongly developed, with an acute dorsal margin and a marked median, longitudinal carina. Alitrunk in dorsal view short and broad, AL approximately 1.53 times PW. Propodeal spines short and acute, about as long as the metapleural lobes in profile. Dorsal surfaces of head, alitrunk and petiole finely reticulate-rugose, the spaces enclosed by the reticulae finely punctulate. Postpetiole and gaster smooth and shining; mandibles smooth with scattered small pits, not striate. Clypeus without a strong transverse carina crossing the median longitudinal carina. Antennal scapes with numerous short hairs and the leading edges also with a number of long, simple, erect or suberect curved hairs which are as long as or longer than the maximum width of the scape.



Dorsum of head with numerous branched hairs, usually trifid, and with long, simple hairs which are erect and very conspicuous, projecting far above the level of the branched hairs. Hairs of first gastral tergite predominantly a mixture of simple and bifid, but with a few trifid hairs also, particularly in the basal half. Outer surfaces of middle and hind tibiae without elongate, simple hairs. Colour black, the appendages yellow-brown.

*Paratype workers.* TL 1.9–2.1, HL 0.52, HW 0.46, CI 88, SL 0.30–0.32, SI 69–70, PW 0.32–0.34, AL 0.52 (2 measured). As holotype but colour somewhat lighter, a very dark brownish black. The mouthparts of one paratype were dissected, giving a palp formula of 3,3.

Holotype worker, GHANA: Mt Atewa, 31.vii.1969, primary forest (*D. Leston*) (BMNH).

Paratypes. 2 workers with same data as holotype (BMNH; MCZ, Cambridge).

This small species is closely related to *muscorum*, sharing the reduced antennomere count and palp formula. It differs from *muscorum* by being much darker in colour and lacking a transverse clypeal carina. *T. cryptica* tends to have a slightly broader head and longer antennal scapes than *muscorum*, at least in the material examined; compare the CI and SI above with *muscorum* CI 91–95, SI 57–64.

### *Triglyphothrix dedefra* sp. n.

(Text-figs 48, 56)

*Holotype worker.* TL 2.3, HL 0.60, HW 0.56, CI 93, SL 0.42, SI 75, PW 0.38, AL 0.60.

Antennal scrobes strongly developed, in profile with an acute dorsal margin, a well-defined median longitudinal carina and a distinct ventral margin behind the eye. In front of the eye the ventral scrobe margin is less marked than behind. Eyes quite small, their maximum diameter about equal to the maximum width of the scape. Propodeal spines absent, in their place is a pair of broad, low, rounded tubercles which are less than half the size of the metapleural lobes. Node of petiole in dorsal view narrow, not anteroposteriorly compressed and transverse. Dorsum of head feebly longitudinally rugulose, shining, the rugulae irregular and broken in places. Dorsal alitrunk with sculpture almost effaced; a few faint, low rugulae are present but are superficial. First gastral tergite unsculptured but the petiole and post-petiole with traces of sculpture. Branched hairs numerous on all surfaces, universally trifid on the first gastral tergite. Elongate, simple hairs absent. Colour uniform light brown, shining.

*Paratype workers.* TL 2.3–2.5, HL 0.60–0.62, HW 0.54–0.58, CI 90–94, SL 0.42–0.44, SI 75–78, PW 0.36–0.40, AL 0.60–0.62 (3 measured). As holotype but two are slightly darker in colour and have the cephalic sculpture somewhat more strongly defined.

Holotype worker, ANGOLA: 7 mls W. Gabela, 16–18.iii.1972 (A30) (*P. M. Hammond*) (BMNH).

Paratypes. 3 workers with same data as holotype (BMNH; MCZ, Cambridge).

The absence of propodeal spines coupled with the lack of simple, elongate hairs and presence of very well developed antennal scrobes make this species quite conspicuous. The type-series was obtained from a berlese funnel sample of wet-forest litter.

Another specimen of this species is present in MCZ, Cambridge from UGANDA: (Kenya-Uganda border) Busnia (= Busia?), 17.ii.1948 (*N. A. Weber*). It is in rather poor condition and is not included in the type-series.



*Triglyphothrix desertorum* Forel

*Triglyphothrix desertorum* Forel, 1910a : 20. Syntype females, males, SOUTH WEST AFRICA: Kalahari, 'zwischen Kgokong und Kang' (L. Schultze) (MHN, Geneva; BMNH; MCZ, Cambridge) [examined].

This species remains known only from the series of females and males mentioned above. The females may very well be associated to the workers at present named *inezulae*, the queens of which are not known, and the males of *desertorum* and *inezulae* are certainly very similar.

In the *desertorum* females the scrobes are well developed, with a median longitudinal carina. Long, simple hairs are present on the upper edges of the dorsal scrobe margins which are longer than the neighbouring branched hairs, and the basal portion of the first gastral tergite has a band of punctate sculpturation. The pronotum is 'square-shouldered' in dorsal view and the propodeal spines are acute but quite short.

All these characters are also possessed by the worker caste of *inezulae*, but here the gastral hairs are trifid whilst in *desertorum* a number of bifid or even simple hairs are present.

There is little doubt in my mind that *inezulae* could very well be the worker caste of *desertorum*, but the differences in gastral pilosities may be of importance and so I have refrained from synonymizing the two. The solution to this problem must obviously await either the discovery of the worker caste of *desertorum* or the queen caste of *inezulae*, so that they can be directly compared.

*Triglyphothrix distincta* sp. n.

*Holotype worker.* TL 1.8, HL 0.46, HW 0.42, CI 91, SL 0.28, SI 66, PW 0.32, AL 0.52.

Antennal scrobes strongly developed, with an acute dorsal margin and a distinct median longitudinal carina. Ventral margin of scrobe well defined behind the eyes. Propodeal spines short and acute, about as long as the metapleural lobes. Promesonotum evenly and shallowly convex in profile, the propodeal dorsum sloping strongly towards the spines. Occipital margin of head shallowly indented medially in full-face view. Dorsum of head with fine, longitudinal rugulae which tend to form a weak reticulum on the extreme posterior portion. Alitrunk finely reticulate-rugose on pronotal dorsum and to some extent on the propodeum; on the mesonotum the rugulae tend to be longitudinal, with very few cross-meshes. Dorsum of petiole and postpetiole rugulose. Gaster unsculptured, smooth. Dorsal surfaces of head and alitrunk with numerous short, branched hairs and also with elongate simple hairs. Leading edge of antennal scape with a number of elongate simple hairs. Hairs on first gastral tergite simple. Colour distinctive, the head capsule, pedicel and gaster black, contrasting strongly to the yellow alitrunk, legs, antennae and mandibles.

*Paratype workers.* TL 1.7–1.9, HL 0.44–0.48, HW 0.40–0.44, CI 90–92, SL 0.26–0.28, SI 62–66, PW 0.28–0.34, AL 0.46–0.52 (7 measured). As holotype but some with the head and gaster blackish brown and the alitrunk a deeper shade than the clear pale yellow of the holotype. In the Mampong paratype series the head is somewhat more coarsely sculptured. One or two paratypes have a few bifid hairs basally on the first gastral tergite.

Holotype worker, GHANA: Tafo, 31.viii.1970, litter sample (B. Bolton) (BMNH).

Paratypes. 3 workers with same data as holotype, and 4 workers, 1 female, GHANA: Mampong, 26.i.1970 (P. Room) (BMNH; MCZ, Cambridge; MHN, Geneva).



This small, brightly coloured species is closest related to *minima* but this species is a uniform dark brown. Both series of *distincta* mentioned above came from samples of leaf-litter taken in dense forest. It is likely that this species nests in twigs in the litter layer. A similarly coloured species of *Tetramorium*, *T. flavithorax* Santschi, occurs sympatrically with *distincta* in West Africa but of course this species lacks branched hairs and has 11-segmented antennae and a spatulate appendage on the sting.

### *Triglyphothrix eminii* Forel

(Text-figs 44, 45, 54)

*Triglyphothrix eminii* Forel, 1894 : 79. Syntype workers, ETHIOPIA: 'Südabessinien', Harar (Ilg) (MHN, Geneva) [examined].

*Triglyphothrix marthae* Forel, 1911 : 265. Holotype worker, TANZANIA: Zanzibar (ZM, Munich) [examined]. **Syn. n.**

*Triglyphothrix marleyi* Forel, 1914 : 221. Holotype worker, SOUTH AFRICA: Natal, Krantz Kloof, 24.v.1914 (*H. B. Marley*) (MHN, Geneva) [examined]. **Syn. n.**

*Tetramorium* (*Triglyphothrix*) *marleyi* var. *akermani* Arnold, 1926 : 276. Syntype workers, SOUTH AFRICA: Pietermaritzburg, 7.viii.1917 (*C. Akerman*) (BMNH; NM, Bulawayo) [examined]. **Syn. n.**

*Triglyphothrix guillodi* Santschi, 1937a : 231. Syntype workers, ANGOLA: Ebanga, no. 141, 26.ix.1932 (*Monard*) (MHN, CdF; NM, Basle) [examined]. **Syn. n.**

*Triglyphothrix guillodi* var. *mus* Santschi, 1937a : 232. Holotype worker, ANGOLA: Ebanga, no. 154 (*Monard*) (MHN, CdF) [examined]. **Syn. n.**

*Triglyphothrix cinereus* Weber, 1943 : 325, 377, pl. 16, fig. 25. Syntype workers, SUDAN: E. slopes of Imatong Mts, 4000 ft, 24.vii.1939 (*N. A. Weber*) (MCZ, Cambridge) [examined]. **Syn. n.**

*Worker.* TL 2.7–3.6, HL 0.62–0.74, HW 0.60–0.74, CI 97–103, SL 0.44–0.54, SI 69–75, PW 0.44–0.58, AL 0.68–0.82 (12 measured).

With the head in profile the antennal scrobes shallow and very poorly developed, scarcely extending beyond the level of the eye. Upper scrobe border not separated from dorsum of head by an acute margin, median longitudinal carina of scrobe absent or indistinguishable from surrounding sculpture. Branched hairs present within the scrobal area; the area occupied by the scrobe in other species is here almost as strongly sculptured as the remainder of the head. Propodeal spines short and acute, very small in some specimens. Dorsal surfaces of head, alitrunk and pedicel finely reticulate-rugulose, the gaster unsculptured; mandibles striate. Dorsal surfaces of head and body densely clothed with branched hairs, universally quadrifid on the first gastral tergite. Elongate, simple hairs absent except for a few on the mouthparts. Colour brown, usually dark brown, sometimes with gaster darker than head and alitrunk.

Widely distributed in savannah and relatively dry forest in Africa, and also occurring on the coastal plains and cleared forest areas of West Africa, this species has been found nesting amongst the roots of small trees and shrubs in Nigeria and Ghana. It is allied closely to *agna* which also has reduced scrobes, but in this last-named species the propodeum lacks spines. A third species, *rothschildi*, also occurs in Africa and has the scrobes completely absent, no trace of them remaining, but here the anterior clypeal margin is strongly excised and the species is much larger than either *agna* or *eminii*.



## MATERIAL EXAMINED.

GHANA: Legon (*D. Leston*). NIGERIA: Gambari (*B. Bolton*). SUDAN: Imatong Mts (*N. A. Weber*). KENYA: Diani Beach (*N. L. H. Krauss*). SOUTH AFRICA: Durban (*G. Arnold*); Natal, Krantz Kloof (*G. Arnold*); Durban (*H. B. Marley*).

*Triglyphothrix furtiva* Arnold

*Triglyphothrix furtiva* Arnold, 1956 : 69, fig. 18. Syntype worker, females, RHODESIA: Vumba Mts, 9.xi.1953 (*G. Arnold*) (NM, Bulawayo) [examined].

*Worker*. TL 2.2–2.5, HL 0.54–0.62, HW 0.50–0.56, CI 90–96, SL 0.34–0.40, SI 68–73, PW 0.36–0.42, AL 0.54–0.64 (16 measured).

Antennal scrobes strongly developed, with acute dorsal margins and well-defined posterior and ventral margins. Median longitudinal carina of scrobe strong, reaching back well beyond the posterior margin of the rather small eye. In a few specimens the carina almost reaches the posterior border of the scrobe. Alitrunk short and compact in profile, the propodeal dorsum sloping behind to the short, acute propodeal spines. Dorsum of head finely longitudinally rugulose, with cross-meshes forming a rugoreticulum posteriorly. Mandibles longitudinally striate. Antennal scrobes shining, without sculpture or at most with a weak punctulation. Dorsal alitrunk predominantly irregularly longitudinally rugulose, the fine rugulae often wavy or meandering. Nodes of pedicel reticulate. Gaster mostly smooth and shining but the basal portion generally with a few scattered, very small punctures. Branched hairs abundant everywhere, predominantly trifid but usually with a number of bifid hairs on the first gastral tergite, the proportions of bifids to trifids tending to vary between series. Elongate, simple hairs absent except around the mouthparts and in a spaced row along the upper margin of the scrobe. The hairs in this row are shorter than in some related species and tend to project laterally to some extent. Nevertheless, they are longer and somewhat stouter than their branched neighbours. Colour black or blackish brown, the appendages lighter.

A small, wet-forest inhabiting species which is widely distributed in Africa. Like a number of other small species the palp formula here is 3,3, but this is not accompanied by a reduction of the antennomere count to eleven. It has been found nesting in leaf mould below a rotten log in Ghana and foragers have been found in leaf-litter in all the localities listed below, either by free collecting or by use of a berlese funnel. In the original description Arnold stated that the type-series was captured 'under dead leaves in damp ground in a forest'. The underside of the data-label of the type states 'in forest at Mountain Lodge Hotel'.

## MATERIAL EXAMINED.

GHANA: Tafo (*B. Bolton*); Tafo (*D. Leston*); South Scarp Forest (*W. Gotwald*). CAMEROUN: Ototomo (*G. Terron*). GABON: Plateau d'Ipassa (*J. A. Barra*). ANGOLA: Gabela (*P. M. Hammond*); Salazar (*P. M. Hammond*); Kahingo (*Mwaoko*); R. Camudembole (*L. de Carvalho*).

*Triglyphothrix gabonensis* André

(Text-fig. 60)

*Triglyphothrix gabonensis* André, 1892 : 53. Syntype worker, female, male, GABON (*Mocquerys*) (MNHN, Paris) [examined].



*Triglyphothrix gabonensis* st. *soyauxi* Forel, 1901 : 53. Holotype female, GABON: Ssibange (Soyaux) (NM, Hamburg). **Syn. n.**

*Triglyphothrix mucidus* Forel, 1909 : 71. Syntype workers, ZAIRE: Kasai, Sankuru (Luja) (MHN, Geneva) [examined]. **Syn. n.**

*Triglyphothrix areolatus* Stitz, 1910 : 142, fig. 9. Syntype workers, CAMEROUN: Bibundi, 15-30.iv.1905 (Tessmann) (MNHU, Berlin) [examined]. **Syn. n.**

*Triglyphothrix gabonensis* var. *boulognei* Forel, 1916 : 423. Syntype workers, ZAIRE (Kohl) (MHN, Geneva) [examined]. **Syn. n.**

*Triglyphothrix gabonensis* subsp. *soyansi* Forel; Emery, 1922 : 273. [Misspelling.]

*Triglyphothrix areolata* var. *burgeoni* Santschi, 1935 : 265. Syntype workers, ZAIRE: Haut Uelé, Moto, 1920 (*L. Burgeon*) (MRAC, Tervuren; NM, Basle) [examined]. **Syn. n.**

*Triglyphothrix gabonensis* var. *kamerunensis* Santschi, 1937b : 102. Holotype worker, CAMEROUN: Buea, Kamerunberg, 12.xi.1935 (*F. Zumpt*) (NM Basle) [examined]. **Syn. n.**

*Worker.* TL 3.8-4.6, HL 0.94-1.16, HW 0.90-1.10, CI 92-98, SL 0.68-0.76, SI 68-75, PW 0.60-0.72, AL 0.92-1.20 (25 measured).

Anterior clypeal margin with a small median indentation, impression or notch, varying in size in different populations. Median carina of clypeus weakly developed, usually only well marked on the posterior portion, tending to fade out anteriorly; very rarely it is completely absent. Antennal scrobes with a sharp dorsal margin, the median longitudinal carina of the scrobes generally poorly developed though usually visible; rarely is it indistinguishable from the sculpture above the eye. Dorsal outline of alitrunk in profile generally showing a long and extremely shallow concavity over the posterior portion of the mesonotum and anterior propodeum. Propodeal spines long and acute, the metapleural lobes low and rounded, rarely triangular. Dorsal surfaces of head, alitrunk and petiole usually finely and quite superficially rugulose and shining, more rarely with rather coarser sculpture, but the postpetiole less strongly sculptured. Mandibles striate, the gaster unsculptured. Dorsal surfaces of head and body densely clothed with branched hairs, those on the first gastral tergite universally quadrifid. Elongate simple hairs absent from dorsum of head and appendages.

Ranging through the forests of Central Africa and into Uganda and Sudan, this is one of the largest species in the genus and the characters noted above make it quite conspicuous. The species closest related to *gabonensis* is *constanciae*, the differences separating them are given under the latter name.

#### MATERIAL EXAMINED.

CAMEROUN: Ikiliwindi (*C. A. Collingwood*); Mt Kala (*G. Terron*); Matute (*B. Malkin*). GABON: Plateau d'Ipassa (*J. A. Barra*); Makokou (*I. Lieberburg*). ZAIRE: Kai Bumba (*H. Schouteden*); Mayumbe, Zobi (*R. Mayné*); Mayumbe (*R. Mayné*); Ituri, Akenge (*Lang & Chapin*); N'Gayu (*Lang & Chapin*); Itoka (*Mayné*); Lundu (*H. Schouteden*); Mongende (*H. Schouteden*); Avakubi (*Bequaert*); Yambuya (*Bequaert*); Yangambi (*N. L. H. Krauss*); Ituri Forest, vic. Epulu (*T. Gregg*); Walikali (*E. S. Ross & R. E. Leech*). UGANDA: Jinja (*E. S. Ross & R. E. Leech*). SUDAN: Imatong Mts. (*Weber*).

#### *Triglyphothrix gestroi* Menozzi

*Triglyphothrix gestroi* Menozzi, 1932 : 105, fig. 3. Syntype workers, UGANDA: Victoria Nyanza, Archip. de Sesse, Bugala, 1908 (*E. Bayon*) (IE, Bologna) [examined].

*Worker.* TL 1.8-2.1, HL 0.44-0.52, HW 0.42-0.48, CI 89-95, SL 0.28-0.32, SI 64-69, PW 0.32-0.38, AL 0.52-0.58 (12 measured).

Antennal scrobes well-developed, shining, with an acute dorsal margin and a distinct



median longitudinal carina. Alitrunk in profile with the promesonotum more or less flat to feebly convex, the propodeum sloping strongly to the acute spines. Dorsal surfaces of head, alitrunk and petiole closely and finely reticulate-rugose, the postpetiole more feebly so. Mandibles striate; gaster unsculptured, smooth and shining. All surfaces of head, body and appendages with numerous short, branched hairs. Dorsal surfaces of upper scrobe margins with a series or spaced row of elongate, simple hairs. These are not as long as in some related species and consequently are less conspicuous, but they are generally 1.5–2.0 times longer than the neighbouring branched hairs. The leading edges of the scapes and outer margins of the tibiae lack such simple hairs. Colour yellow, usually light, the gaster generally a darker shade.

This minute species bears a close relationship to *furtiva* and has a similar distribution. However, *furtiva* is larger, black, and tends to have the rugulose sculpturing of the head and alitrunk more widely spaced and more distinctly longitudinal in organisation.

Along with *cryptica* and *muscorum*, *gestroi* shares the reduced palp formula of 3,3 but lacks the corresponding reduction in antennomere count. The species inhabits wet-forest areas in central and eastern Africa, but has not yet been found in the West African forests. All collections of this species examined have been made from leaf-litter and the species apparently nests there as the long series from Uganda, noted below, bears the data 'Litter and humus under hardwoods in dense forest'.

#### MATERIAL EXAMINED.

UGANDA: Bundibugyo (*G. O. Evans*). GABON: Plateau d'Ipasa (*J. A. Barra*). ANGOLA: Mouth of R. Mussungue (*Luna de Carvalho*); Salazar (*P. M. Hammond*); Dundo, Carrisso Park ('native collector'); Route Saurimo-Luso (*Luna de Carvalho*); route Dundo-Saurimo (*L. de Carvalho*).

### *Triglyphothrix imbellis* Emery

*Triglyphothrix imbellis* Emery, 1915a : 18, fig. 9. Holotype worker, ETHIOPIA: Eritrea, Nefasit (*F. Silvestri*) (MCSN, Genoa).

I have not been able to examine the holotype of this species, nor have I seen any other material which may be referred to *imbellis*. In the original description Emery makes it quite plain that this species is very closely related to and may even be a subspecies of *auropunctatus* (now a synonym of *microps*). In the light of these statements *imbellis* is presently regarded as a good species, very close to *microps* but separated from it by lack of acute propodeal spines, which in *imbellis* are represented by a pair of low, rounded tubercles.

### *Triglyphothrix inezulae* Forel

(Text-fig. 40)

*Triglyphothrix inezulae* Forel, 1914 : 221. Syntype workers, male, SOUTH AFRICA: Natal, Durban, Beach Bush, 15.i.1914 (*G. Arnold*) (MHN, Geneva; BMNH; MCZ, Cambridge) [examined].



*Tetramorium* (*Triglyphothrix*) *hepburni* Arnold, 1917 : 340. Syntype workers, females, males, RHODESIA: Bulawayo, Hillside, 10.iv.1915 (G. Arnold) and Bulawayo, Hillside, 23.i.1916 (G. Arnold) (BMNH; NM, Bulawayo) [examined]. **Syn. n.**

*Triglyphothrix hepburni* subsp. *mashonana* Arnold, 1949 : 266, fig 7a. Holotype and paratype workers, RHODESIA: Mashonaland, Hunyáni, 30.i.1948 (G. Arnold) (BMNH; NM, Bulawayo) [examined]. **Syn. n.**

*Worker.* TL 2.5–3.3, HL 0.60–0.80, HW 0.54–0.78, CI 90–97, SL 0.38–0.52, SI 67–74, PW 0.40–0.58, AL 0.60–0.88 (12 measured).

Antennal scrobes strongly developed, with an acute dorsal margin and a strong median longitudinal carina. Propodeal spines short and acute, usually about as long as their basal width in profile, occasionally longer. Mandibles striate. Dorsal surfaces of head, alitrunk and pedicel finely reticulate-rugose, the sculpture generally more strongly defined in smaller individuals. Base of first gastral tergite with a transverse band of dense and usually coarse punctures, the apical portion of the tergite lacking such sculpture. Entire body with numerous branched hairs, which are predominantly or universally trifid on the first gastral tergite. Elongate, simple hairs which are much longer than the neighbouring branched hairs are present on the mouthparts and in a spaced row along the dorsal surface of the upper margin of the antennal scrobe. Colour uniform medium to dark brown.

The closest relative of *inezulae* is certainly the minute species *trimeni*, also found in southern Africa. The two are separable as *trimeni* is very small and has the lower portion of the scrobe poorly developed, the median carina of the scrobe being indistinguishable from other rugulae which occur in the vicinity. In *inezulae* the lower portion of the scrobe is strongly developed and only very weakly sculptured so that the median carina of the scrobe is very distinctive.

The names given in synonymy above represent three sizes in what turns out to be a continuous size-range in this rather variable species. The main difference separating *hepburni* from *inezulae* was the relative sizes of the specimens, *hepburni* being smaller (largest measured had HL 0.66, HW 0.62), and *inezulae* larger (smallest measured had HL 0.74, HW 0.70). The types of *mashonana*, when measured, bridged this gap nicely by falling directly between the largest *hepburni* and smallest *inezulae*, having measurements in the order of HL 0.70, HW 0.66.

#### MATERIAL EXAMINED.

TANZANIA: Mt Meru (E. S. Ross & R. E. Leech). ZAIRE: Mutshatsha (E. S. Ross & R. E. Leech). RHODESIA: Bulawayo (G. Arnold); Bulawayo, Hillside (G. Arnold); Matopos (G. Arnold); Lonely Mines (H. Swale).

### *Triglyphothrix menkaura* sp. n.

(Text-figs 41, 46, 47, 55)

*Holotype worker.* TL 2.4, HL 0.56, HW 0.54, CI 96, SL 0.38, SI 70, PW 0.42, AL 0.62.

Antennal scrobes strongly developed, deep, with an acute dorsal margin and sharply defined posterior border. Ventral margin of scrobe well developed behind eye, the median longitudinal carina narrow but distinct, extending to the posterior margin of the eye. Clypeus with a transverse carina crossing the median longitudinal carina (this is better developed in the holotype than in some of the paratypes). Dorsal alitrunk evenly convex in profile, sloping behind to the propodeal declivity. Propodeal spines absent, in their place a pair of very low, broad, rounded tubercles, considerably smaller than the metapleural lobes. Mandibles



striate. Head virtually unsculptured except for the median carina, smooth and shining with a few minute, superficial rugulae and fine punctures from which hairs arise. Dorsal surfaces of alitrunk, pedicel and gaster unsculptured apart from minute hair-pits, smooth and shining. All dorsal surfaces with numerous branched, short hairs; the upper surfaces of the dorsal scrobe margins also with a spaced row of elongate, simple hairs. First gastral tergite with a mixture of simple and bifid hairs. Trifid hairs rare or absent but present at least on alitrunk and pedicel where simple and bifid forms are also present. Colour a deep blackish brown everywhere.

*Paratype workers.* TL 2.3–2.4, HL 0.56–0.58, HW 0.54, CI 93–96, SL 0.36–0.38, SI 67–70, PW 0.40–0.44, AL 0.62–0.64 (6 measured). As holotype.

Holotype worker, GHANA: Tafo, 7.vi.1970, twig in leaf-litter (*B. Bolton* (BMNH)).

Paratypes. 6 workers and 2 alate females, same data as holotype (BMNH; MCZ, Cambridge; MHN, Geneva).

The only species of *Triglyphothrix* yet known in which the body is mostly unsculptured and smooth and which lacks propodeal spines yet retains elongate simple hairs on the head. The first two of these characters are also shown in *dedefra* but this species lacks simple cephalic hairs.

The nest from which the type-series was taken was situated in a small piece of rotten twig embedded in deep leaf-litter in a cocoa plot.

### *Triglyphothrix microps* Mayr

(Text-figs 43, 53)

*Triglyphothrix microps* Mayr, 1901 : 25. Syntype worker, female, SOUTH AFRICA: Port Elizabeth (*H. Brauns*) (BMNH) [examined].

*Triglyphothrix auropunctatus* Forel, 1910a : 20. Syntype workers, female, SOUTH AFRICA: Natal, 2500 ft, no. 211 (*Haviland*) (MHN, Geneva; MCZ, Cambridge) [examined]. **Syn. n.**

*Triglyphothrix auropunctatus* var. *pallens* Forel, 1910b : 424. Syntype workers, SOUTH AFRICA: Natal (*Haviland*) (MHN, Geneva) [examined]. **Syn. n.**

*Triglyphothrix auropunctatus* var. *fusciventris* Forel, 1913a : 116. Syntype workers, RHODESIA (*G. Arnold*) (MHN, Geneva; MCZ, Cambridge) [examined]. **Syn. n.**

*Triglyphothrix auropunctatus* var. *rhodesiana* Forel, 1913b : 221. Syntype females, RHODESIA: Bembesi, 1912 (*G. Arnold*) (MHN, Geneva) [examined]. **Syn. n.**

*Tetramorium (Triglyphothrix) auropunctatus* var. *bulawayensis* Arnold, 1917 : 335. Syntype workers, RHODESIA: Bulawayo, 12.vii.1913 (*G. Arnold*) (BMNH) [examined]. **Syn. n.**

*Worker.* TL 3.4–3.7, HL 0.64–0.72, HW 0.60–0.68, CI 90–97, SL 0.40–0.44, SI 62–70, PW 0.44–0.50, AL 0.64–0.74 (12 measured).

Eyes very small, their maximum diameter distinctly less than the maximum width of the scape. Antennal scrobes well developed, their dorsal margins acute, usually also well defined posteriorly but the lower margin behind the eye not so strongly defined. Median longitudinal carina of scrobe distinct. Propodeum armed with a pair of acute, triangular spines, the metapleural lobes rounded in profile, not elongate or dentiform. Dorsum of head rugose, tending to be more or less longitudinal but often with reticulation posteriorly. Dorsum of alitrunk and pedicel irregularly rugulose, most or all the rugulae longitudinal in direction on the alitrunk. Postpetiole generally less strongly sculptured than petiole. Mandibles striate. All dorsal surfaces with numerous branched hairs, predominantly trifid on first gastral tergite but often with a few bifid or simple hairs present. Dorsum of upper margin of antennal scrobe with a spaced row of elongate, simple hairs which are much longer than their branched neighbours. Colour yellow to yellow-brown, a few specimens darker brown, often with the gaster somewhat darker than the head and alitrunk.



Arnold (1917) records this species nesting in or near the galleries of *Platythyrea cribrinodis* (Gerstaecker), 'apparently in plesiobiosis'. The closest relative of *microps*, *arnoldi*, has also been found amongst the galleries of larger ponerine species. The two are easily separable as *arnoldi* lacks branched hairs and has the dorsal alitrunk densely reticulate-punctate.

#### MATERIAL EXAMINED.

RHODESIA: Bembesi (G. Arnold); Shiloh (G. Arnold); Matopos (G. Arnold); Bulawayo (G. Arnold). SOUTH AFRICA: Algoa Bay (H. Brauns); Grahamstown (J. Hewitt); Natal (Haviland); Cape Prov., Balfour (E. S. Ross & R. E. Leech); Cape Prov., Umtata (E. S. Ross & R. E. Leech). ANGOLA: Bruco (P. M. Hammond).

### *Triglyphothrix minima* sp. n.

*Holotype worker.* TL 2.0, HL 0.46, HW 0.40, CI 87, SL 0.28, SI 70, PW 0.30, AL 0.48.

Antennal scrobes well developed and deep, with acute and well-defined dorsal, posterior and ventral margins behind the eyes. Median longitudinal carina of scrobe extending beyond the posterior margin of the eye. Promesonotal dorsum in profile evenly convex, the propodeal dorsum sloping posteriorly to the short, acute propodeal spines. Mandibles smooth with the rugulae become more crowded and some reticulation may be developed. Dorsal surfaces of alitrunk and pedicel rugulose, the latter more closely so than the former. Gaster smooth, scattered small punctures, not striate. Head finely longitudinally rugulose; on the anterior portion the rugulae are very spaced out, with only 4 or 5 on each side between the cephalic median carina and the upper scrobe margin. On the extreme posterior portion of the head unsculptured. Branched hairs present but relatively sparse on head, alitrunk and pedicel, generally bifid and short. Elongate simple hairs present in a row along the leading edge of the scape, and on the head and dorsal alitrunk. Hairs of first gastral tergite predominantly simple, with a few bifid hairs basally. Colour uniform dark brown, the appendages lighter.

*Paratype workers.* TL 1.7–2.0, HL 0.42–0.46, HW 0.38–0.40, CI 86–90, SL 0.26–0.28, SI 69–70, PW 0.28–0.30, AL 0.44–0.50 (5 measured). As holotype.

Holotype worker, GHANA: Kumasi, 15.i.1969, in termite nest (B. Bolton) (BMNH).

Paratypes. 2 workers with same data as holotype. 5 workers, GHANA: Mampong 26.i.1970 (P. Room). 1 worker, NIGERIA: Ibadan, I.I.T.A., 8–11.vii.1974 (B. R. Critchley) (BMNH; MCZ, Cambridge).

The closest known relative of this minute species is *distincta*, also from West Africa, but this species is strikingly coloured black and yellow and is easily distinguished. The holotype and two paratype workers from Kumasi were in the walls of a small termite colony in a rotten log. It is not possible to say whether this species is termitolestic or not as the workers may just have been foraging in the termite log quite accidentally.

Three series of specimens from IVORY COAST: Abidjan, Banco Forest, i.1963; 9.i.1963, no. A13; 10.i.1963, no. A33 (W. L. Brown) which are deposited in MCZ, Cambridge also represent this species. They all fit the above description except that in series A13 the sculpture on the dorsal alitrunk is reduced and effaced so that the surface is mostly smooth with only traces of sculpture remaining. In series A33 the sculpture is more distinct and these form a link between the more strongly sculptured type-series and the less strongly sculptured individuals.



***Triglyphothrix monardi* Santschi**

*Triglyphothrix monardi* Santschi, 1937a : 230, figs 1, 2. Holotype worker, ANGOLA: Ebanga, no. 154, xi. 1932 (*Monard?*) (MHN, CdF) [examined].

*Holotype worker.* TL 4.0, HL 0.90, HW 0.90, CI 100, SL 0.60, SI 67, PW 0.70, AL 1.02.

Antennal scrobes well developed, with an acute dorsal margin and a marked median longitudinal carina. Propodeal spines long, strong and acute, the metapleural lobes short and rounded. Node of petiole massively developed, its maximum width in dorsal view ca 0.48. Shape in dorsal view thickly and bluntly crescentic, the anterior margin broadly convex, the posterior somewhat concave so that the blunt 'horns' of the crescent are directed posterolaterally. Dorsal surfaces of head, alitrunk and pedicel finely reticulate-rugose, the mandibles striate. Basal portion of first gastral tergite with a transverse band of enlarged but shallow punctures, this area distinctly more strongly sculptured than the remainder of the gaster. Elongate, simple hairs absent from head, body and appendages; entirely covered in a dense coat of branched hairs. First gastral tergite with a mixture of trifid and quadrifid hairs. Colour dark brown.

The closest relatives of this species, which is known only from the holotype worker, are certainly *gabonensis*, *brevispinosa* and their allies. In these species, however, the petiole node is not so markedly developed as in *monardi* and the disc of the first gastral tergite has only trifid or quadrifid hairs, not a mixture of both. The presence of a band of punctate sculpture on the base of the first gastral tergite may be variable in extent and intensity, as is the case in *brevispinosa*, but it will separate *monardi* from all specimens of *gabonensis* examined during the course of this study, none of which possessed the punctate area.

***Triglyphothrix muscorum* (Arnold)**

*Tetramorium* (*Triglyphothrix*) *muscorum* Arnold, 1926 : 274, fig. 78. Syntype workers, MOZAMBIQUE: Amatongas Forest, 13.ii.1917 (*G. Arnold*) (BMNH; MCZ, Cambridge; NM, Bulawayo) [examined].

*Worker.* TL 1.6–1.9, HL 0.44–0.48, HW 0.40–0.46, CI 91–96, SL 0.24–0.28, SI 57–64, PW 0.32–0.36, AL 0.44–0.52 (10 measured).

Antennae with 11 segments. Scrobes strongly developed, with distinct margins and a marked median longitudinal carina. Propodeal spines short and acute, about as long as the metapleural lobes. Petiole in profile with a short, thick anterior peduncle. Palp formula 3,3, the basal segment of the maxillary palp short and indistinct. Dorsal surfaces of head, petiole and postpetiole reticulate-rugose. This sculpture may be reduced on the postpetiole but is always present. Mandibles smooth with scattered pits, not striate; gaster unsculptured. Clypeus with a distinct transverse carina crossing the median longitudinal carina. Leading edges of antennal scapes with a number of long, simple hairs which are as long as or longer than the maximum width of the scape. Dorsum of head with numerous branched hairs and with a number of long, simple hairs, especially on the upper surface of the dorsal scrobe margin. These simple hairs are markedly longer than the neighbouring branched hairs and are very conspicuous. Colour yellow-brown, usually with the gaster darker but the colour uniform in some populations.

This small species is widespread in forested areas throughout Africa and is closely related to *cryptica*, a species known at present only from Ghanaian primary forest. The differences separating these two species are given under *cryptica*. Most of the samples examined were from berlese funnel extracts of forest leaf-litter, but



in the original description Arnold noted that 'the nest was placed in moss which covered the bark of a large tree growing in the depths of the forest'.

#### MATERIAL EXAMINED.

IVORY COAST: Divo (*L. Brader*). GHANA: Tafo (*B. Bolton*). UGANDA: F. Portal (*N. A. Weber*). CAMEROUN: No. V6 (no. loc.) (*G. Terron*). GABON: Plateau d'Ipassa (*J. A. Barra*). ANGOLA: R. Camudembele (*Luna de Carvalho*); Dundo, Carrisso Park ('native collector'). CENTRAL AFRICAN REPUBLIC: Ubangi Shari, Haut Mbomu (*N. A. Weber*). ZAIRE: W. side Ruwenzori (*N. A. Weber*); Ituri For., Beni Irumu (*N. A. Weber*).

### *Triglyphothrix osiris* sp. n.

(Text-fig. 61)

*Holotype worker.* TL 2.9, HL 0.70, HW 0.64, CI 91, SL 0.46, SI 72, PW 0.52, AL 0.72.

Antennal scrobes well developed, with acute margins dorsally, posteriorly and ventrally both in front of and behind the eyes. Median longitudinal carina of scrobe strongly marked, extending well beyond the posterior margin of the eye. Alitrunk convex dorsally, sloping more steeply posteriorly than anteriorly. Propodeal spines long and very narrow, scarcely tapered from base to apex and feebly downcurved along their length. Mandibles smooth, unsculptured except for a few scattered small pits. Head with sculpture almost completely effaced and quite shining, here and there with minute and very faint superficial rugulae and a few hair pits. Dorsal surfaces of alitrunk and pedicel finely reticulate-rugulose, the spaces between the rugulae finely punctate. Gaster unsculptured. All surfaces of head, body and appendages with abundant branched hairs, those on the first gastral tergite predominantly quadrifid but with a number of trifid hairs also present. Leading edges of antennal scapes with a number of very long, simple hairs, considerably longer than their branched neighbours, the longest of them greater than the maximum width of the scape. Dorsal surface of head also with very long, simple hairs and some are present on the dorsal alitrunk. On this last-named surface the simple hairs are less conspicuous as the branched hairs are longer than on the head. Colour brown, the alitrunk and pedicel a much lighter shade than the gaster, which is very dark brown.

*Paratype workers.* TL 2.8–2.9, HL 0.68, HW 0.62–0.64, CI 91–94, SL 0.44–0.46, SI 71–72, PW 0.48–0.52, AL 0.70–0.74 (2 measured). As holotype.

Holotype worker, GHANA: Mt Atewa, 10.vii.1968, in leaf-litter (*B. Bolton*) (BMNH).

Paratypes. 2 workers with same data as holotype (BMNH; MCZ, Cambridge).

The diagnosis above will serve to separate this species from all others in the Ethiopian region. In some respects *osiris* resembles the tramp species *lanuginosa*, but in this species the branched hairs are primarily bifid, mixed with simple hairs, whilst in *osiris* the branched hairs are trifid and quadrifid and very dense. Finally, in *lanuginosa* the mandibles are striate in all but the smallest individuals whereas in *osiris* they are smooth.

For the present *osiris* is dubiously grouped with *reptana* and *yarthiella* (see list of species) but it may well have its origins in a different group, perhaps the *gabonensis*-group.



*Triglyphothrix paupera* Santschi

*Triglyphothrix pauper* Santschi, 1917 : 286. Syntype workers, RHODESIA: Umgusa, Cawston Farm (G. Arnold) (NM, Basle; BMNH; MCZ, Cambridge) [examined].

*Tetramorium ericae* Arnold, 1917 : 332. Syntype workers, RHODESIA: Bulawayo, Hillside, 28.iii.1915 (G. Arnold) (BMNH; MCZ, Cambridge; NM, Bulawayo) [examined]. **Syn. n.**

*Worker.* TL 1.8–2.0, HL 0.48–0.54, HW 0.42–0.48, CI 88–92, SL 0.26–0.32, SI 60–69, PW 0.30–0.38, AL 0.48–0.56 (10 measured).

Upper portion of antennal scrobes strongly developed, with an acute dorsal margin. Usually the lower portion of the scrobe best developed behind the eye, the latter being large in this species. Median longitudinal carina of scrobe developed, usually running beyond the posterior margin of the eye. Propodeal spines distinct, as long as or slightly longer than their basal width, acute. Sculpture on head and dorsal alitrunk a loose and rather spaced-out rugosity, tending to be longitudinal on most of the head but reticulate posteriorly. The alitrunk may be reticulate everywhere or the rugulae may become longitudinal behind the pronotum. Petiole dorsum more strongly sculptured than postpetiole, the latter sometimes almost smooth. Gaster unsculptured. Dorsal surfaces of head and body with numerous short, branched hairs, first gastral tergite with a mixture of bifid and simple hairs, the former predominating; trifid hairs apparently absent. Elongate, simple hairs which are much longer than their branched neighbours are present on the leading edge of the scape, in a spaced row along the dorsal surface of the upper scrobe margin and on the dorso-lateral margins of pro- and mesonotum. Colour yellow to mid-brown, often with gaster darker than alitrunk and head.

In his original description of this species Arnold (1917) failed to notice the presence of branched hairs and consequently placed it in *Tetramorium*, saying that it was 'intermediate in structure between *Tetramorium* s.str. and its subgenus *Triglyphothrix*'. Later Arnold (1926) re-examined his *ericae* specimens and noted that bifid hairs were present. *T. ericae* is, however, an absolute synonym of *paupera*, and the diagnostic notes above will isolate the species from its closest relatives.

## MATERIAL EXAMINED.

RHODESIA: Sawmills (G. Arnold); Bulawayo, Hillside (G. Arnold).

*Triglyphothrix pulcherrima* Donisthorpe

(Text-fig. 59)

*Triglyphothrix pulcherrima* Donisthorpe, 1945 : 76. Syntype workers, UGANDA: Kampala, Nambazidza Forest, 3.iv.1926 (G. L. R. Hancock) (BMNH) [examined].

*Worker.* TL 2.7, HL 0.68, HW 0.66–0.68, CI 97–100, SL 0.42, SI 62–64, PW 0.56, AL 0.74–0.76 (2 measured).

Antennal scrobes strongly developed, with an acute dorsal margin and a distinct median longitudinal carina. Alitrunk short and very broad across the pronotum in dorsal view, in profile the dorsum strongly convex. Propodeal spines short and acute. Petiole in dorsal view somewhat broader than long but not markedly transverse. Mandibles striate. Dorsal surfaces of head and alitrunk finely and densely reticulate-rugulose. Dorsum of pedicel similarly sculptured but the rugulae tending to be more longitudinal, especially on the post-petiole. Base of first gastral tergite finely longitudinally striate. Head, body and appendages abundantly covered with short, branched hairs; simple hairs apparently present on mouthparts and gastral apex. Head, antennae and mandibles bright yellow, contrasting strongly to the remainder of the body which is black or very deep blackish brown. Legs brown.



The striking colouration of this medium-sized species is its most obvious feature and is immediately reminiscent of *fulviceps* of New Guinea. I am sure that this similarity in colour and also in sculpturation is due to convergence as the shapes of the petiole nodes in the two species are fundamentally different. In *pulcherrima* the node in profile is high and narrow, with long anterior and posterior faces and a short, convex dorsal face whilst in *fulviceps* the node is long and low in profile, with the anterior face very short and merging into the peduncle (compare Text-figs 59 and 62).

The distinctive colour pattern of *pulcherrima* will easily distinguish the species from any other in the Ethiopian region. The only other strongly bicoloured African species is *distincta*, but in this case the head, gaster and usually the pedicel are black whilst the alitrunk is clear yellow. There are numerous other differences as comparison of the descriptions will show.

#### MATERIAL EXAMINED.

ZAIRE: Ituri Forest, Beni-Iruma (*N. A. Weber*).

### *Triglyphothrix reptana* sp. n.

*Holotype worker.* TL 3.4, HL 0.74, HW 0.70, CI 94, SL 0.50, SI 71, PW 0.56, AL 0.82.

Antennal scrobes very strongly developed and deep, bordered above by a narrow, flange-like extension of the frontal carinae and bordered posteriorly and ventrally by an acute and prominent ridge which is strongest ventrally in the space between the eye and the mandibular articulation. Median longitudinal carina of scrobe strong, acute, reaching back almost to the posterior border of the scrobe, well behind the level of the eye. Alitrunk in profile strongly and evenly convex, the propodeum armed with a pair of short, stout spines which are longer than the rounded metapleural lobes. Mandibles striate. Dorsal surfaces of head, alitrunk and pedicel finely, densely and shallowly reticulate-rugulose, the sculpture on the head weaker than on the alitrunk, that on the postpetiole weaker than on the petiole. Gaster unsculptured. Entirety of head, body and appendages very densely clothed in branched hairs. On the first gastral tergite they are predominantly quadrifid but are so close-packed that the outlines of individual hairs are difficult to see. Elongate erect simple hairs are mostly absent, present only on the mouthparts and clypeus and with a row along the leading edges of the antennal scapes. Apart from these there is a single pair at the posterior extremity of the scrobes and another pair close to the midline of the dorsum of the head at about the level of the anterior eye margins when the head is viewed in profile. Colour uniform light yellowish brown.

Holotype worker, UGANDA: 10 miles W. Jinja, 1200 m, 1.xii.1957 (*E. S. Ross & R. E. Leech*) (BMNH).

This species is easily characterised by the odd distribution of erect long, simple hairs coupled with the extremely strongly developed antennal scrobes. It shows resemblances to *osiris* and *menkaura* but both of these show a row of simple hairs along the upper scrobe margins.

### *Triglyphothrix rothschildi* Forel

(Text-figs 42, 52)

*Triglyphothrix rothschildi* Forel, 1907 : 134. Holotype worker, ETHIOPIA: Harrar, mars 1905 (*M. de Rothschild*) (MNHN, Paris) [examined].



*Worker.* TL 3.8–4.7, HL 1.00–1.34 (measured from clypeal apex, not from base of impression), HW 1.00–1.34, CI 100–104, SL 0.62–0.86, SI 62–66, PW 0.64–0.84, AL 0.86–1.20 (8 measured).

Median portion of clypeus with the anterior margin broadly and deeply excavated, concave. Antennal scrobes completely absent, the area which they occupy in other species is here as strongly sculptured as the remainder of the head and has numerous branched hairs arising from it. Pronotum square-shouldered in dorsal view, the propodeum armed with a pair of acute spines. Node of petiole in dorsal view about as broad as long, with more or less straight anterior and posterior faces and the sides diverging posteriorly so that the node is broader behind than in front. Head and alitrunk finely rugose dorsally, with a tendency for the rugae to be longitudinal, the petiole and postpetiole rugose dorsally. First gastral tergite with the basal portion longitudinally striate, often with very fine punctures between the striae. Elongate, simple hairs present only on mouthparts and gastral apex, and a few on the cephalic dorsum, elsewhere the head and body with numerous branched hairs which tend to be closely applied on the head. Colour red-brown.

Apparently widely though sporadically distributed in dry or semi-desert localities, this large distinctive species is one of the most easily recognisable in the Ethiopian region. The combination of size, lack of scrobes and strong clypeal emargination immediately identifies the species. It does not appear to have any direct relatives and is not related to *agna* and *emini*, two other species in which the scrobes are reduced. In both these species the petiole node is transverse and very different in shape from that of *rothschildi* and the clypeus is not emarginate, so there is no chance of confusing these species.

#### MATERIAL EXAMINED.

ETHIOPIA: Adamitullo (*K. M. Guichard*). KENYA: Mt Elgon (*G. Arnold*); Nairobi (*N. A. Weber*). GHANA: Northern Region, Tumu (*P. M. Room*).

#### *Triglyphothrix sericea* (Arnold) stat. n.

*Tetramorium* (*Triglyphothrix*) *hepburni* var. *sericeus* Arnold, 1926 : 277. Syntype workers, RHODESIA: Redbank, 3.xii.1917 (*G. Arnold*) (BMNH; NM, Bulawayo [examined]).

*Worker.* TL 2.3–2.8, HL 0.58–0.72, HW 0.54–0.70, CI 93–97, SL 0.36–0.46, SI 65–67, PW 0.40–0.52, AL 0.64–0.80 (8 measured).

Antennal scrobes strongly developed, deep, with an acute dorsal margin and a marked median longitudinal carina. Propodeal spines triangular and acute. Mandibles striate. Dorsal surfaces of head, alitrunk and pedicel finely and densely irregularly rugulose or reticulate-rugulose. Base of first gastral tergite with a narrow, transverse band of punctate sculpture which is partially concealed by the overlying hairs and which is better developed in larger than in smaller specimens. Dorsal surfaces of head and body with numerous short branched hairs which are decumbent or are strongly curved basally and very closely applied to the surface from which they arise. Erect or suberect branched hairs are absent. Elongate, simple hairs are present only on the mouthparts. Colour uniform dark brown.

This is the only species in the Ethiopian region which completely lacks standing hairs of any description on the dorsal surfaces of the head and body, and this character alone renders it easily recognizable.

Arnold (1926) records that the nest of this species was constructed in loose sand.

#### MATERIAL EXAMINED.

RHODESIA: Victoria Falls (*G. Arnold*).



*Triglyphothrix silvestrii* Emery

*Triglyphothrix silvestrii* Emery, 1915a: 17, fig. 8. Syntype workers, ETHIOPIA: Eritrea, Nefasit, 30.viii.1914 (*F. Silvestri*) (MHN, Geneva; NM, Bulawayo) [examined].

*Worker.* TL 3.1, HL 0.72, HW 0.68, CI 94, SL 0.46, SI 68, PW 0.48, AL 0.74 (2 measured). Answering to the description of *brevispinosa*, from which it differs in the following respects.

1. Smaller, compare the above measurements with *brevispinosa*, HW minimum 0.74, PW minimum 0.50, CI minimum 98.
2. Node of petiole in dorsal view strongly anteroposteriorly compressed, very narrow and transverse, about 2.0 times broader than long. Anterior surface of node in dorsal view flat. In *brevispinosa* the node is not strongly compressed, is much less than 2.0 times broader than long and has the anterior surface convex in dorsal view.
3. Basal portion of first gastral tergite not punctate. In nearly all populations of *brevispinosa* punctures are present here, rarely reduced and even more rarely completely lacking.

Based only upon the type-series, the maintenance of *silvestrii* as a species separate from *brevispinosa* is open to question. The two are obviously very closely related indeed, but in the numerous series of *brevispinosa* examined none showed the highly compressed petiole possessed by the types of *silvestrii*. Nevertheless, I feel sure that further collections will gradually narrow the variation between the two forms and that *silvestrii* will eventually fall as a synonym of *brevispinosa*.

*Triglyphothrix talpa* sp. n.

*Holotype worker.* TL 3.7, HL 0.88, HW 0.88, CI 100, SL 0.58, SI 66, PW 0.66, AL 0.98.

Antennal scrobes strongly developed, with an acute dorsal margin and a strong median longitudinal carina which extends back to the level of the posterior margin of the eye. Lower margin of scrobe weak behind the eye, more strongly developed in front. Median clypeal carina strongly developed, prominent; median cephalic carina distinct to level of posterior margin of antennal scrobe, behind this not more strongly developed than other sculpture. Propodeal spines short, stout and acute, the metapleural lobes low and rounded, not at all dentiform. Petiole in profile with the posterodorsal angle broadly rounded so that the dorsum curves evenly into the posterior face. Dorsal surfaces of head, alitrunk, petiole and post-petiole with a fine, close rugoreticulum. The basal third of the gaster with fine, spaced longitudinal costulae, punctures from which hairs arise and fine shagreening. Posterior to this the first and second components disappear so that only fine scattered punctures remain and posterior to this the gaster is smooth. Antennal scapes without elongate, erect hairs. Upper margins of antennal scrobes with a spaced row of elongate, simple hairs which are conspicuous and project freely above the general pilosity. Other long, simple hairs are present on the head, sparse except on the occiput where they are numerous. Long, simple hairs are present amongst the branched hairs on the alitrunk and pedicel but on the first gastral tergite the hairs are almost universally simple, with only one or two branched hairs (bifid or trifid) present. Legs with abundant short pilosity but without long, freely projecting hairs. Colour a uniform light yellow-brown.

Holotype worker, ZAIRE ('B. CONGO' on data label): 12 miles E. of Kikwit 6.viii.1957 (*E. S. Ross & R. E. Leech*) (CAS, San Francisco).

Related to *inezulae* and sharing most characters with that species, but differing in the lack of branched hairs on the first gastral tergite, slightly larger size and much lighter colour.



***Triglyphothrix tenebrosa* (Arnold) stat. n.**

*Tetramorium* (*Triglyphothrix*) *constanciae* var. *tenebrosa* Arnold, 1926 : 275, fig. 79. Syntype workers, female, male, MOZAMBIQUE: Amatongas Forest, ii. 1917 and 12.ii.1917 (*G. Arnold*) (BMNH; NM, Bulawayo) [examined].

*Worker.* TL 3.6–3.8, HL 0.86–0.90, HW 0.80–0.84, CI 93–96, SL 0.58–0.60, SI 69–72, PW 0.60–0.64, AL 0.92–0.98 (6 measured).

Upper halves of antennal scrobes strongly developed, with an acute dorsal margin and a well-marked posterior margin. Lower portion of scrobe not strongly developed, usually containing a number of longitudinal rugae above and in front of the eye, which may be as well marked as the rather weak median longitudinal carina of the scrobe. In one or two specimens this carina is virtually indistinguishable from the other sculpturation. Pronotum strongly convex, the latter portion of the mesonotum and the propodeum sloping steeply to the long, acute, propodeal spines. Head loosely and predominantly longitudinally rugulose, the alitrunk reticulate-rugose, more coarsely sculptured than the head. Petiole and postpetiole reticulate-rugulose dorsally. Mandibles striate, base of first gastral tergite with a faint transverse band of puncturation or shagreening, stronger in some individuals than in others. All dorsal surfaces of head and body with numerous branched hairs, those on the first gastral tergite trifid, rarely with a few quadrifid hairs also. Elongate, simple hairs present in a spaced row along the dorsal margin of the scrobes, and also a few scattered, simple hairs are present elsewhere on the dorsum of the head. Colour brown, the gaster usually a darker shade than the head and alitrunk.

Arnold originally described this species as a variety of *constanciae* but the two are in reality quite distinct. In *tenebrosa* elongate, simple hairs are present on the head and the hairs on the first gastral tergite are trifid, whereas in *constanciae* simple hairs are absent and the gastral hairs are quadrifid.

Arnold (1926) notes that this species was very common in the shady part of the (Amatongas) forest, nesting in the ground.

**MATERIAL EXAMINED.**

KENYA: Diani Beach (*N. L. H. Krauss*).

***Triglyphothrix thoth* sp. n.**

*Holotype worker.* TL 2.4, HL 0.60, HW 0.54, CI 90, SL 0.40, SI 74, PW 0.42, AL 0.62.

Antennal scrobes developed and distinct, with an acute dorsal margin and a marked median longitudinal carina. Lower margin of scrobe behind eyes less strongly developed than upper margin. Alitrunk in profile short and broad, with short, triangular, acute propodeal spines. Entire dorsum of propodeum sloping strongly downwards from its junction with the mesonotum to the spines. Mandibles smooth with scattered pits, not longitudinally striate. Dorsal surfaces of head, alitrunk and pedicel finely and densely reticulate-rugulose, the first gastral tergite smooth and shining. Elongate, simple hairs absent, the entire body densely clothed with branched hairs, those on the first gastral tergite trifid. Colour uniform medium brown, the legs lighter, yellow-brown.

*Paratype worker.* TL 2.4, HL 0.58, HW 0.52, CI 90, SL 0.36, SI 69, PW 0.40, AL 0.56. Otherwise as holotype.

Holotype worker, SOUTH AFRICA: E. Cape Prov., Grahamstown, 22.ii.1969, Kloof off Southwell Rd (*W. L. Brown*) (MCZ, Cambridge).

Paratype. 1 worker, same data as holotype (BMNH).

This small species shows some affinities with *walshi* of the Oriental region but



unlike that species it lacks simple hairs on the cephalic dorsum. Amongst its congeners in the Ethiopian region, *thoth* is the only species in its size-range which lacks long, simple hairs in a row on the upper scrobe margins. In most other very small species such hairs are present not only on the scrobe margins but also upon the leading edges of the antennal scapes.

### *Triglyphothrix trimeni* Emery

*Triglyphothrix trimeni* Emery, 1895 : 40. Syntype worker, females, SOUTH AFRICA: Kimberley 1893 (*E. Simon*) (MCSN, Genoa).

*Note.* Three specimens in the Forel collection (MHN, Gendva) are labelled as cotypes (= syntypes) of this species. They are in no sense to be regarded as type-material as the locality given is E. Africa, Kibosho, Katona. These specimens serve as the basis for my interpretations of *trimeni* as they were apparently identified by Emery.

*Worker.* TL 2.2–2.3, HL 0.52–0.58, HW 0.46–0.50, CI 86–92, SL 0.32–0.34, SI 66–70, PW 0.38–0.40, AL 0.58–0.60 (3 measured).

Antennal scrobes present but shallow, the lower halves less strongly developed than the upper. Median longitudinal carina of scrobe weak, poorly differentiated, scarcely or not stronger than other rugulae occurring near the eye. Alitrunk short and broad, the anterior pronotal angles sharp in dorsal view, giving a square-shouldered appearance. Propodeal spines acute, the propodeum sloping downwards to the bases of the spines. Mandibles striate. Dorsal surfaces of head, alitrunk and pedicel finely reticulate-rugose, the transverse reticulation on the anterior half of the cephalic dorsum suppressed so that the rugulae are longitudinal. Basal portion of first gastral tergite with a band of punctate sculpturation, remainder of gaster unsculptured. Everywhere with numerous branched bifid or trifid hairs, the former apparently predominating. Dorsal surfaces of upper scrobe margins with a number of elongate simple hairs, which are longer than the neighbouring branched hairs. Colour dark brown.

This small, darkly coloured species bears a superficial resemblance to *furtiva* and *thoth*, but in both these species the base of the gaster is unsculptured or at most has only scattered minute punctures. Also *furtiva* has the lower portion of the scrobe well developed, with a strong median carina whilst *thoth* has the scrobes similar to *furtiva* but lacks elongate simple hairs on the upper scrobe margins. The species most closely related to *trimeni* appears to be *inezulae*; this is separable by the characters given in the key.

### *Triglyphothrix yarhiella* sp. n.

*Holotype worker.* TL 3.4, HL 0.76, HW 0.72, CI 94, SL 0.54, SI 75, PW 0.54, AL 0.84.

Antennal scrobe with strongly developed dorsal margin but defined posteriorly and ventrally by a weak margin and a change in sculpture pattern. Median carina of scrobe weak, ending just behind the posterior margin of the eye. This median carina is situated low down in the scrobal area so that the upper compartment is much broader and more strongly developed than the lower, which is too small to accommodate the funiculus. Dorsal alitrunk evenly curved in profile, the propodeal spines short, quite stout. Metapleural lobes broadly triangular, acute apically. Node of petiole in dorsal view almost as long as broad, only very slightly broader than long. Dorsal surfaces of head, alitrunk and pedicel closely and distinctly fine reticulate-rugose. Upper compartment of scrobes reticulate-punctate. Base of first gastral tergite with a broad belt of coarse puncturation. All dorsal surfaces of head and



body densely coated with branched hairs which on the first gastral tergite are predominantly quadrifid. Elongate, erect to suberect simple hairs are numerous on all dorsal surfaces of the head and body, projecting above the level of the branched hairs and easily visible in profile. Antennal scapes with a row of erect simple hairs on their leading (anterior) edges, the longest of which are subequal to the maximum width of the scape. Upper surfaces of dorsal margins of scrobe with a spaced row of long, simple hairs. Dorsal (outer) surfaces of middle and hind tibiae without elongate hairs. Colour uniform dark brown.

*Paratype workers.* As holotype, with measurements of TL 3.1–3.4, HL 0.70–0.78, HW 0.66–0.72, CI 90–95, SL 0.48–0.54, SI 73–79, PW 0.50–0.56, AL 0.76–0.86 (20 measured).

Holotype worker, ZAMBIA: Kapiri Mposhi, 1280 m, 10.ii.1958 (E. S. Ross & R. E. Leech) (CAS, San Francisco).

Paratypes. 34 workers with same data as holotype (CAS, San Francisco; BMNH; MCZ, Cambridge; MHN, Geneva; NM, Basle).

A medium-sized species related to *reptana* and *osiris* by the characters mentioned in the discussion of the species-groups. *T. yarthiella* is quickly separable from these two species as it possesses a band of coarse punctate sculpture at the base of the first gastral tergite, whereas in *reptana* and *osiris* this area is smooth and shining. Other species in which the gaster shows sculpture at the base are *inezulae* and its allies, but here elongate simple hairs are absent from the leading edges of the antennal scapes.

## SPECIES OF THE ORIENTAL, INDO-AUSTRALIAN AND POLYNESIAN REGIONS

### SYNONYMIC LIST OF SPECIES

#### *obesa*-group

*antennata* Mann **stat. n.**

*brevidentata* Kutter

*chepocha* **sp. n.**

*coonoorensis* (Forel) **comb. n.**

*decamera* Forel

*indosinensis* (Wheeler) **comb. n.**

*lanuginosa* (Mayr)

*striatidens* (Emery) **syn. n.**

*striatidens* st. *orissana* Forel **syn. n.**

*striatidens* var. *australis* Forel **syn. n.**

*striatidens* var. *felix* Forel **syn. n.**

*ceramensis* Stitz **syn. n.**

*striatidens* var. *flavescens* Wheeler **syn. n.**

*mauricei* Donisthorpe **syn. n.**

*tricolor* Donisthorpe **syn. n.**

*obesa* (André)

*pacifica* Mann

*rossi* **sp. n.**

#### *walshi*-group

*adpressa* **sp. n.**

*fulviceps* Emery

*katypa* **sp. n.**

*kheperra* **sp. n.**

*mayri* Mann

*meshena* **sp. n.**



*nacta* sp. n.

*parvispina* Emery

*parvispina* var. *formosae* Forel syn. n.

*pnyxis* sp. n.

*pulchella* Mann

*walshi* Forel

*musculus* Forel syn. n.

*walshi* var. *spuria* Forel syn. n.

#### THE SPECIES-GROUPS

In the regions now under discussion 22 species are known, divisible for convenience into two equal-sized groups depending upon whether the gastral hairs are universally trifid (*walshi*-group) or not (*obesa*-group).

THE *walshi*-GROUP. The 11 species in this group, linked by their common factor of only having trifid hairs on the first gastral tergite and a stout, compact build, are roughly divisible into three complexes of more or less closely related forms. One complex contains the species *adpressa*, *fulviceps*, *mayri*, *meshena* and *pulchella* and is characterized by the complete lack of elongate simple hairs on the dorsum of the head and by the possession of distinct sculpturation on the basal portion of the first gastral tergite. The species *fulviceps*, *mayri* and *pulchella*, the first from New Guinea and the other two from the Solomon Islands, are very closely related and the remaining two, *adpressa* from Sulawesi and *meshena* from Malaya and Java, form a close species-pair.

The second complex contains *katypa*, *kheperra*, *nacta*, *parvispina* and *pnyxis*, and is characterized by the lack of basigastral sculpture and usually by the presence of long, simple hairs on the head, at least a row along the upper margins of the frontal carinae. Of these five, *parvispina* is known from Borneo, the Philippines and Taiwan but *katypa*, *nacta* and *pnyxis* are known only from their type-localities, respectively Philippines, Thailand and West Malaysia. The remaining species, *kheperra*, has a wide distribution in the Oriental and Indo-Australian regions and is capable of being spread by human commerce. It has been recorded twice to my knowledge in Great Britain, on both occasions imported with tropical plants or plant produce.

The final species, *walshi*, is unique in the south-east Asian *Triglyphothrix* fauna as the petiole node is strongly antero-posteriorly compressed and is transverse, much broader than long in dorsal view. It is possible that *walshi* originated in the Ethiopian region as its general build and petiole form appear to show relationship with the smaller species of the Ethiopian *inezulae*-group and to *thoth*, but no specimens matching *walshi* have been found in sub-Saharan Africa as yet. In distribution *walshi* is predominantly a species of the Indian subcontinent but also occurs sporadically elsewhere in the Oriental and Indo-Australian regions.

THE *obesa*-GROUP. In the group of 11 species the hairs of the head and body are not universally trifid, and in many species trifid hairs do not occur, their place being taken by bifid hairs. The predominant pilosity is of a mixture of simple and bifid hairs, usually with one or the other predominating but sometimes with



approximately equal numbers of each. The general build of the body is less squat and stout than in the *walshi*-group and elongate simple hairs on the head and appendages are commonly encountered. The members of this species-group can be aggregated roughly into two complexes, the first of which contains *conoorensis*, *decamera*, *lanuginosa*, *obesa* and *rossi*. These five species have long, erect or suberect hairs on the antennal scapes and the tibiae of the middle and hind legs, and also have elongate simple hairs on the dorsal head and alitrunk along with shorter branched hairs. The first gastral tergite usually has a mixture of simple and bifid hairs but in *conoorensis* all are simple and in *obesa* some trifid hairs are present at least basally. All the species of this complex are more or less confined to the Indian subcontinent with the exception of *lanuginosa* which has a very wide range, being known throughout the Oriental, Indo-Australian and Polynesian regions and from many other localities both in and out of the tropics in both hemispheres. It is a highly successful tramp species spread by human commerce.

The species *antennata*, *brevidentata*, *chepocha*, *pacifica* and *vombis* form a complex characterized by the presence of numerous simple, long hairs on the head and alitrunk which are absent from the scapes and tibiae. Hairs of the first gastral tergite tend to be all simple, but in some bifid hairs are present. The distributions of these species are quite limited, with two Solomon Islands forms (*antennata*, *vombis*), one from the Fiji Islands (*pacifica*), and one each from Borneo and Java, *chepocha* and *brevidentata* respectively.

The final species included here, *indosinensis*, is known only from Vietnam and in many respects is the most peculiar member of the genus *Triglyphothrix* of all the regions at present under discussion. All hairs in this species are short and reclinate, predominantly trifid on head and alitrunk, universally simple on the dorsal portion of the first gastral tergite but trifid on the lateral parts of that sclerite. Coupled with this the antennal scapes and legs are very long and the antennal scrobes are absent. This peculiar species is included in this group for convenience; in many respects it is aberrant enough to merit a group on its own.

Only *antennata* and *brevidentata* of the *obesa*-group show any trace of sculpture on the first gastral tergite, the remaining species all have the sclerite smooth and shining.

#### KEY TO SPECIES

##### (Workers)

*Note.* The worker of *decamera* is not known, couplet 1 below refers to the queen.

- |   |   |                          |    |
|---|---|--------------------------|----|
| 1 | Antennae with 10 segments, propodeum unarmed. (India).  | <i>decamera</i> (p. 347) |    |
| – | Antennae with 12 segments, propodeum with a pair of spines or teeth . . . . .   |                          | 2  |
| 2 | Basal one-quarter to two-thirds of first gastral tergite distinctly sculptured with striation, puncturation or a combination of both; this area either markedly more strongly sculptured than the remainder of the sclerite or rarely the tergite sculptured throughout . . . . . |                          | 3  |
| – | Basal portion of first gastral tergite not sculptured, the entire sclerite smooth and shining . . . . .   |                          | 10 |
| 3 | Dorsal surface of head in profile with a number of elongate, simple hairs which are noticeably longer than the neighbouring simple or branched hairs and which project freely above the level of the shorter hairs . . . . .  |                          | 4  |



- Dorsal surface of head in profile without elongate, simple hairs. All hairs on cephalic dorsum branched and of approximately the same length . . . . . 6
- 4 Node of petiole in dorsal view strongly antero-posteriorly compressed, transverse, distinctly broader than long. Hairs on first gastral tergite universally and conspicuously branched, trifid. (India, Sri Lanka, China, Singapore, Philippines) *walshi* (part) (p. 358)
- Node of petiole in dorsal view not antero-posteriorly compressed, as long as or longer than broad. Hairs on first gastral tergite predominantly or entirely simple . . . . . 5
- 5 Propodeum armed with a pair of spines which are at least as long as the metapleural lobes. Antennal scapes relatively longer,  $SI > 83$ . (Solomon Islands) *antennata* (p. 344)
- Propodeum with a pair of minute, obtuse tubercles which are much shorter than the metapleural lobes (Text-fig. 69). Antennal scapes relatively shorter,  $SI < 80$ . (Java) . . . . . *brevidentata* (p. 345)
- 6 Basal portion of first gastral tergite longitudinally striate or costulate, sometimes with scattered punctures between the striae . . . . . 7
- Basal portion of first gastral tergite punctate or reticulate-punctate, usually coarsely so; striation or costulation absent . . . . . 8
- 7 Head bright yellow, contrasting strongly with the blackish brown alitrunk, pedicel and gaster. (New Guinea) . . . . . *fulviceps* (p. 347)
- Entirety of head and body yellow, the alitrunk generally slightly darker in shade than the head and gaster. (Solomon Islands) . . . . . *pulchella* (p. 356)
- 8 Smaller species with narrower head and relatively longer antennal scapes,  $HW < 0.60$ ,  $CI$  ca 87-90,  $SI$  in range 77-81. Upper boundary of antennal scrobe without an acute, narrow, flange-like margin formed by the frontal carinae. Median longitudinal carina of scrobe very weak or absent, not more strongly developed than the surrounding sculpture. Colour yellow. (Solomon Islands) . . . . . *mayri* (p. 352)
- Larger species with broader heads and relatively shorter antennal scapes,  $HW > 0.60$ ,  $CI$  ca 94-97,  $SI$  in range 61-68. Upper boundary of antennal scrobe with a distinct, acute, narrow flange-like margin formed by the frontal carinae. Median longitudinal carina of scrobe strongly developed, easily distinguished from the surrounding sculpture. Colour red-brown. . . . . 9
- 9 Propodeal spines long and narrow, much longer in profile than their basal width (Text-fig. 66). Trifid hairs on disc of first gastral tergite and on head short and closely applied to the surface from which they arise. (Sulawesi) *adpressa* (p. 344)
- Propodeal spines short, stout and broadly triangular, in profile about as long as their basal width (Text-fig. 67). Trifid hairs on disc of first gastral tergite and on head long and erect or suberect, not closely applied to the surface from which they arise. (West Malaysia, Java) . . . . . *meshena* (p. 353)
- 10 Antennal scapes exceptionally long,  $SL > 0.75$ ,  $SI$  100 or more; antennal scrobes completely absent. (Vietnam) . . . . . *indosinensis* (p. 348)
- Antennal scapes much shorter,  $SL < 0.65$ ,  $SI < 90$ ; antennal scrobes most commonly present, only rarely vestigial or absent . . . . . 11
- 11 Node of petiole in dorsal view strongly antero-posteriorly compressed, transverse, distinctly broader than long. (India, Sri Lanka, China, Singapore, Philippines) *walshi* (part) (p. 358)
- Node of petiole in dorsal view not antero-posteriorly compressed, not transverse, generally as long as broad or very slightly broader than long . . . . . 12
- 12 Hairs on first gastral tergite universally trifid and forming a dense pelt over the sclerite; simple or bifid hairs completely absent from the tergite . . . . . 13
- Hairs on first gastral tergite universally simple, or bifid, or a mixture of simple and branched hairs . . . . . 17



- 13 With the petiole in profile the tergal portion of the node distinctly longer than high (Text-fig. 70) . . . . . 14
- With the petiole in profile the tergal portion of the node at most as long as high, usually distinctly higher than long (Text-figs 64, 71) . . . . . 15
- 14 Dorsal margin of frontal carinae forming the border of the scrobe with a spaced row of long, simple hairs which are very prominent. (Philippines) . **katypa** (p. 349)
- Dorsal margin of frontal carinae forming the border of the scrobe with abundant short, branched hairs but without a spaced row of long, simple hairs. (West Malaysia) . . . . . **pnyxis** (p. 356)
- 15 Propodeal spines distinctly longer than the metapleural lobes. (India, Vietnam, Hong Kong, Philippines, Borneo, Malaya, Java, Sumba, Sulawesi; introduced in temperate zone with plant products) . . . . . **kheperra** (p. 349)
- Propodeal spines shorter than metapleural lobes, at most the spines almost as long as the lobes . . . . . 16
- 16 Larger species, with relatively shorter antennal scapes,  $HW > 0.70$ ,  $SI < 70$ . (Thailand) . . . . . **nacta** (p. 353)
- Smaller species with relatively longer antennal scapes,  $HW < 0.65$ ,  $SI > 70$ . (Borneo, Philippines, Taiwan) . . . . . **parvispina** (p. 355)
- 17 Dorsal (outer) surface of hind tibiae viewed from in front or behind with numerous long hairs of varying length, the longest of them at least subequal to the maximum tibial width; these hairs never forming a close mat above the tibial surface (Text-fig. 38) . . . . . 18
- Dorsal (outer) surface of hind tibiae viewed from in front or behind with abundant short, curved hairs of approximately uniform length which are much shorter than the maximum tibial width, usually less than half the tibial width; these hairs characteristically forming a close mat above the tibial surface (Text-fig. 39) . . . . . 20
- 18 First gastral tergite with all hairs simple. (India) . . . . . **coonoorensis** (p. 346)
- First gastral tergite with at least a few bifid or trifid hairs present . . . . . 19
- 19 Mandibles smooth with scattered punctures, not longitudinally striate. HW in range 0.76–0.82. First gastral tergite with trifid hairs on basal half. (India, Burma) . . . . . **obesa** (p. 354)
- Mandibles longitudinally striate, the striation sometimes indistinct or absent in small specimens. HW in range 0.52–0.70. First gastral tergite basally with a mixture of simple and bifid hairs, trifid hairs usually completely absent. (Throughout Oriental and Indo-Australian regions; cosmopolitan tramp species) . . . . . **lanuginosa** (p. 350)
- 20 Dorsal surfaces of both petiole and postpetiole reticulate-rugose, the two about equally densely sculptured . . . . . 21
- Dorsum of postpetiole mostly smooth and shining with only vestigial sculpture in places, distinctly less densely sculptured than the petiole dorsum. (Fiji Islands) . . . . . **pacifica** (p. 255)
- 21 First gastral tergite with hairs universally simple or at most with only 1–2 bifid hairs. Antennal scrobes strongly developed, with an acute dorsal margin . . . . . 22
- First gastral tergite with a distinct mixture of simple and bifid hairs. Antennal scrobes vestigial, without an acute dorsal margin. (India) . . . . . **rossi** (p. 357)
- 22 Node of petiole in profile massive, its outline almost square, and with well developed antero- and posterodorsal angles (Text-fig. 72). Larger species with HW in range 0.72–0.76, SL in range 0.56–0.58. (Borneo) . . . . . **chepocha** (p. 345)
- Node of petiole in profile relatively low and convex above, its outline not square, and with the dorsal surface rounding into the posterior face so that there is no defined posteroventral angle (Text-fig. 73). Smaller species with HW in range 0.64–0.66, SL in range 0.46–0.50. (Solomon Islands) . . . . . **vombis** (p. 358)



## TREATMENT BY SPECIES

*Triglyphothrix adpressa* sp. n.

(Text-fig. 66)

*Holotype worker.* TL 3.1, HL 0.72, HW 0.70, CI 97, SL 0.44, SI 63, PW 0.52, AL 0.80.

Sides of head convex, occipital margin shallowly concave in full-face view. Antennal scrobes strongly developed, with a distinct dorsal margin and a marked median longitudinal carina which is well differentiated from the surrounding sculpture and which reaches back beyond the posterior margin of the eye. Propodeal spines long and acute, quite narrow, distinctly longer than their basal width in profile. Metapleural lobes strongly developed, acute, feebly upcurved (Text-fig. 66). Pedicel in dorsal view with the postpetiole very slightly broader than the petiole (about 0.02 difference) and the petiole node slightly broader than long (about 0.04 difference). Mandibles striate; head, alitrunk, petiole and postpetiole densely punctate with scattered rugulae, base of first gastral tergite densely punctate. Pilosity on dorsum of body entirely of short trifid hairs of approximately equal length, which are closely adpressed on the head and gaster; long simple hairs completely absent from dorsal surfaces and from appendages. Hairs on scapes and tibiae short, distinctly less than half the maximum width of the surfaces on which they arise.

*Paratype workers.* TL 2.8–3.1, HL 0.70–0.74, HW 0.66–0.72, CI 94–97, SL 0.42–0.44, SI 61–64, PW 0.50–0.54, AL 0.74–0.80 (3 measured). As holotype.

Holotype worker, SULAWESI ('N. Celebes' on label): SW. slope Mt Klabat, 400–600 m, 13–19.vi.1972, rain forest (*W. L. Brown*) (MCZ, Cambridge).

Paratypes. 3 workers with same data as holotype (MCZ, Cambridge, BMNH).

This species is very closely related to *meshena* and I would not be surprised if further collections from Indonesia were to lead to the conclusion that the two are inseparable. For the present, however, I consider that they should be separated on the grounds that in *adpressa* the cephalic and gastral hairs are very short and strongly adpressed, the propodeal spines are long, narrow and acute and the metapleural lobes are narrower and upcurved. In *meshena* the cephalic and gastral hairs are longer and are erect or suberect, the propodeal spines are short and broad and the metapleural lobes are broader and scarcely or not upcurved (compare Text-figs 66 and 67). Other closely related species include *parvispina* and the widespread *kheperra*, but in both these species the basal portion of the first gastral tergite is unsculptured.

*Triglyphothrix antennata* Mann stat. n.

*Triglyphothrix fulviceps* subsp. *antennata* Mann, 1919: 350, fig. 30. Syntype workers, SOLOMON ISLANDS: Santa Cruz, Graciosa Bay, 1916 (*W. M. Mann*) (MCZ, Cambridge) [examined].

*Worker.* TL 3.0–3.2, HL 0.66–0.68, HW 0.56–0.60, CI 85–89, SL 0.50–0.52, SI 87–89, PW 0.46, AL 0.76–0.78 (2 measured).

Antennal scrobes poorly developed, with a weak dorsal border which is only differentiated to about the level of the posterior margin of the eye when viewed in profile. Behind the level of the eye it tends to merge into the surrounding sculpturation, which is moderately strongly developed on the sides of the head behind the eyes. Median longitudinal carina of scrobe absent or so weakly developed that it is indistinguishable from other longitudinal rugulae above the eye. Antennal scapes long, the SI of 87–89 being approached only by *mayri* and



*pacifica* which have a maximum SI of about 80. Mandibles striate, the dorsal surfaces of head, alitrunk and pedicel finely reticulate-rugose, the basal portion of first gastral tergite strongly punctate. Pilosity everywhere predominantly of fine, dense, simple hairs which are of varying length on the head and dorsal alitrunk. On the scapes and legs the hairs are shorter and more or less uniform in length; long, erect projecting hairs are absent. Head and gaster yellow-brown in colour, the alitrunk and pedicel darker.

Along with its allies *brevidentata*, *pacifica* and *vombis* this species shows a marked tendency towards the loss of branched hairs. This tendency is obviously better developed in *antennata* than in the other species as here branched hairs appear to be almost completely absent whilst at least a few are retained in the related species. Despite this *antennata* is still very densely hairy, the individual hairs fine and generally curved. Identification of the species should be relatively simple by the use of the combination of characters given in the diagnosis above.

### *Triglyphothrix brevidentata* Kutter

(Text-fig. 69)

*Triglyphothrix brevidentata* Kutter, 1932 : 208, figs. Holotype worker, JAVA: Sarangan, Lawoe-Geb. 1927 (*H. Overbeck*) (Dresden Museum).

*Worker.* TL 2.6–2.7, HL 0.62–0.64, HW 0.54–0.58, CI 88–91, SL 0.40–0.42, SI 72–75, PW 0.44–0.46, AL 0.68–0.70 (4 measured).

Antennal scrobes developed but weakly so, the median longitudinal carina scarcely more strongly developed than the surrounding sculpture. Propodeal spines reduced to a pair of minute, obtusely-rounded tubercles above the broad, triangular, acute metapleural lobes. Mandibles striate. Dorsal surfaces of head, alitrunk and pedicel finely reticulate-rugulose. Extreme basal portion of first gastral tergite sparsely punctate, the spaces between punctures usually finely shagreened; remainder of gaster smooth and shining. Branched hairs sparse on head and alitrunk, more numerous on petiole and postpetiole, apparently absent on gaster. Long, simple hairs numerous on dorsal surfaces of head and body but scapes and tibiae with only short, curved hairs. Colour brown to reddish brown, the appendages lighter.

Of the species known from the regions at present under consideration only two have the propodeal armament strongly reduced, *brevidentata* and *parvispina*, but in the latter the propodeal spines are still present as small, acute teeth, whereas in the former only low, rounded tubercles are present. Also, *parvispina* has abundant branched hairs upon the gaster whilst in *brevidentata* all gastral hairs appear to be simple. Finally, the base of the gaster is sculptured in *brevidentata* and is not in *parvispina*.

Within the obesa-group *brevidentata* appears closest related to *antennata* but the latter has strongly developed propodeal spines and relatively much longer antennal scapes.

Apparently *brevidentata* is only known from Java, where it has been collected twice in my knowledge, besides the type-collection. Both these collections were made at Tjibodas by Dammerman, in 1921 and 1922.

### *Triglyphothrix chepocha* sp. n.

(Text-fig. 72)

*Holotype worker.* TL 3.2, HL 0.76, HW 0.72, CI 95, SL 0.56, SI 77, PW 0.58, AL 0.94.



Antennal scrobes shallow, with very feebly defined posterior and ventral margins. Dorsal margin of scrobe more strongly defined and acute, but not a distinct flange or rim as is seen in most species of this group, rather it is an uneven line where the sculpture of the cephalic dorsum terminates at the frontal carinae. Median carina of scrobe absent or not differentiated from the surrounding sculpture. Propodeal spines long and acute, longer than the large, triangular, upcurved metapleural lobes. Node of petiole in profile blocky and massive, its outline almost square, with strongly developed antero- and postero-dorsal angles. In dorsal view the node is about as broad as long, much broader behind than in front and narrowly rounded anteriorly. Dorsal surfaces of head, alitrunk, petiole and postpetiole finely and quite densely reticulate-rugulose. All dorsal surfaces of head and body with numerous long, simple hairs, universally simple on the first gastral tergite. Elsewhere numerous short bifid or trifid hairs are present amongst the more conspicuous long simple hairs. Long hairs such as are present on the head and alitrunk are absent from the legs and antennae where much shorter simple hairs are present with a few bifid individuals. Colour dark red-brown, the appendages lighter, yellow-brown.

*Paratype workers.* As holotype but one or two specimens with a single bifid hair on the first gastral tergite. TL 3.0–3.4, HL 0.74–0.80, HW 0.72–0.76, CI 95–97, SL 0.56–0.58, SI 76–78, PW 0.56–0.60, AL 0.92–0.98 (9 measured).

Holotype worker, BORNEO: Kiduk Arok, Trus Madi Massif, 1500 m, Cambridge N. Borneo Exped. no 75 (*P. W. Bryant*) (MCZ, Cambridge).

Paratypes. 11 workers with same data as holotype (BMNH; MCZ, Cambridge).

*T. chepocha* appears to be most closely related to *vombis* of the Solomon Islands, but this species is smaller and has a differently shaped petiole node, details of which are given in the key.

### *Triglyphothrix coonoorensis* (Forel) **comb. n.**

(Text-fig. 65)

*Tetramorium coonoorensis* Forel, 1902a : 237. Syntype workers, female, INDIA: Coonoor (*Wroughton*) (MHN, Geneva) [examined].

*Worker.* TL 2.7–2.8, HL 0.64–0.66, HW 0.56–0.58, CI 87–89, SL 0.44–0.46, SI 77–79, PW 0.44–0.46, AL 0.72–0.74 (4 measured).

Antennal scrobes poorly developed and shallow, the dorsal margin formed by the termination of the cephalic rugosity and not by a projecting, flange-like edge. Median longitudinal carina of scrobe not developed. Dorsal outline of alitrunk regularly convex, the propodeal spines long and quite narrow, only slightly tapered from base to apex. Petiole node in profile low, paniform, longer than high, the anterior peduncle of the petiole meeting the node so that its dorsal surface is continuous with the anterior face of the node and the ventral surface meets the ventral surface of the node through an obtuse angle. Dorsum of head, alitrunk and pedicel reticulate-rugulose, the gaster unsculptured. Sculpture within the scrobe basically a continuation of the rugulation present on the remainder of the head but weaker and with a tendency for it to be replaced by dense puncturation, especially in the upper half of the scrobe. Long, simple hairs present on all dorsal surfaces and on appendages. Branched, bifid hairs sparse everywhere, best developed on dorsal alitrunk and sides of petiole, completely absent from first gastral tergite. Colour light brown to mid-brown, the head usually distinctly darker than the alitrunk.

Closely related to *obesa* and *lanuginosa* but separated from them by the absence of branched hairs from the first gastral tergite; such hairs are numerous or abundant in the related species.



Apart from the type-series of three workers and a female the only other material of this species examined comes from a short series collected by Bingham, presumably from India but without further data, and the series noted below.

#### MATERIAL EXAMINED.

INDIA: Nilgiri, Madras, Halical nr Coonoor (*Besuchet, Löbl, Mussard*).

### *Triglyphothrix decamera* Forel

*Triglyphothrix decamera* Forel, 1902a : 240. Holotype female, INDIA: Kanara (*Aitken*) (MHN, Geneva) [examined].

*Holotype female.* TL 2.9, HL 0.60, HW 0.54, CI 90, SL 0.34, SI 63, PW 0.56, AL 0.82.

Although only known from the type-collection of a single female this species should be easily recognised if found again as the antennae have only 10 segments and the propodeum is completely unarmed, without trace of teeth. The petiole is distinctly narrower than the postpetiole in dorsal view, their respective widths ca 0.20, 0.30. Pilosity everywhere is long, erect, and consists of a mixture of simple and bifid hairs, with the former tending to predominate. Head, alitrunk and pedicel covered with fine, superficial rugosity, the gaster shining, unsculptured.

The form of the pilosity and the presence of long, erect simple hairs projecting from the tibiae and antennal scapes relates *decamera* to *obesa* and its allies, but in all other species of the *obesa*-group the female has 12-segmented antennae as in the worker and the propodeum is armed with spines or teeth. The possibility that *decamera* is a temporary or permanent social parasite should not be overlooked, and if this is the case then it is also possible that the workers (if any) do not share the singular characters of the female, as Brown (1964) has pointed out in his study of *Rhoptromyrmex*, where the queens are quite different from the workers of the same species and are assumed to be social parasites.

### *Triglyphothrix fulviceps* Emery

(Text-fig. 62)

*Triglyphothrix fulviceps* Emery 1897 : 588. Syntype workers, NEW GUINEA: Friedrich-Welhelmshafen (*L. Biró*) (MCSN, Genoa) [examined].

*Note.* A number of specimens in MHN, Geneva are labelled as cotypes (= syntypes). These were collected in New Guinea by Biró but in 1898-99 and are thus not types. The localities of these specimens are Huon Golf, Sattelberg and Astrolabe Bai, Stephansort.

*Worker.* TL 2.5-3.0, HL 0.60-0.70, HW 0.52-0.64, CI 84-91, SL 0.34-0.46, SI 63-72, PW 0.42-0.52, AL 0.62-0.80 (15 measured).

Antennal scrobes distinct, with a weakly developed median longitudinal carina which in some specimens runs the length of the scrobe. Propodeal spines long and acute, varying in length between individuals but always much longer than the metapleural lobes which are somewhat reduced and rounded. Node of petiole low in profile, its anterior face very short, merging into the peduncle. In dorsal view the node broader than long. Dorsal surfaces of head, alitrunk and pedicel closely and very finely and densely reticulate-rugose; mandibles striate. Basal half or more of first gastral tergite strongly longitudinally striate, the spaces between the striae often with punctures, especially basally. First gastral sternite sculptured.



Entirety of head, body and appendages covered with a dense mat of short, branched hairs, apparently mixed trifid-quadrifid. Simple long hairs absent. Alitrunk, pedicel and gaster light to very dark brown, the head bright yellow, contrasting strongly to the remainder of the body.

This very distinctive species is apparently confined to New Guinea but two related species, *pulchella* and *mayri*, are known from the Solomon Islands. A third species, and the one most closely resembling *fulviceps*, is *pulcherrima* from Uganda, but the apparent similarities in colour, sculpture and body form may be due to convergence as the petiole node is very differently constructed in the Ugandan species, the node being high and narrow in profile with a deep anterior face (compare Text-figs 62 and 59).

#### MATERIAL EXAMINED.

NEW GUINEA: Huon Peninsula, Lower Busu R. (*E. O. Wilson*); Huon Peninsula, Ngandus (*E. O. Wilson*); Nadzab (*E. O. Wilson*); Lae, Didiman Ck. (*E. O. Wilson*); Bunbok Valley, Boana (*E. O. Wilson*); Lae (*E. Hardy*); Cyclops Mts, Mt Lina (*L. E. Cheesman*); Wau N. on Bulolo Rd (*S. Peck*); W. Highlands, Baiyer R. (*S. Peck*).

#### *Triglyphothrix indosinensis* (Wheeler) **comb. n.**

*Tetramorium indosinense* Wheeler, 1927 : 97, fig. 6. Syntype workers, VIETNAM: Klinai Tao, 2.viii.1925 (*F. Silvestri*) (MCZ, Cambridge) [examined].

*Note.* In the original description the type-locality is given as Hanoi, but the specimens determined and labelled as types by Wheeler give the locality as Klinai Tao. As these specimens fit the original description perfectly and have been labelled as types by Wheeler himself it is assumed that the locality of Hanoi is an error.

*Worker.* TL 3.4–3.6, HL 0.88–0.92, HW 0.78–0.80, CI 87–89, SL 0.80–0.82, SI 100–103, PW 0.50–0.52, AL 0.94–0.96 (3 measured).

Antennal scrobes absent, frontal carinae reduced, ending at the level of the anterior margin of the eye. Eyes small, maximum diameter ca 0.14, very slightly greater than the maximum width of the scape. Antennal scapes exceptionally long, the longest recorded in the genus to date. Promesonotal dorsum evenly convex, metanotal groove faintly indicated in profile. Propodeal spines elongate and acute. Legs very long, maximum length of hind femur ca 0.88. Petiole in profile with a long anterior peduncle and a high, roughly rectangular node. In dorsal view the node is compressed from side to side, slightly longer than broad and broader behind than in front. Mandibles longitudinally striate-rugulose. Dorsum of head predominantly finely longitudinally rugulose, the rugulae diverging posteriorly and with a few faint cross-meshes which are distinctly weaker than the longitudinal component. Dorsal alitrunk with pronotum reticulate-rugulose, the sculpture becoming much weaker posteriorly. Petiole with vestiges of rugulation but the postpetiole almost completely smooth. Gaster unsculptured. All surfaces of head and body with numerous fine short hairs which are reclinate or closely adpressed to the surface and which are predominantly trifid, except on the dorsum of the first gastral tergite where the majority of hairs are simple. Elongate, erect, simple hairs completely absent. Colour dull yellow-brown.

The combination of extremely long antennal scapes, lack of scrobes and very long legs makes this species unmistakable. At present it cannot be assigned to



any definite species-group as it shows very few similarities with any other known species.

***Triglyphothrix katypa* sp. n.**

*Holotype worker.* TL 2.7, HL 0.64, HW 0.58, CI 90, SL 0.44, SI 77, PW 0.44, AL 0.74.

Antennal scrobes with a sharp dorsal margin, less strongly defined posteriorly and ventrally, primarily demarcated ventrally by a change in sculpture from a rugoreticulum outside the scrobe to reticulate-punctate inside. Median carina of scrobe distinct to level of posterior margin of eye. Dorsal alitrunk evenly convex, the propodeum with a pair of short, acute spines which are shorter than the long, broadly triangular, metapleural lobes. Petiole in profile with the tergal portion of the node distinctly longer than high, in dorsal view the node slightly broader than long, broadest at about its midlength. All dorsal surfaces of head, alitrunk, petiole and postpetiole finely, closely reticulate-rugulose. Mandibles longitudinally striate; gaster smooth and shining. All dorsal surfaces of head and body with numerous trifid hairs, those on the first gastral tergite universally so. Dorsum of head with numerous elongate, simple hairs and especially with a spaced row of long, simple, quite stout hairs along the dorsal edge of the frontal carinae where they form the upper borders of the scrobes. A few simple long hairs are also present on the dorsal alitrunk but are absent from the first gastral tergite, antennae and legs. Colour light red-brown, the appendages and gaster yellow-brown.

*Paratypes.* As holotype, with dimensions TL 2.6–2.7, HL 0.60–0.64, HW 0.54–0.58, CI 90–93, SL 0.42–0.44, SI 73–77, PW 0.42–0.46, AL 0.70–0.74 (4 measured).

Holotype worker, PHILIPPINES: Dumaguete, Lake, 30.iv.1931 (*J. W. Chapman*) (MCZ, Cambridge).

Paratypes. 4 workers with same data as holotype (BMNH; MCZ, Cambridge).

This small species is most closely related to *pnyxis* of West Malaysia but is separable by the lack of elongate simple hairs from the upper scrobe margins in *pnyxis*, distinct in *katypa*.

Several more series of this species are present in the Chapman collection at MCZ, Cambridge, but they are all dirty and in rather poor condition; they will require cleaning and remounting before they can be of any value to systematics.

***Triglyphothrix kheperra* sp. n.**

(Text-fig. 71)

*Holotype worker.* TL 2.6, HL 0.66, HW 0.64, CI 97, SL 0.44, SI 69, PW 0.46, AL 0.68.

Antennal scrobes strongly developed, with an acute dorsal margin and a distinct median longitudinal carina; the lower margin of the scrobe well defined behind the eye. Propodeal spines acute, longer than the metapleural lobes (which in many specimens tend to be low, broad and rounded). The petiole node in dorsal view is slightly broader than long (ca 0.04–0.06 difference) but in profile it is high and relatively narrow, with front and rear faces roughly parallel. Dorsal surfaces of head, alitrunk and pedicel finely and closely reticulate-rugose, the gaster unsculptured, smooth and shining. All dorsal surfaces of head and body coated with abundant trifid hairs, the cephalic dorsum also with a few longer, simple hairs on the upper margins of the antennal scrobes. (In some specimens, rarely, one or two long, simple hairs are present elsewhere on the dorsum of the head.) Hairs on outer surfaces of middle and hind tibiae short, of equal length, distinctly less than the maximum tibial width. Colour uniform brown, varying in shade from light to mid-brown in the material available.

*Paratypes.* As holotype, with a size-range TL 2.5–2.8, HL 0.56–0.70, HW 0.50–0.66, CI 92–97, SL 0.34–0.46, SI 67–72, PW 0.40–0.52, AL 0.62–0.76 (10 measured).



Holotype worker, JAVA: Bogor, 21.x.1973 (*B. Bolton*) (BMNH).

Paratypes. 8 workers with same data as holotype; 5 workers as holotype but 24.x.73; 1 worker 19.x.1973, and 6 workers 29.x.73. (BMNH; MCZ, Cambridge; MHN, Geneva.)

This species, although previously undescribed, is widespread in the Oriental and Indo-Australian regions and is capable of acting as a tramp species in human commerce dealing with fresh plants and their products. Specimens have been intercepted at least twice in Britain, once from York (1928) in a consignment of illipic nuts from Borneo (recorded by Donisthorpe, 1933 as *lanuginosa*), and more recently in Kew Gardens, London (1974) amongst the roots of a plant imported from Assam. No doubt the species has been introduced on other occasions but has gone unnoticed or has been assumed to be *lanuginosa* (= *striatidens*), the most common tramp-species in this genus both in Britain and in other temperate-zone countries.

The closest relatives of *kheperra* include *adpressa* and *meshena*, which are easily separated as they have the first gastral tergite sculptured basally, and *parvispina*. This last-named species is close to *kheperra* but has much shorter propodeal spines.

#### MATERIAL EXAMINED.

INDIA: Assam (intercepted at Kew Gdns, England). VIETNAM: Van Phu (*F. Silvestri*). HONG KONG (*R. H. Lefevre*). PHILIPPINES: Mt Magading (*C. F. Baker*). BORNEO: Sarawak (*R. Thaxter*); Pontianak (*H. Britten*) (intercepted at York, England). SUMBA: Kananggar (*Dammerman*). PRINSEN I. (*Dammerman*). SULAWESI: Balampesoang For. (*W. L. Brown*).

### *Triglyphothrix lanuginosa* (Mayr)

(Text-fig. 63)

*Tetramorium lanuginosum* Mayr, 1870 : 972, 976. Holotype worker, JAVA: Batavia (= Djakarta) (NM, Vienna) [examined].

*Tetramorium obesum* race *striatidens* Emery, 1889b : 501. Syntype workers, BURMA: Bhamó, vii. 1886 (*L. Fea*) (MHN, Geneva) [examined]. **Syn. n.**

*Triglyphothrix lanuginosa* (Mayr) Emery, 1891 : 4 (implied in footnote 2).

*Triglyphothrix obesus* race *striatidens* (Emery); Emery, 1891 : 4.

*Triglyphothrix striatidens* var. *laevidens* Forel, 1900 : 284. Syntype workers, MEXICO (MHN, Geneva) [examined]. **Syn. n.**

*Triglyphothrix striatidens* (Emery); Forel, 1902b : 704. [Raised to species.]

*Triglyphothrix striatidens* st. *orissana* Forel, 1902a : 239. Syntype workers, INDIA: Orissa XLIV/17b (*Taylor*) (MHN, Geneva) [examined]. **Syn. n.**

*Triglyphothrix striatidens* var. *australis* Forel, 1902c : 449. Syntype workers, females, AUSTRALIA: Queensland, Mackay (*Turner*) (MHN, Geneva; MCZ, Cambridge) [examined]. **Syn. n.**

*Triglyphothrix striatidens* var. *felix* Forel, 1912b : 160. Syntype workers, SEYCHELLE ISLANDS: Félicité, Silhouette, Mare aux Cochons, 1908 (*H. Scott*) (MHN, Geneva; BMNH) [examined]. **Syn. n.**

*Triglyphothrix ceramensis* Stitz, 1912 : 506. Holotype worker, SERAM (*Tauern*) (location of holotype not known). **Syn. n.**

*Triglyphothrix striatidens* var. *flavescens* Wheeler, 1929 : 55. Syntype workers, SINGAPORE: Johore, 11.ii.25 (*F. Silvestri*) (MCZ, Cambridge) [examined]. **Syn. n.**



*Triglyphothrix mauricei* Donisthorpe, 1946a : 778. Holotype and paratype worker, MAURITIUS: Rose Hill, 1942 (*R. Mamet*) (BMNH) [examined]. **Syn. n.**  
*Triglyphothrix tricolor* Donisthorpe, 1948 : 136. Paratype workers, females, NEW GUINEA: Maffin Bay, 17 and 20.vi.1944 (*E. S. Ross*) (BMNH; CAS, San Francisco) [examined]. **Syn. n.**

*Worker.* TL 2.2–3.0, HL 0.56–0.72, HW 0.52–0.70, CI 92–97, SL 0.36–0.50, SI 68–75, PW 0.40–0.50, AL 0.58–0.80 (25 measured).

Antennal scrobes well developed with a sharply marked dorsal margin and usually with a defined median longitudinal carina, although in some specimens this may be rather reduced. In all material examined the scrobe ends well behind the posterior margin of the eye. Propodeal spines long and acute, longer than the metapleural lobes, and are usually feebly upcurved along their length. Metapleural lobes usually somewhat upcurved and acute. Node of petiole in profile with the dorsal surface curving into the posterior face so that the two are not separated by an angle but by a curvature which is much less acute than the angle separating anterior and dorsal surfaces. In extreme cases the dorsal and posterior faces are united in a single convexity (Text-fig. 63). Petiole more massively built than postpetiole. Mandibles striate except in some small individuals where it may be partially effaced or absent. Dorsal surfaces of head, alitrunk, petiole and postpetiole finely reticulate-rugose. On the head there is a tendency for the transverse rugulae to break down on the anterior portion, leaving this area longitudinally rugose, and on the postpetiole the sculpture may be partially or totally effaced, usually in smaller specimens. First gastral tergite smooth and shining. All dorsal surfaces of head and body with abundant hairs, predominantly a mixture of simple and bifid but sometimes also with a few trifid hairs. On the first gastral tergite trifid hairs are nearly always absent. Numerous elongate, simple hairs present. Leading edges of antennal scapes and outer margins of middle and hind tibiae with numerous simple hairs of varying length, the longest of which are at least as long as the maximum width of the appendage from which they arise. Colour brown, varying in shade from light to dark, often with alitrunk and gaster of different shades.

An accomplished tramp-species on a worldwide scale, *lanuginosa* (better known by its junior synonym *striatidens*), is known or has been reported from all major and a great number of minor land masses on the earth's surface. Wilson & Taylor (1967) state that the species (recorded as *striatidens*) 'is probably native to tropical Asia', and I concur with this as the most closely related species to *lanuginosa* (*coonoorensis* and *obesa*) are known only from India and Burma. In the tropics the species survives outdoors but known collections of *lanuginosa* from the temperate zones have all been made in botanical or zoological gardens where the ants have most probably been imported with tropical plants or animal foodstuffs.

#### MATERIAL EXAMINED.

INDIA: Barrakpore (*Rothney*); Calicut (*A. B. Soans*); Maharashtra, Edalabad (*E. S. Ross* & *D. Q. Cavagnaro*); Assam, Jorhat (*A. C. Cole*); Assam, Garo Hills, Siju Cave; Kerala State, Kannothe (*A. B. Soans* & *W. L. Brown*); Calcutta (ex coll. *F. Smith*); no. loc. (*Wroughton*); Poona (*Wroughton*). NEPAL: Amlekhganj (*E. I. Coher*). SRI LANKA: Pollonaruwa (*K. L. A. Perera*). BURMA: Bhamo (*Bingham*). PHILIPPINES: Mindoro, San Jose (*E. S. Ross*); Luzon, Mt Makiling (*K. Dumont* & *R. Morse*); Dumaguette (*J. W. Chapman*); Iloilo (*S. Amaguin*); Negros I., Bago (*F. del Rosario*); Davao (*A. Reyes*); Dumaguete (*D. Empeso*); Dumaguete (*F. del Rosario*); Horns of Negros (*J. W. Chapman*). SOLOMON IS.: Guadalcanal (*P. Greenslade*); New Georgia (*P. Greenslade*). WEST MALAYSIA: Alor Star (*G. H.*



*Lowe*); Sg. Patani (*G. H. Lowe*); Kuala Lumpur (*K. W. Ng*). BORNEO: Kuching (*J. Hewitt*). JAVA: Batavia (= Jakarta); Semarang. FLORES: Nangagete (*W. L. Brown*). SUMBA: Laora (*Dammerman*); Kambera (*Dammerman*). AUSTRALIA: Queensland, Townsville (*Dodd*); Cape York, Silver Plains (*Darlington*); N. Terr., Howard Springs (*Brown*); N. Terr., Mt Bundy Rd (*Brown*); Lankelly Ck. (*Darlington*); Mackay (*R. E. Turner*); N. Terr. (*G. F. Hill*). MARIANAS I.: Guam, Pt Oca (*G. E. Bohart & J. L. Gressitt*); Pati Point (*H. S. Dybas*); Amantes Point (*H. S. Dybas*). CAROLINE IS.: Truk I. (*Yasu et Yoshi*); Yap I., S. Ramung I. (*R. J. Goss*). WALLIS IS.: Nuku Tapu I; Nuku Hifala I; Uvea; Nukuione I. (*G. Hunt*). SAMOA: Upolu, Lauili (*T. E. Woodward*). CHRISTMAN I. (no data). ALDABRA: South I. (*B. Cogan & A. Hutson*). LEBANON: Antilias Stream (*Christiansen*). ENGLAND: London, Kew Gdns (*Donisthorpe*); Birmingham, Bot. Gdns (*Bibikoff*); Birmingham, Dudley Zoo (*A. L. Mills*). CLIPPERTON I. (*C. F. Harbison*). GERMANY (WEST): Hamburg, imported from Mexico in orchids (ex coll. Forel). JAPAN: Ogasahara, Chichi-jima (*M. Tanaka*).

Other localities include: Seychelle Is., Seram, Singapore, New Guinea, Mauritius, Mexico—see type-data; U.S.A.: south-eastern United States N. to Carolinas (Creighton, 1950); Tunisia (Emery, 1891); Barbados, Mexico (Kempf, 1972).

### *Triglyphothrix mayri* Mann

*Triglyphothrix mayri* Mann, 1919 : 351. Syntype workers, SOLOMON ISLANDS: San Cristoval, Star Harbor (*W. M. Mann*) (MCZ, Cambridge) [examined].

*Worker*. TL 2.5–2.8, HL 0.58–0.62, HW 0.52–0.54, CI 87–90, SL 0.42–0.44, SI 77–81, PW 0.42–0.44, AL 0.68–0.70 (5 measured).

Antennal scrobe weakly developed, its upper margin poorly defined, not bounded by a narrow flange-like margin but limited by the sculpturation of the cephalic dorsum. Median longitudinal carina of scrobe poorly developed or indistinguishable from other scrobal sculpture. Sides of head more or less straight in full-face view, only extremely feebly convex; eyes prominent. Propodeal spines about as long as the metapleural lobes. Petiole in dorsal view slightly broader than long, in profile the anterior face confluent with the peduncle. Mandibles mostly smooth, with some very faint, almost effaced striation and a few scattered punctures. Dorsal surfaces of head, alitrunk and pedicel finely and densely reticulate-rugose. Basal half or more of first gastral tergite coarsely punctate. All surfaces of head, body and appendages densely coated with short, branched (trifid) hairs of approximately the same length. Long, simple hairs absent from legs, scapes and body behind the mouthparts. Colour uniform pale yellow.

Apparently known only from the type-collection, this species is one of four endemic species known to the present only from the Solomon Islands. Two of these species, *antennata* and *vombis*, belong to the *obesa*-group and have numerous simple long hairs projecting from the cephalic dorsum. *T. mayri*, along with the remaining Solomon Islands endemic, *pulchella*, do not have such hairs. These last two may be easily separated by the gastral sculpture, which consists of coarse punctures in *mayri* and longitudinal striation in *pulchella*.



***Triglyphothrix meshena* sp. n.**

(Text-figs 51, 67)

*Holotype worker.* TL 3.4, HL 0.74, HW 0.70, CI 94, SL 0.46, SI 66, PW 0.54, AL 0.82.

Antennal scrobes strongly developed, with a distinct, sharp dorsal margin and a marked median longitudinal carina. Outline shape of alitrunk as in Text-fig. 67. Propodeal spines short and stout, acute, approximately as long as their basal width and scarcely longer than the metapleural lobes. Petiole in profile massive, with a long anterior face and a short, broad peduncle. Postpetiole also massively built, in profile blocky, subrectangular in shape and higher than long. In dorsal view the petiole node as wide as long. Dorsal surfaces of head, alitrunk, petiole and post-petiole finely and densely reticulate-rugose. Basal portion of first gastral tergite coarsely punctate. Mandibles striate. Dorsal surfaces of head, body and appendages covered with a dense mat of erect or suberect trifold hairs, elongate simple hairs absent.

*Paratype workers.* TL 3.1–3.4, HL 0.70–0.74, HW 0.68–0.70, CI 94–97, SL 0.44–0.46, SI 63–68, PW 0.54–0.56, AL 0.80–0.82 (7 measured). Otherwise as holotype.

Holotype worker, WEST MALAYSIA: Selangor, Gombak, 7.x.1973 (*B. Bolton*) (BMNH).

Paratypes. 5 workers with same data as holotype; 2 workers, WEST MALAYSIA: Selangor, Ulu Gombak For. Reserve, 24.viii.1967, tree lookout area, ca 450 m, hill forest (*R. Crozier*) (BMNH; MCZ, Cambridge).

Most closely related to *adpressa*; notes on the differences of the two species are given under *adpressa*.

A number of specimens in the MCZ, Cambridge collection are also referable to this species. These include three short series from JAVA collected by Dammerman at Depok, 23.xii.1923 (2 workers and a female); Buitenzorg (= Bogor), 18.xii.1922 (2 workers); Buitenzorg, Tjampea, 19.x.1922 (1 worker).

The series from Bogor compare perfectly with the type-series, but the specimens from Depok have less massively built pedicel segments and shorter, more obviously reclinate branched hairs on the head and also to some extent upon the gaster. Whether these specimens represent part of the natural variation of *meshena* or a link in the direction of *adpressa* or indeed a separate species, cannot be decided on the few specimens presently available, but I note their existence here to bring them to the attention of any future worker on this group.

***Triglyphothrix nacta* sp. n.***Holotype worker.* TL 3.0, HL 0.78, HW 0.76, CI 97, SL 0.50, SI 66, PW 0.56, AL 0.82.

Antennal scrobes strongly defined dorsally and posteriorly, much more weakly delimited ventrally. Median longitudinal carina of scrobe extending back to level of posterior margin of eye and quite distinct. Eyes relatively small, their maximum diameter ca 0.14, only very slightly greater than the maximum width of the antennal scape. Dorsal alitrunk evenly convex in profile, the propodeal spines short, narrow and acute. Metapleural lobes large, lobate, roughly semicircular and longer than the propodeal spines. Petiole node relatively high in profile, the tergal portion of the node higher than long. Postpetiole rounded above in profile, the sternal portion forming a distinctly projecting, roughly rectangular mass ventrally. In dorsal view the petiole is subglobular, slightly broader than long and broadest at about its midlength. Mandibles coarsely striate. Dorsum of head finely and irregularly longitudinally rugose, without reticulations except near the occiput. Dorsal alitrunk, petiole and



postpetiole densely reticulate-rugulose, the gaster smooth and shining. Entire head and body densely clothed with trifid hairs, those of the first gastral tergite universally trifid. Simple hairs absent except for one or two relatively short ones which occur on the upper margin of the frontal carina where it forms the dorsal border of the scrobe, but these hairs are not exceptional and are difficult to distinguish from the surrounding branched pilosity. Colour uniform medium brown.

*Paratype workers.* As holotype, with range of dimensions TL 2.9–3.1, HL 0.76–0.80, HW 0.72–0.78, CI 96–100, SL 0.48–0.52, SI 63–68, PW 0.52–0.56, AL 0.76–0.84 (15 measured).

Holotype worker, THAILAND: Nong Hoi, 19.vii.75, in soil (*D. Jackson*) (BMNH).

Paratypes. 19 workers with same data as holotype (BMNH; MCZ, Cambridge).

This species is certainly most closely related to *parvispina* but is a much larger, more robust form in which the petiole is relatively higher and narrower.

### *Triglyphothrix obesa* (André)

*Tetramorium obesum* André, 1887 : 294. Syntype workers, INDIA: Gingi (MCZ, Cambridge; MNHN, Paris) [examined].

*Triglyphothrix obesa* (André); Emery, 1891 : 4.

*Worker.* TL 3.1–3.5, HL 0.78–0.84, HW 0.76–0.82, CI 95–98, SL 0.54–0.58, SI 68–76, PW 0.54–0.58, AL 0.86–0.90 (7 measured).

Antennal scrobes developed, with a distinct dorsal margin but with the median longitudinal carina weakly developed or in some indistinguishable from the surrounding sculpture. Upper portion of scrobe usually less strongly sculptured than the lower. Propodeal spines long, narrow and acute, generally two or more times longer than the metapleural lobes, which are acute and upcurved. Petiole in profile with the dorsal and posterior faces united in a single convex surface, the petiole more massively developed than the postpetiole. Dorsal surfaces of head, alitrunk, petiole and postpetiole finely reticulate-rugose, the reticulation tending to be more strongly developed on the posterior portion of the cephalic dorsum than the anterior, where often only longitudinal rugulae are present. First gastral tergite unsculptured. Mandibles smooth, with scattered pits but without striation. All dorsal surfaces of head and body with numerous branched (bifid and trifid) hairs, also with numerous elongate, simple hairs. Leading edge of antennal scapes and outer surfaces of middle and hind tibiae with abundant long hairs, the longest of which are at least as long as the maximum width of the appendage upon which they arise. Colour orange-brown to reddish brown.

Closest related to *lanuginosa*, *obesa* may be separated by the characters given in the key. In general the presence of mandibular striae in *lanuginosa* is sufficient to separate the two, and this character has been used on a number of occasions (Forel, 1902b; Bingham, 1903; Mann, 1919) to isolate *obesa*. Unfortunately a number of small individuals of *lanuginosa* are now known in which the mandibular striation is reduced or even absent, but in these the HW range falls considerably below the minimum for *obesa* and the array of branched hairs on the first gastral tergite lacks trifid members, some of which are invariably present in *obesa*, at least basally.

#### MATERIAL EXAMINED.

INDIA: Travancore (*Ferguson*); Kerala State, Perumanna Village (*A. B. Soans*); Kerala State, Nilambur (*A. B. Soans*). BURMA: Ruby Mines District (*Bingham*); Pegu Yoma (*Bingham*).



*Triglyphothrix pacifica* Mann

*Triglyphothrix pacifica* Mann, 1921 : 460. Syntype workers, female, FIJI ISLANDS: Viti Levu, Nadarivatu (*W. M. Mann*) (MCZ, Cambridge) [examined].

*Worker*. TL 2.5–3.0, HL 0.68–0.70, HW 0.60–0.64, CI 88–91, SL 0.48–0.50, SI 77–80, PW 0.50–0.52, AL 0.76–0.82 (6 measured).

Antennal scrobes weakly developed, with a poorly defined dorsal margin and a very weak, meandering median longitudinal carina which is not more strongly developed than adjacent rugulae. Propodeal spines long and acute, longer than the metapleural lobes. Node of petiole blocky and massive, larger than the postpetiole in profile. Mandibles striate. Dorsal surfaces of head, alitrunk and petiole finely reticulate-rugose, dorsal surface of postpetiole unsculptured, smooth and shining or at most with vestigial traces of sculpture. First gastral tergite unsculptured. Leading edge of antennal scapes and outer margins of middle and hind tibiae with short hairs only which are less than half the maximum width of the appendage from which they arise. Dorsal surfaces of head, alitrunk and pedicel with a mixture of simple and branched hairs and with some elongate, simple hairs on head. Hairs on first gastral tergite either almost universally simple, or with bifid hairs present. Colour light reddish brown to dark brown.

Apart from a few small individuals of *striatidens* this is the only known species of *Triglyphothrix* outside the Ethiopian region which has the postpetiole unsculptured. This single character serves to separate *pacifica* from its closest relatives also. It is the only endemic species of this genus known from the Fiji Islands, and the species appearing to be closest related are *antennata* and *vombis*, both endemic in the Solomon Islands.

## MATERIAL EXAMINED.

FIJI ISLANDS: Nausori Highlands, SW. Fiji (*W. L. & D. E. Brown*); Viti Levu, Nadala (*E. O. Wilson*).

*Triglyphothrix parvispina* Emery

(Text-fig. 64)

*Triglyphothrix parvispina* Emery, 1893 : 214 [diagnosis in key]. Syntype (?) workers, BORNEO (?): Pulo Laut (*Bedot & Pictet*) (MCSN, Genoa).

*Triglyphothrix parvispina* var. *formosae* Forel, 1912a : 52. Syntype workers, TAIWAN: 'Formosa', Pilam (*H. Sauter*) (MHN, Geneva) [examined]. **Syn. n.**

*Worker*. TL 2.4–2.6, HL 0.60–0.66, HW 0.56–0.62, CI 93–97, SL 0.40–0.44, SI 70–75, PW 0.40–0.48, AL 0.64–0.70 (6 measured).

Antennal scrobes strongly developed, with a sharply defined, narrow, flange-like dorsal margin and a well-differentiated median longitudinal carina. Propodeal spines short, reduced to a pair of triangular, acute teeth which are at most only as long as the metapleural lobes, often shorter. Metapleural lobes low and rounded, not developed into upcurved teeth. Dorsal surfaces of head, alitrunk and pedicel finely reticulate-rugose, first gastral tergite unsculptured. All dorsal surfaces of body densely clothed with short, predominantly branched (trifid) hairs. Long, erect hairs absent.

On the whole this species shows a close resemblance to *kheperra* and their separation at present rests rather uneasily upon the relative lengths of the propodeal spines. Further collections may show that the two species intergrade.

With some reservation I refer to *parvispina* two specimens in MCZ, Cambridge



collection with data as follows: [CHINA:] Foochow, Peta (*F. Silvestri*). These may represent a variant population of *parvispina* or may be a separate species. The main character setting them somewhat apart from my concept of *parvispina* is the array of hairs on the gaster which in these specimens is primarily a mixture of simple and bifid hairs, whilst in *parvispina* the gastral hairs are predominantly trifid. Despite this I feel that it would be unwise to separate these specimens from *parvispina* at the present time as collections are too few to allow a sound judgement to be made.

#### MATERIAL EXAMINED.

PHILIPPINES: Dumaguete (*J. W. Chapman*); Dumaguete (*D. Empeso*).

### *Triglyphothrix pnyxis* sp. n.

(Text-fig. 70)

*Holotype worker.* TL 2.9, HL 0.68, HW 0.62, CI 91, SL 0.48, SI 77, PW 0.46, AL 0.76.

Upper border of antennal scrobe demarcated by the irregular line at which the cephalic sculpture terminates, without a flange or narrow, acute margin formed by the frontal carinae. Posteriorly and ventrally the scrobe margins are even less well defined than this, being indicated merely by a change in sculpturation. Median carina of scrobe present but very weak. Propodeal spines narrow and acute, longer than the triangular metapleural lobes. Node of petiole in profile long and low, distinctly longer than high. In dorsal view the node longer than broad, broadest posteriorly and quite narrowly rounded in front. Dorsal surfaces of head, alitrunk, petiole and postpetiole finely and closely reticulate-rugulose. Mandibles striate; gaster smooth and shining. All dorsal surfaces of head and body densely covered with trifid hairs; the hairs on the first gastral tergite universally trifid. A few very fine simple hairs are present on the dorsum of the head but the upper margins of the scrobes are without a regular spaced row of elongate simple hairs. Colour dark red-brown, the appendages yellow-brown.

*Paratype worker.* As holotype, differing only in that HW is 0.50 and SI 80.

*Holotype worker*, WEST MALAYSIA: Trengganu, Gn. Lawit, summit ridge, 4200 ft, 11.iii.1974 (*T. Clay*) (BMNH).

*Paratype.* A single worker with same data as holotype (MCZ, Cambridge).

Amongst the five species making up the *kheperra*-complex in the *walshi*-group, two species, *pnyxis* and *katypa*, have a petiole node which is elongate and low in profile. The two are quickly separable as *katypa* has a sharply defined dorsal margin to the antennal scrobe from which projects a row of elongate, simple hairs which are stout and very conspicuous. In *pnyxis* on the other hand the dorsal margin of the scrobe is feebly marked and elongate simple hairs are absent from it.

### *Triglyphothrix pulchella* Mann

*Triglyphothrix pulchella* Mann, 1919: 352, fig. 31. Syntype workers, female, SOLOMON ISLANDS: Malaita, Auki (*W. M. Mann*) (MCZ, Cambridge) [examined].

*Worker.* TL 2.4–2.6, HL 0.56–0.62, HW 0.52–0.54, CI 89–93, SL 0.38–0.42, SI 72–77, PW 0.40–0.42, AL 0.62–0.66 (3 measured).

Antennal scrobes shallow, with a poorly defined upper margin and a weak, feebly differentiated median longitudinal carina. Propodeal spines long, narrow and acute, much longer than the metapleural lobes. Dorsal surfaces of head, alitrunk and pedicel finely reticulate-rugose. Mandibles striate. Basal one-third or more of first gastral tergite with strong



longitudinal striation. Dorsal surfaces of head and body densely coated with short branched (trifid) hairs, long, simple hairs absent. Leading edges of antennal scapes and outer margins of tibiae with a dense coat of short hairs of approximately equal length, without elongate, simple hairs. Colour yellow, the head and gaster generally a lighter shade than the alitrunk and pedicel.

This distinctive small species is endemic in the Solomon Islands and appears to be closely related to *fulviceps* of New Guinea. The diagnostic notes above should serve to separate this species from other endemic species found in the Solomon Islands.

#### MATERIAL EXAMINED.

SOLOMON ISLANDS: Malaita I., Dala (*P. Greenslade*); Nggela I. (*P. Greenslade*); Isabel I., Buala (*P. Greenslade*).

### *Triglyphothrix rossi* sp. n.

*Holotype worker.* TL 2.8, HL 0.62, HW 0.56, CI 90, SL 0.48, SI 86, PW 0.42, AL 0.72.

Antennal scrobes very poorly developed, virtually erased, the extensions of the frontal carinae which form the upper scrobe margins are extremely weak and cannot be distinguished from the other sculpture behind the level of the eyes. Scrobal area not differentiated from rest of the head, without a median carina, the scrobal area almost or quite as strongly sculptured as the cephalic dorsum. Dorsal alitrunk evenly convex in profile, terminating in a pair of narrow propodeal spines. Metapleural lobes dentiform and directed upwards. Petiole in profile shaped as in *lanuginosa* (Text-fig. 63) but with the antero-dorsal angle more rounded. In dorsal view the petiole broadly triangular with a broadly rounded, blunt apex anteriorly, broadest posteriorly where its maximum width is equal to the width of the postpetiole. Dorsal surfaces of head, alitrunk and the pedicel segments with a fine rugoreticulum. Mandibles striate. Gaster smooth and shining, unsculptured. All dorsal surfaces of head and body with a mixture of simple and bifid hairs, very distinctive on the first gastral tergite. Dorsum of head with a row of long, erect, simple hairs along the line of the frontal carinae and with scattered long, simple hairs elsewhere on the head and dorsal alitrunk. Outer surfaces of middle and hind tibiae with numerous suberect to subdecumbent hairs which are all of approximately the same length and are much shorter than the maximum tibial width. Leading edges of antennal scapes without long simple hairs which are greater in length than the maximum scape width. Colour uniform dark brown, the appendages lighter.

*Paratype worker.* As holotype, with size range TL 2.6–2.9, HL 0.60–0.66, HW 0.54–0.58, CI 85–90, SL 0.46–0.52, SI 85–89, PW 0.40–0.46, AL 0.68–0.76 (10 measured).

Holotype worker, INDIA: South, 8 miles NE. Munnar, 6200 ft, 20.iii.1962 (*E. S. Ross & D. Q. Cavagnaro*) (CAS, San Francisco).

Paratypes. 32 workers and 1 female mounted, a number of other workers plus brood in alcohol; with same data as holotype (CAS, San Francisco; BMNH; MCZ, Cambridge).

Within the *obesa*-group *rossi* is most closely related to *conoorensis*. Both species have reduced antennal scrobes and both are endemic in the Indian subcontinent. *T. rossi* is separated from *conoorensis*, and also from the remainder of the *obesa*-group, by its lack of long simple hairs on the leading edge of the antennal scape. In all its allies these hairs are very long, generally longer than the maximum width of the scape.



*Triglyphothrix vombis* sp. n.

(Text-fig. 73)

[*Triglyphothrix obesa* (André) sensu Mann, 1919 : 349. Misidentification.]*Holotype worker.* TL 3.1, HL 0.72, HW 0.66, CI 92, SL 0.48, SI 73, PW 0.50, AL 0.80.

Antennal scrobes strongly developed, with a sharply defined dorsal margin and a weak but distinct median longitudinal carina. Propodeal spines narrow and acute, slightly longer than the acute metapleural lobes. Petiole in profile with the dorsal and posterior faces united in a single convex surface; the postpetiole about as high as the petiole. Mandibles mostly smooth but with a few scattered pits and vestiges of longitudinal striation in places. Dorsal surfaces of head, alitrunk and pedicel finely and densely reticulate-rugose. First gastral tergite smooth and shining. Head, alitrunk and pedicel densely clothed with fine hairs, the majority of which are simple, relatively few bifid hairs being present. Hairs on first gastral tergite universally simple. Dorsum of head and alitrunk also with a number of long, simple hairs. Outer margins of tibiae of middle and hind legs with a dense coat of short hairs, all of approximately equal length and less than half the maximum width of the tibia upon which they arise. Colour light orange-brown, the gaster yellowish brown.

*Paratype workers.* TL 2.9–3.1, HL 0.70–0.72, HW 0.64–0.66, CI 91–94, SL 0.46–0.50, SI 70–75, PW 0.46–0.50, AL 0.76–0.80 (7 measured). As holotype but in some the mandibles smooth, without trace of striation.

Holotype worker, SOLOMON Is.: Ugi (*W. M. Mann*) (MCZ, Cambridge).

Paratypes. 7 workers, 1 female, same data as holotype (MCZ, Cambridge; BMNH).

Originally described by Mann (1919) as *obesa*, this species is in fact distinct and belongs to a complex containing also *antennata*, *brevidentata*, *chepocha* and *pacifica*. It is easily distinguished from *obesa* and its allies by its lack of varying-length simple hairs on the tibiae, having instead a dense coat of short hairs of uniform length.

*Triglyphothrix walshi* Forel

(Text-fig. 68)

*Triglyphothrix walshi* Forel, 1890 : cvii. Syntype workers, female, INDIA: Bengal, Poree (*J. Walsh*), and Poona (*R. C. Wroughton*) (MHN, Geneva) [examined].

*Triglyphothrix musculus* Forel, 1902a : 239. Syntype workers, INDIA: Coonoor (*Wroughton*) (MHN, Geneva) [examined]. **Syn. n.**

*Triglyphothrix walshi* var. *spuria* Forel, 1912c : 58. Syntype workers, SINGAPORE and SRI LANKA: Colombo (*A. Müller*) (MHN, Geneva) [examined]. **Syn. n.**

*Worker.* TL 2.3–2.8, HL 0.56–0.68, HW 0.52–0.66, CI 93–98, SL 0.32–0.48, SI 61–67, PW 0.40–0.54, AL 0.54–0.74 (14 measured).

Antennal scrobes strongly developed, with a sharply defined dorsal margin and a distinct median longitudinal carina. Alitrunk in dorsal view short and broad, compact, the pronotal angles sharp, giving the species a square-shouldered appearance. Propodeal spines acute, longer than the metapleural lobes. Node of petiole in dorsal view strongly antero-posteriorly compressed, transverse, distinctly broader than long. Dorsal surfaces of head, alitrunk, petiole and postpetiole finely reticulate-rugose, the rugosity sometimes reduced on the postpetiole. First gastral tergite usually with the basal one-third or more finely longitudinally striate, often with punctures between the striae, but in some populations from Sri Lanka this sculpture is reduced or absent. Head, body and appendages uniformly clothed with a dense mat of fine, trifid hairs, the head also with a few elongate simple erect hairs which are



longer than the neighbouring trifid hairs and which are present at least on the dorsal surface of the upper margins of the scrobes. Colour light to dark brown.

In a number of ways this species resembles the Ethiopian region forms related to *inezulae* more than any other species. The resemblance to *thoth* is particularly striking and further investigation of their relationship would be interesting when *thoth* is better known. Suffice to say that the two seem distinct as *thoth* lacks erect simple hairs on the head, has reduced propodeal spines and has the gaster unsculptured.

#### MATERIAL EXAMINED.

INDIA: Kanara (*Wroughton*); no loc. (coll. Bingham); Izatnagar (ex C.I.E. coll.); Nilgiris (?); Cochin (*Rothney*); Kerala State, Silent Valley Reserve (*A. B. Soans & W. L. Brown*); Kerala State, Peruva (*A. B. Soans & W. L. Brown*); Irinjalakuda (*A. B. Soans*); Calicut (*A. B. Soans*); Madras Presidency, Chilka Lake (?); Wallon? (ex coll. Wasmann). SRI LANKA: Colombo (*W. L. Brown*); Gilimale (*E. O. Wilson*); Nuwara Eliya (*K. L. A. Perera*). CHINA: Foochow (*H. H. Chung*). PHILIPPINES: Dumaguete (*J. W. Chapman*); Dumaguete, Silliman University (*D. Empeso*).

### TETRAMORIUM Mayr

*Tetramorium* Mayr, 1855 : 423. Type-species: *Formica caespitum* L., 1758 : 581; by subsequent designation of Giraud, 1879 : 1016.

*Tetrogmus* Roger, 1857 : 10. Type-species: *Tetrogmus caldarius* Roger, op. cit. : 12 [= *Tetramorium simillimum* (F. Smith), 1851 : 118]; by monotypy. [Synonymy by Mayr, 1863 : 456.]

*Xiphomyrmex* Forel, 1887 : 385 [as subgenus of *Tetramorium*]. Type-species: *Tetramorium (Xiphomyrmex) kelleri* Forel, loc. cit.; by subsequent designation of Wheeler, 1911 : 175.

#### Syn. n.

*Xiphomyrmex* Forel; Emery, 1896a : 183; 1914a : 42. [Raised to genus.]

*Atopula* Emery, 1912 : 104. Type-species: *Atopomyrmex nodifer* Emery, 1901 : 115; by original designation. **Syn. n.**

*Macromischoides* Wheeler, 1920 : 53. Type-species: *Macromischa aculeata* Mayr, 1866 : 507; by original designation. **Syn. n.**

*Sulcomyrme* Kratochvíl, 1941 : 84 [as subgenus of *Tetramorium*]. [Proposed without designation of type-species; name not available.]

*Lobomyrmex* Kratochvíl, 1941 : 84 [as subgenus of *Tetramorium*]. Type-species: *Tetramorium (Lobomyrmex) ferox silhavyi* Kratochvíl, loc. cit. [= *Tetramorium ferox* Ruzsky, 1903 : 309], by monotypy. **Syn. n.**

DIAGNOSIS. *Worker*. Mandibles with three teeth apically; the third smaller than the second and followed by a row of 3–7 small or minute denticles; the arrangement 3 teeth plus 4 denticles overwhelmingly predominant. Palp formula 4, 3 (47 species dissected), very rarely 4, 2 (1 species) or 3, 2 (1 species). (The formula 3,3 has not been detected but probably occurs in some minute species as in *Triglyphothrix*.) Antennae 11- or 12-segmented, the three apical antennomeres forming a club. Eyes present, usually moderate to large, very rarely reduced or minute. Frontal carinae strongly developed in most species, reaching almost to the occipital margins, but in a few groups (e.g. *caespitum*-group; *sericeiventris*-group) and a number of isolated species reduced and petering out before the level of the eyes. Median longitudinal clypeal carina usually distinct, reduced or absent in only a few species. Cephalic median carina generally developed but not uncommonly reduced or absent. Antennal scrobes



showing all stages of development from absent to deep, but in the latter case the scrobe is only very rarely divided into upper and lower compartments by a longitudinal ridge or carina. Alitrunk fusiform, without sutures, but the metanotal groove is impressed in many species. Propodeum usually armed with a pair of spines or teeth, only very rarely unarmed. Metapleural lobes present, usually acute or dentiform but sometimes reduced and rounded, sometimes minute or vestigial. Petiole pedunculate, without a large ventral process. Lamelliform appendage of sting variable in shape, triangular, dentiform, pennant-shaped or spatulate. Tibial spurs present on middle and hind legs in many large species, usually simple but in a few they may be minutely barbate. In some smaller and some larger species the spur is absent or indistinguishable from the adjacent pilosity. Pilosity very variable; usually with numerous erect or suberect hairs on all dorsal surfaces but these may be absent from various sclerites, reduced in number and size, appressed, or rarely completely absent. Very rarely the pilosity is bizarre, the hairs being spatulate, short-clavate, palmate, plumose or pinnate, but never with regularly bifid, trifid or quadrifid hairs.

*Female.* As worker but with flight sclerites and ocelli, the virgin queens fully alate.

*Male.* Known for only very few species. Antennae 10 to 11-segmented, the second funicular forming an elongate fusion-segment. Mandibles dentate. Palp formula as worker. Pilosity variable as in worker, without the branched hairs characteristic of *Triglyphothrix*.

As defined above *Tetramorium* is a large compact genus which, on recent count, included some 465 named forms, of which I suspect that about 200–250 are valid. As was the case with *Triglyphothrix* it is apparent that numerous common species of *Tetramorium* have been described many times and have quite a lot of infraspecific or infrasubspecific names attached to them whilst of the less common forms a great number of valid species remain undescribed. Revision of this great mass of names is at present in progress and I have already completed studies on the species with 11-merous antennae which formerly constituted the genus *Xiphomyrmex*, now synonymized (see below). I envisage the revision of *Tetramorium* as being published in two or three sections, each dealing with a fairly restricted faunal area but it is already obvious that the Ethiopian/Malagasy fauna is by far the largest and seems to present the most problems of a taxonomic nature.

The distribution of *Tetramorium* embraces all of the Old World tropics and subtropics and the Palaearctic and Nearctic Regions. The only region without any endemic species is the Neotropical but even here a few species have been introduced by accident and now appear to be flourishing. The principle nest-sites of this genus include rotten wood, under stones or directly into the earth but a few species are known which are arboreal, nesting either in the wood, under bark, or constructing carton nests of vegetable fibre and debris. The majority of species are cryptic or retiring forms but some are very distinctive and run actively on the surface of the ground or on trees.

#### GENERIC SYNONYMY OF *Tetramorium*

*Xiphomyrmex.* When Forel (1887) described *Xiphomyrmex* he made it a sub-genus of *Tetramorium*, stating that the only difference between them was contained in the number of antennal segments which each possessed, namely eleven for *Xiphomyrmex* and twelve for *Tetramorium*. Emery (1896a; 1914a) considered that this difference was sufficient to raise *Xiphomyrmex* to generic status and this view was endorsed by Wheeler (1922). Arnold (1917; 1926) on the other hand continued



to treat *Xiphomyrmex* as a subgenus. In later years, as various new species were described, they were assigned to one of these two groups solely on their antennomere count, without regard for any other characters which they possessed.

Whilst studying *Triglyphothrix* and *Rhoptromyrmex* it became obvious that it was possible for antennal segmentation to vary within genera in this tribe without affecting characters of generic significance, which remained stable, and this prompted a search for definitive characters which could be used to separate *Tetramorium* and *Xiphomyrmex*. No new characters could be found, but Brown (1973) had noted that the sting appendage in workers and females was 'perpendicular to the shaft and sharply dentiform or pennant-shaped' in *Tetramorium*, whilst in *Xiphomyrmex* the sting appendage was 'Rounded-spatulate'.

On investigation it was found that the rounded-spatulate appendage, supposedly confined to *Xiphomyrmex*, also occurred in *Tetramorium* (as defined by their 12-merous antennae) throughout the *grassii*- and *squaminode*-groups, and that an appendage perpendicular to the long axis of the sting or inclined at an angle to it occurred in the *carinatum*- and *schaufussi*-groups of *Xiphomyrmex* (as defined by their 11-merous antennae). Examination of a large number of species further appeared to show that a straight-spatulate appendage may be derived from a perpendicular-dentiform structure. The main forms of sting appendage and the antennomere counts are tabulated below, with some examples.

- |  |  |
|--|--|
| 1. Sting appendage perpendicular or slightly inclined from long axis of shaft, acute apically. | Antennae with 12 segments: <i>camerunense</i> -group, <i>caespitum</i> -group, <i>sericeiventre</i> -group, <i>guineense</i> -group.<br>Antennae with 11 segments: <i>striolatum</i> -group. |
| 2. Sting appendage perpendicular or slightly inclined from long axis of shaft, blunt apically. | Antennae with 12 segments: part of <i>grassii</i> -group and of <i>squaminode</i> -group.<br>Antennae with 11 segments: <i>carinatum</i> -group.   |
| 3. Sting appendage continuing long axis of shaft (may be feebly up-curved), blunt apically.    | Antennae with 12 segments: part of <i>grassii</i> -group and of <i>squaminode</i> -group.<br>Antennae with 11 segments: <i>muralti</i> -group, <i>angulinode</i> -group.                     |
| 4. Sting appendage continuing long axis of shaft; blunt and upcurved apically.                 | Antennae with 11 segments: <i>weitzeckeri</i> -group, <i>angulinode</i> -group.  |

The species in the first category may be regarded as 'super-*Tetramorium*' and those in the fourth as 'super-*Xiphomyrmex*' when sting structure alone is considered but it is obvious that all possible intergrades exist, regardless of their antennomere count. As there are absolutely no other characters which can be considered it is apparent that *Tetramorium* is capable of showing the same variation as *Triglyphothrix* and *Rhoptromyrmex* as regards antennal segmentation, and *Xiphomyrmex* falls into the synonymy of *Tetramorium*.



Once this has been accepted a number of interesting correspondences become apparent. For instance, the *weitzeckeri*-group (formerly of *Xiphomyrmex*) is inseparable from the *squaminode*-group (formerly of *Tetramorium*) in all characters except that of antennal segmentation, and the closest relatives of *T. grassii* seem to be the former *Xiphomyrmex* species of the *schaufussi*-group.

In view of the above it seems most probable that the antennomere count of eleven has arisen independently and at different times from a number of species-groups with 12-segmented antennae within *Tetramorium*. One interesting point arising from the 11- versus 12-merous antennae is the fact that *Tetramorium* in which the antennae are 11-segmented are predominant in Australia and Madagascar, where they outnumber the 12-segmented forms in terms of numbers of endemic species, whereas elsewhere they form a relatively minor part of the fauna. It can be postulated from this relict distribution that the parts of the genus with 11-segmented antennae and relatively unspecialized body-form (this excludes the very specialized *weitzeckeri*-group) represent the remnants of an earlier radiation of the genus which has since been in large part replaced by their later-radiating 12-segmented congeners. This presupposes that the early loss of an antennomere in some groups somehow gave its owners an early advantage over their relatives which retained the ancestral 12-merous antennae but that a later change of circumstance obviated this advantage and the 12-merous species then overhauled and gradually replaced their 11-merous allies except in peripheral or inaccessible parts of the range.

This is of course speculation but it does fit the present facts of distribution as regards 11- versus 12-segmented antennae and may even explain why a single endemic 11-segmented species is still found in North America, the only holarctic endemic species with this antennomere count.

*Atopula*. Emery (1912) created the genus *Atopula* to contain two species which he had described previously (Emery, 1901) in *Atopomyrmex* André. These were *A. nodifera* (made the type-species of *Atopula*) from Cameroun, and *A. ceylonica* from Sri Lanka (which Emery referred to as *ceylonensis* in his 1912 publication).

Wheeler (1919) recognized that these two species were different at generic level and, disagreeing with Forel's (1917) placement of *ceylonica* in *Leptothorax* Mayr, erected a new genus *Paratopula* to hold *ceylonica* and its infraspecific forms. This procedure meant that *Atopula* at that time contained only its type-species, *nodifera*, but later authors added a few more names to the genus.

Unfortunately the type-species, *Atopula nodifera*, is a quite ordinary tetramoriine, with all the diagnostic tribal characters, and furthermore the generic name *Atopula* is a straight synonym of *Tetramorium*. (Palp formula of 4,3 confirmed by dissection of BMNH specimen. Syntype worker of *nodifera* examined at MCZ, Cambridge.)

Having established this point, the generic identity of the three remaining species of *Atopula* must now be clarified.

*Atopula belti* (Forel) was placed in the monotypic genus *Brunella* Forel (1917), and for the time being I think that *belti* is best returned to *Brunella* until it can be investigated in detail. It is certainly not a tetramoriine and its affinities are unclear.



*Atopula longispina* Stitz (1938) appears to be close to *ceylonica* and its allies and is transferred to *Paratopula*; thus its name is now *Paratopula longispina* (Stitz) **comb. n.**

*Atopula hortensis* Bernard (1948) is a tetramoriine. In fact it is a direct junior synonym of the common African species *Tetramorium sericeiventre* Emery, and I am amazed that it was not recognized as such by Bernard as its identity is immediately obvious merely by examining the figures which he gives (Bernard, 1948: 174, fig. 9). *T. sericeiventre* is the most common arid-ground and semi-desert inhabiting species of its genus in the entire Ethiopian region and should be well known to anyone who is acquainted with the ant fauna of the region.

*Macromischoides*. When Wheeler (1920) first introduced the name *Macromischoides* he cited a type-species (*Macromischa aculeata* Mayr) but did not define the genus. Later he gave a diagnosis and notes on the genus (Wheeler, 1922) and in the catalogue in the same publication he assigned the genus to the tribe Leptothoracini, in which it was retained by numerous later authors despite the fact that Santschi (1924) had demonstrated its tetramoriine character. Santschi's findings are confirmed here and it is shown that Emery (1896b) was correct in assigning the known species of this group to genus *Tetramorium*.

In his diagnosis of the genus Wheeler (1922) does not cite any characters which differentiate *Macromischoides* from the mass of *Tetramorium* except for the fact that the palp formula is reduced to 3,2 from the primitive maximum tetramoriine count of 4,3. Taken as it stands Wheeler's definition of *Macromischoides* is really no more than a short description of its type-species, and the characters of the only other species which he included, *africanum*, are not noted. In fact *africanum* is summarily dismissed with the comment that it is 'hardly more than a subspecies of *aculeata*'. This statement is incorrect and a close examination of *africanum* reveals that it shows numerous characters intermediate between *aculeatum* and the less specialized members of *Tetramorium*. In particular, the palp formula of *africanum* (4,2) is the main character which destroys the validity of *Macromischoides* as it is intermediate between the great mass of the genus (PF 4,3) and the specialized *aculeatum* (PF 3,2). All the other characters given by Wheeler are paralleled elsewhere in *Tetramorium*, particularly in the *carinatum*-group which, through adoption of a sub-arboreal lifeway, show similar modifications in body form but retains the palp formula of 4,3.

A character cited by Wheeler (1922) for the males of *Macromischoides* concerns the antennomere count in the male of *aculeatum*, which Wheeler gives as eleven. He states that 'Mayr claimed that the male *aculeata* has 11-jointed antennae, but Emery, after examination of six specimens, maintained that these appendages are 10-jointed'. Santschi (1924) proved that the funicular segmentation of the male showed considerable variation in degree of fusion of the antennomeres and this is confirmed in the present study, which also indicates that such variation is quite common throughout the males of this genus.

Wheeler (1922) was of the opinion that *Tetramorium* became more homogeneous with the removal of *aculeatum* and *africanum* to a separate genus. I completely disagree with this statement as dividing up a genus by artificial and arbitrarily



drawn lines often generates rather than removes confusion because the definition of the genus-group names thus produced becomes extremely difficult or impossible. This increased difficulty of definition is implicit in the process of splitting a genus by these means as it is usually accomplished by cutting out one or two species from the main mass of the genus which are said to show derived or specialized characters whilst leaving the closest relatives of the derived forms in the parent genus, from which they cannot be separated.

The subgenera *Lobomyrmex* and *Sulcomyrmex*. Kratochvíl (1941; 1944) attempted to overhaul the *Tetramorium* species of central Europe in general and Czechoslovakia in particular, and in doing so fell into the strange trap of splitting the few central European species into three subgenera, apparently without realizing that subgeneric names cannot be applied on such a limited basis but, once designated, apply to the entire world fauna and include all species of the genus which possess the characters delimited. As soon as this is given objective consideration his subgenera collapse in a welter of derivative forms and species or whole species-groups which overlap or refuse to comply with his subgeneric limits.

The subgenus *Sulcomyrmex* was said to contain the species *simillimum* and *guineense* (both of which are tramp species not endemic in the Palaearctic region) and was defined by the fact that the frontal carinae extend back to the occipital margin. On this character *Sulcomyrmex* would contain the vast majority of the world fauna but unfortunately for the subgenus some species of the *guineense*-, *pacificum*-, *simillimum*- and many other species-groups exist in which the frontal carinae are reduced or lost in some species but not in others, as was recognized by Arnold as long ago as 1917. Consideration must also be given to the *squaminode*-group, the *occidentale*-group and the *weitzeckeri*-group. The members of these groups have strongly developed frontal carinae, which would place them firmly in *Sulcomyrmex*, but also have a petiolar and postpetiolar structure which would place them equally firmly in *Lobomyrmex*, the next to be discussed.

In subgenus *Lobomyrmex* the frontal carinae are stated as being short, not extending to the occipital margin, and the pedicel is defined as having the 'petiole dorsally almost as broad or only slightly narrower than the postpetiole'. In contrast to this the third subgenus, *Tetramorium* sensu stricto, as well as having short frontal carinae has, 'petiole dorsally always distinctly narrower than postpetiole; if not distinctly then . . .', and one is already on very unfirm ground, as can be deduced from the ambiguous nature of the couplet. Factually, all that this couplet set out to do was to separate *T. ferox* and its allies (subgen. *Lobomyrmex*) from *T. caespitum* and its allies (subgen. *Tetramorium* sensu stricto) which in reality only belong to different complexes of species within a single very compact species-group. Applying the definitions of these subgenera to the rest of the world fauna produces unbelievable results as, in almost all groups in which the frontal carinae are reduced in all species (*aculeatum*-group, *solidum*-group, *sericeiventris*-group), as opposed to the many groups in which only one or two species have the carinae reduced, some species fall into one subgenus and some into another, and again the question arises as to where to place the *squaminode*- and related groups.



I think that this is sufficient to show the artificiality of these subgenera and the impossibility of dividing up the world fauna solely from the study of less than a dozen species from a restricted area of the Palaearctic region, especially when the main fauna of this genus is strictly tropical in its distribution.

## ACKNOWLEDGEMENTS

I would like to express my thanks and gratitude to the following persons, who have provided types or other material during the course of this study.

Dr P. H. Arnaud (CAS, San Francisco); Dr C. Besuchet (MHN, Geneva); Professor W. L. Brown (Cornell Univ., Ithaca, N.Y.); Dr J. Decelle (MRAC, Tervuren); Herr E. Diller (ZM, Munich); Dr M. Fischer (NM, Vienna); M. R. Forissier (MHN, CdF.); Dott. D. Guiglia (MCSN, Genoa); Dr E. Königsman (MNHU, Berlin); Professor E. Mellini (IE, Bologna); Mr F. C. de Moor (NM, Bulawayo); Mr C. O'Toole (UM, Oxford); Mrs J. C. Scott (MCZ, Cambridge); Dr G. Terron (Univ. of Cameroun, Yaoundé); Dr R. W. Taylor (ANIC, Canberra); Dr C. Baroni Urbani (NM, Basle); Mme J. C. Weulersse (MNHN, Paris).

## REFERENCES

- ANDRÉ, E. 1887. Description de quelques fourmis nouvelles ou imparfaitement connues. *Revue Ent.* **6** : 280-298.
- 1892. Matériaux myrmécologiques. *Revue Ent.* **11** : 45-56.
- ARNOLD, G. 1917. A monograph of the Formicidae of South Africa, part 3. *Ann. S. Afr. Mus.* **14** : 271-402.
- 1926. A monograph of the Formicidae of South Africa, appendix. *Ann. S. Afr. Mus.* **23** : 191-295, figs 60-82.
- 1949. New species of African Hymenoptera, no. 9. *Occ. Pap. natn. Mus. Sth. Rhod.* **15** : 261-275, 16 figs.
- 1956. New species of African Hymenoptera, no. 12. *Occ. Pap. natn. Mus. Sth. Rhod.* **21(B)** : 52-77, 25 figs.
- BERNARD, F. 1948. Les insectes sociaux du Fezzân. *Mission scientifique du Fezzân* (1944-45). **5** Zoologie : 87-201, 2 pls, 10 figs.
- 1952. La réserve naturelle intégrale du Mt. Nimba, part 11. Hyménoptères Formicidae. *Mém. Inst. fr. Afr. noire* **19** : 165-270, 3 pls, 15 figs.
- BINGHAM, C. T. 1903. *Fauna of British India, including Ceylon and Burma*. Hymenoptera **2**, Ants and Cuckoo Wasps. 506 pp., 161 figs, 1 pl. London.
- BOLTON, B. 1973. The ant genera of West Africa: a synonymic synopsis with keys. *Bull. Br. Mus. nat. Hist. (Ent.)* **27** : 317-368, 1 fig.
- BROWN, W. L., JR. 1953. Characters and synonymies among the genera of ants, part 2. *Breviora* **18** : 1-8.
- 1955. The identity of the British *Strongylognathus*. *J. Soc. Br. Ent.* **5** : 113-114.
- 1964. Genus *Rhoptromyrmex*, revision and key to species. *Pilot Reg. Zool. cards* 11-19, figs.
- 1973. A comparison of the Hylean and Congo-West African rain forest ant faunas. In *Tropical forest ecosystems in Africa and South America: a comparative review*. Pp. 161-185. Washington.
- 1974. A remarkable new island isolate of the ant genus *Proceratium*. *Psyche, Camb.* **81** : 70-83, 2 figs.



- CLARK, J. 1938. Reports of the McCoy society for field investigation and research, no. 2. Sir Joseph Banks Islands part 1. Formicidae. *Proc. R. Soc. Vict.* **50** : 365-382, 22 figs.
- COLLINGWOOD, C. A. 1956. A rare parasitic ant in France. *Entomologist's mon. Mag.* **92** : 197.
- CREIGHTON, W. S. 1934. Descriptions of three new North American ants with certain entomological observations on previously described forms. *Psyche, Camb.* **41** : 185-200.
- 1950. The ants of North America. *Bull. Mus. comp. Zool. Harv.* **104** : 1-585, 57 pls.
- DONISTHORPE, H. StJ. K. 1932. On the identity of Smith's types of Formicidae collected by Alfred Russel Wallace in the Malay archipelago, with descriptions of two new species. *Ann. Mag. nat. Hist.* (10) **10** : 441-476.
- 1936. *Strongylognathus diveri*, a genus and species new to the British list, with notes on the genus. *Entomologist's mon. Mag.* **72** : 111-116, 7 figs.
- 1941. A new genus and species of Formicidae from Papua. *Entomologist's mon. Mag.* **77** : 175.
- 1945. A new species of *Triglyphothrix* Forel from Uganda, with some notes on the genus. *Entomologist's mon. Mag.* **81** : 76.
- 1946a. New species of ants from the island of Mauritius. *Ann. Mag. nat. Hist.* (11) **12** : 776-782.
- 1946b. *Ireneopone gibber*, a new genus and species of myrmicine ant from Mauritius. *Entomologist's mon. Mag.* **82** : 242-243, 2 figs.
- 1948. A fourth instalment of the Ross collection of ants from New Guinea. *Ann. Mag. nat. Hist.* (12) **1** : 131-143, figs.
- EMERY, C. 1884. Materiali per lo studio della fauna Tunisia raccolti da G. e L. Doria, 3. Rassegna delle Formiche della Tunisia. *Annali Mus. civ. Stor. nat. Genova* (2) **1** [21] : 373-386, figs.
- 1889a. Intorno ad alcune Formiche della fauna paleartica. *Annali Mus. civ. Stor. nat. Genova* (2) **7** [27] : 439-443.
- 1889b. Viaggio di Leonardo Fea in Birmania e regioni vicine, 20. Formiche di Birmania e del Tenasserim raccolte da Leonardo Fea (1885-1887). *Annali Mus. civ. Stor. nat. Genova* (2) **7** [27] : 485-520, pls 10, 11.
- 1891. *Exploration scientifique de la Tunisie*. Revision critique des fourmis de la Tunisie. 21 pp. Paris.
- 1893. Voyage de MM. Bedot et Pictet dans l'archipel malais. Formicides de l'archipel malais. *Revue suisse Zool.* **1** : 187-229.
- 1895. Voyage de M. E. Simon dans l'Afrique australe (janvier-avril 1893). Formicides. *Annls Soc. ent. Fr.* **64** : 15-56, 1 pl.
- 1896a. Clef analytique des genres de la famille des formicides, pour la determination des neutres. *Annls Soc. ent. Belg.* **40** : 172-189.
- 1896b. Sur les fourmis du genre *Macromischa* Rog. *Bull. Soc. ent. Fr.* **1896** : 102-103.
- 1897. Formicidarum species novae vel minus cognitae in collectione Musaei nationalis hungarici, quas in Nova-Guinea, colonia Germanica, collegit L. Biró. *Természetr. Füzet.* **20** : 571-599, pls 14, 15.
- 1899. Formiche di Madagascar raccolte dal Sig. A. Mocquerys nei pressi della Baia di Antongil (1897-1898). *Boll. Soc. ent. ital.* **31** : 263-290, figs.
- 1901. Ameisen gesammelt in Ceylon von Dr. W. Horn 1899. *Dt. ent. Z.* **1901** : 113-122, figs.
- 1908. In G. Cecconi, Contributo alla fauna delle Isole Tremiti. *Boll. Mus. Zool. Anat. Comp. Univ. Torino* **23** : 53 pp.
- 1909. Beiträge zur Monographie der Formiciden des paläarktischen Faunengebietes. *Dt. ent. Z.* **1909** : 695-712, 7 figs.
- 1912. Études sur les Myrmicinae. *Annls Soc. ent. Belg.* **56** : 94-105, 5 figs.
- 1914a. Intorno alla classificazione dei Myrmicinae. *Rc. Sess. Accad. Sci. Ist. Bologna* **1914** : 27-42.



- 1914b. In Sarasin & Roux, *Nova Caledonia Zool.* **1**. Les fourmis de la Nouvelle-Calédonie et des îles Loyalty : 393-435, pl. 13.
- 1915a. Formiche raccolte nell'Eritrea dal Prof. F. Silvestri. *Boll. Lab. Zool. gen. agr. Portici* **10** : 1-26, 13 figs.
- 1915b. Noms de sous-genres et de genres proposés pour la sous-famille des Myrmecinae. Modifications à la classification de ce groupe. *Bull. Soc. ent. Fr.* **1915** : 189-192.
- 1915c. Contributo alla conoscenza delle formiche delle Isole Italiane, descrizioni di forme mediterranee nuove o critiche. *Annali Mus. civ. Stor. nat. Giacomo Doria* (3) **6** [46] : 244-270, pl. 4.
- 1922. Hymenoptera fam. Formicidae subfam. Myrmicinae. In Wytsman, *Genera Insect.* fasc. **174b-174c** : 95-397, 7 pls.
- ETTERSHANK, G. 1966. A generic revision of the world Myrmicinae related to *Solenopsis* and *Pheidologeton*. *Aust. J. Zool.* **14** : 73-171, 141 figs.
- FINZI, B. 1924a. Formiche dell'Isole d'Elba e Monte Argentario. *Boll. Soc. ent. ital.* **56** : 12-15.
- 1924b. Secondo contributo alla conoscenza della fauna mirmecologica della Venezia Giulia. *Boll. Soc. ent. ital.* **56** : 120-123.
- FOREL, A. 1874. Les fourmis de la Suisse. *Denkschr. schweiz. Ges. Naturw.* **26** : 447 pp., 2 pls.
- 1887. Fourmis récoltées à Madagascar par le Dr. Conrad Keller. *Mitt. schweiz. ent. Ges.* **7** : 381-389.
- 1890. *Aenictus-Typhlatta* découverte de M. Wroughton. Nouveaux genres de formicides. *C. r. Soc. ent. Belg.* **34** : cii-cxiii.
- 1894. Abessinische und andere afrikanische Ameisen, gesammelt von Herrn Ingenieur Alfred Ilg, von Herrn Dr. Liengme, von Herrn Pfarrer Missionar P. Berthoud, Herrn Dr. Arth. Müller, etc. *Mitt. schweiz. ent. Ges.* **9** : 64-100.
- 1897. Deux fourmis d'Espagne. *Annls Soc. ent. Belg.* **41** : 132-133.
- 1900. Fourmis du Japon. Nids en toile. *Strongylognathus huberi* et voisins. Fourmilière triple. *Cyphomyrmex wheeleri*. Fourmis importées. *Mitt. schweiz. ent. Ges.* **10** : 267-287.
- 1901. Formiciden des Naturhistorisches Museums zu Hamburg. Neue *Calyptomyrmex*, *Dacryon*, *Podomyrma* und *Echinopla*-Arten. *Mitt. naturh. Mus. Hamb.* **18** : 43-82.
- 1902a. Myrmicinae nouveaux de l'Inde et de Ceylan. *Revue suisse Zool.* **10** : 165-249.
- 1902b. Les formicides de l'Empire des Indes et de Ceylan, part 10. *J. Bombay nat. Hist. Soc.* **14** : 679-715.
- 1902c. Fourmis nouvelles d'Australie. *Revue suisse Zool.* **10** : 405-548.
- 1904. Miscellanea myrmécologiques. *Revue suisse Zool.* **12** : 1-52.
- 1907. Fourmis d'Ethiopie. Récoltées par M. le baron Maurice de Rothschild en 1905. *Revue Ent.* **26** : 129-144.
- 1909. Fourmis du Musée de Bruxelles. Fourmis de Benguela, récoltées par M. Creighton Wellman et fourmis du Congo, récoltées par MM. Luja, Kohl et Laurent. *Annls Soc. ent. Belg.* **53** : 51-73.
- 1910a. In Schultze, L. S., *Zoologische und anthropologische Ergebnisse einer Forschungsreise im westlichen und zentralen Südafrika*. Formicidae: 1-30, 1 pl., 1 fig.
- 1910b. Note sur quelques fourmis d'Afrique. *Annls Soc. ent. Belg.* **54** : 421-458.
- 1911. Die Ameisen des K. Zoologischen Museums in München. *Sber. bayer. Akad. Wiss.* **1911** : 249-303.
- 1912a. H. Sauter's Formosa-Ausbeute. Formicidae. *Ent. Mitt.* **1** : 45-81.
- 1912b. The Percy Sladen expedition to the Indian Ocean in 1905, no. 11. Fourmis des Seychelles et des Aldabras, reçues de M. Hugh Scott. *Trans. Linn. Soc. Lond.* **15** : 159-167.
- 1912c. Einige neue und interessante Ameisenformen aus Sumatra etc. *Zool. Jb. suppl.* **15** : 51-78.
- 1912d. Descriptions provisoires de genres, sous-genres et espèces de formicides des Indes orientales. *Revue suisse Zool.* **20** : 761-774.



- 1913a. Fourmis de Rhodesia etc., récoltées par M. G. Arnold, le Dr. H. Brauns et K. Fikendey. *Annls Soc. ent. Belg.* **57** : 108–147.
- 1913b. Ameisen aus Rhodesia, Kapland usw. gesammelt von Herrn G. Arnold, Dr. H. Brauns und anderen. *Dt. ent. Z.* **1913** (Beiheft) : 203–225.
- 1913c. Wissenschaftliche Ergebnisse einer Forschungsreise nach Ostindien, ausgeführt im Auftrage der Kgl. Preuss. Akademie der Wissenschaften zu Berlin von H. v. Buttel-Reepen. 2. Ameisen aus Sumatra, Java, Malacca und Ceylon. *Zool. Jb. (Syst.)* **36** : 1–148 figs.
- 1914. Formicides d'Afrique et d'Amérique nouveaux ou peu connus. *Bull. Soc. vaud. Sci. nat.* **50** : 211–288.
- 1916. Fourmis du Congo et d'autres provenances récoltées par MM Herman Kohl, Luja; Mayné, etc. *Revue suisse Zool.* **24** : 397–460, 7 figs.
- 1917. Cadre synoptique actuel de la fauna universelle des fourmis. *Bull. Soc. vaud. Sci. nat.* **51** : 229–253.
- 1922. Glanures myrmécologiques en 1922. *Revue suisse Zool* **30** : 87–102.
- GIRARD, M. 1879. *Traité élémentaire d'entomologie* **2** : 1028 pp., 15 pls. Paris.
- GÖSSWALD, K. 1952. Zur Biologie und Histologie parasitär degenerierter Ameisenarten mit besonderer Berücksichtigung von *Teleutomyrmex schneideri* Kutter. *Trans. 9 int. Congr. Ent. Amsterdam* (1951) **1** : 446–448.
- HAHN, C. W. 1832. *Die Wanzenartigen Insecten* **1** (3) : 1–236, 36 pls. Nürnberg.
- KEMPF, W. W. 1972. Catálogo abreviado das formigas da Regiao Neotropical. *Studia Ent.* **15** : 3–344.
- 1973. A revision of the neotropical myrmicine ant genus *Hylomyrma* Forel. *Studia Ent.* **16** : 225–260, 20 figs.
- KRATOCHVÍL, J. 1941. In Novák, V. & Sadil, J., Klíč k určování mravenců střední evropy se zvláštním zřetelem k mravenčí Čech a Moravy. *Ent. Listy* **4** : 65–115, 22 figs.
- 1944. In Kratochvíl, J., Novák, V., Šnoflák, J., Mohelno. Soubor prací věnovaných studiu významne památky přírodní, 5, Hymenoptera Aculeata. Formicidae-Apidae-Vespoidea. *Arch. Svazu ochran. přírody domov. Morave* **6** : 1–155, 7 figs.
- KUTTER, H. 1923. Die Sklavenräuber *Strongylognathus huberi* Forel ssp. *alpinus* Wheeler. *Revue suisse Zool.* **30** : 387–424.
- 1932. Ameisen aus dem Museum zu Dresden. *Mitt. schweiz. ent. Ges.* **15** : 207–210, figs.
- 1950. Über eine neue extrem parasitische Ameise. *Mitt. schweiz. ent. Ges.* **23** : 81–94, 23 figs.
- 1969. Die Sozialparasitischen Ameisen der Schweiz. *NeujBl. naturf. Ges. Zurich* **171** : 1–62, 19 figs.
- LINNAEUS, C. 1758. *Systema naturae*. Regnum animale, edn 10 : 824 pp.
- MANN, W. M. 1919. The ants of the British Solomon Islands. *Bull. Mus. comp. Zool. Harv.* **63** : 271–391, 59 figs.
- 1921. The ants of the Fiji Islands. *Bull. Mus. comp. Zool. Harv.* **64** : 401–499, 38 figs.
- MAYR, G. 1853. Ueber die Abtheilung der Myrmiciden, und eine neue Gattung derselben. *Verh. zool.-bot. Ver. Wien* **3** : 387–394, 1 pl.
- 1855. Formicina austriaca. Beschreibung der bisher im österreichischen Kaiserstaate aufgefundenen Ameisen nebst Hinzufügung jener in Deutschland, in der Schweiz und in Italien vorkommenden Arten. *Verh. zool.-bot. Ver. Wien* **5** : 273–478, 1 pl.
- 1863. Formicidarum index synonymicus. *Verh. zool.-bot. Ges. Wien* **13** : 385–460.
- 1866. Myrmecologische Beiträge. *Sber. Akad. Wiss.* **53** : 484–517.
- 1870. Neue Formiciden. *Verh. zool.-bot. Ges. Wien* **20** : 939–996.
- 1901. Südafrikanische Formiciden, gesammelt von Dr. Hans Brauns. *Annln naturh. Mus. Wien* **16** : 1–30, 2 pls.
- MENOZZI, C. 1921. Formiche dei dintorni di Sambiasa di Calabria. *Boll. Lab. Zool. gen. agr. Portici* **15** : 24–32, 3 figs.
- 1932. Raccolte mirmecologiche dell'Africa orientale conservate nel Museo Civico di Storia Naturale "Giacomo Doria" di Genova. Parte seconda. Formiche dell'Uganda e

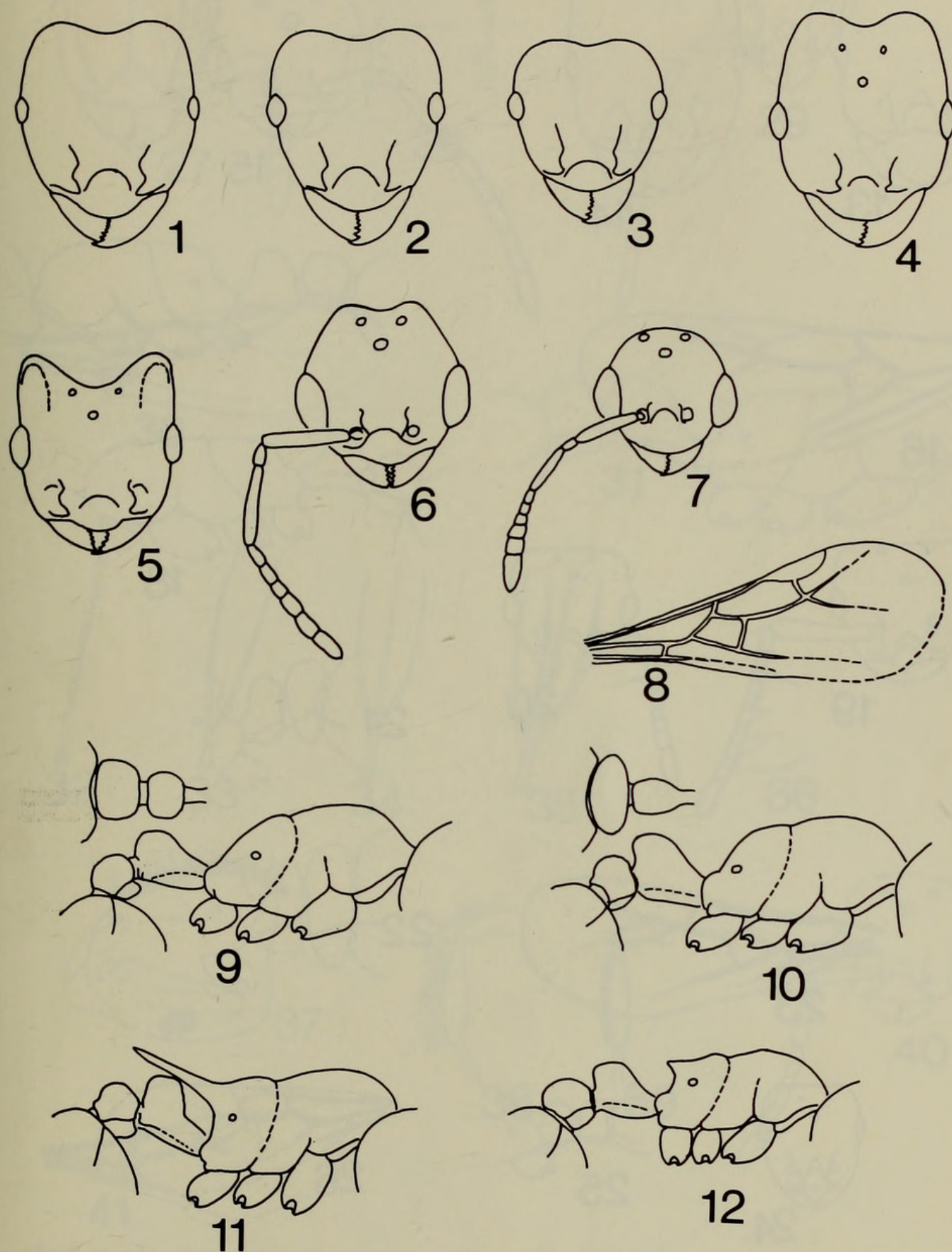


- delle Isole Sesse raccolte dal Dr. E. Bayon. *Annali Mus. civ. Stor. nat. Giacomo Doria* **56** : 93-114, 4 figs.
- 1933. Le formiche della Palestina. *Memorie Soc. ent. ital.* **12** : 49-113, 5 figs.
- 1936. Nuovi contributi alla conoscenza della fauna delle isole italiane dell'Egeo. 6, Hym. Formicidae. *Boll. Lab. Zool. gen. agr. Portici* **24** : 262-311, 19 figs.
- PISARSKI, B. 1965. Études sur les fourmis du genre *Strongylognathus* Mayr. *Annales Zool. Warszawa* **23** : 509-523, 44 figs.
- ROGER, J. 1857. Einiges über Ameisen. *Berl. ent. Z.* **1** : 10-20.
- RUZSKY, M. 1903. Die Ameisenfauna der Astrachanischen Kirgisensteppe. *Trudy russk. ent. Obshch.* **36** : 294-316.
- SANTSCHI, F. 1916. Descriptions de fourmis nouvelles d'Afrique et d'Amerique. *Annls Soc. ent. Fr.* **84** : 497-513, fig.
- 1917. Fourmis nouvelles de la Colonie du Cap, du Natal et de Rhodesia. *Annls Soc. ent. Fr.* **85** (1916) : 279-296.
- 1921. Notes sur les fourmis paléarctiques. *Boln R. Soc. esp. Hist. nat.* **21** : 110-116, 1 fig.
- 1923. Descriptions de nouveaux formicides éthiopiens et notes diverses 1. *Revue Zool. Bot. afr.* **11** : 259-295, 5 figs.
- 1924. Descriptions de nouveaux formicides éthiopiens et notes diverses 2. *Revue Zool. Bot. afr.* **12** : 195-224, 10 figs.
- 1925. Nouveaux formicides brésiliens et autres. *Bull. Annls Soc. ent. Belg.* **65** : 221-247.
- 1927. A propos du *Tetramorium caespitum* L. *Folia Myrm. et Term.* **1** : 52-58.
- 1932. Formicides Sud-Africains. *Soc. ent. Fr. livre du centenaire 1932* : 381-392, 12 figs.
- 1935. Fourmis du Musée du Congo Belge. *Revue Zool. Bot. afr.* **27** : 254-285, 40 figs.
- 1937a. Fourmis angolaises. (Résultats de la mission scientifique suisse en Angola, 1932-33.) *Revue suisse Zool.* **44** : 209-248, 48 figs.
- 1937b. Résultats entomologiques d'un voyage au Cameroun. Formicides récoltés par M. le Dr. F. Zumpt. *Mitt. schweiz ent. Ges.* **17** : 93-104, 5 figs.
- SCHENK, C. F. 1852. Beschreibung Nassauischer Ameisenarten. *Jb. ver. Naturk. Nassau* **8** : 1-149.
- 1853. Die Nassauischen Ameisen-Species. *Stettin. ent. Ztg* **14** : 185-198.
- ŠILHAVÝ, V. 1937. *Strongylognathus kratochvili* n. sp., une fourmi nouvelle, reliquat du temps préglacial de Moravie, Tchécoslovaquie. *Sb. přír. Klubu Třebíči* **1** : 1-12, 6 figs.
- SMITH, F. 1851. *List of the specimens of British animals in the collection of the British Museum.* 6 Hymenoptera Aculeata. 134 pp. London.
- 1861. Catalogue of hymenopterous insects collected by Mr. A. R. Wallace in the islands of Ceram, Celebes, Ternate and Gilolo. *J. Linn. Soc. (Zool.)* **6** : 36-66, pl. 1.
- SMITH, M. R. 1953. A revision of the genus *Romblonella* W. M. Wheeler. *Proc. Hawaii ent. Soc.* **15** : 75-80, 1 fig.
- 1956. A list of the species of *Romblonella* including two generic transfers. *Bull. Brooklyn ent. Soc.* **51** : 18.
- STITZ, H. 1910. Westafrikanische Ameisen 1. *Mitt. zool. Mus. Berl.* **5** : 125-151, 11 figs.
- 1912. Ameisen aus Ceram und Neu-Guinea. *Sber. Ges. naturf. Freunde Berlin* **1912** : 498-514, 14 figs.
- 1938. Neue Ameisen aus dem indo-malayischen Gebiet. *Sber. Ges. naturf. Freunde Berlin* **1938** : 99-122, 13 figs.
- STUMPER, R. 1950. Les associations complexes des fourmis. Commensalisme, symbiose et parasitisme. *Bull. Biol. Fr. Belg.* **84** : 376-399.
- URBANI, C. BARONI. 1962. Studi sulla mirmecofauna d'Italia 1. *Redia* **47** : 129-138, 3 figs.
- 1968. Studi sulla mirmecofauna d'Italia 4. La fauna mirmecologica delle isole Maltesi ed il suo significato ecologico e biogeografico. *Annali Mus. civ. Stor. nat. Giacomo Doria* **77** : 408-559, 52 figs, 12 pl.
- 1969. Gli *Strongylognathus* del gruppo *huberi* nell'Europa occidentale: saggio di una revisione basata sulla casta operaia. *Boll. Soc. ent. ital.* **99-101** : 132-168, 16 figs.



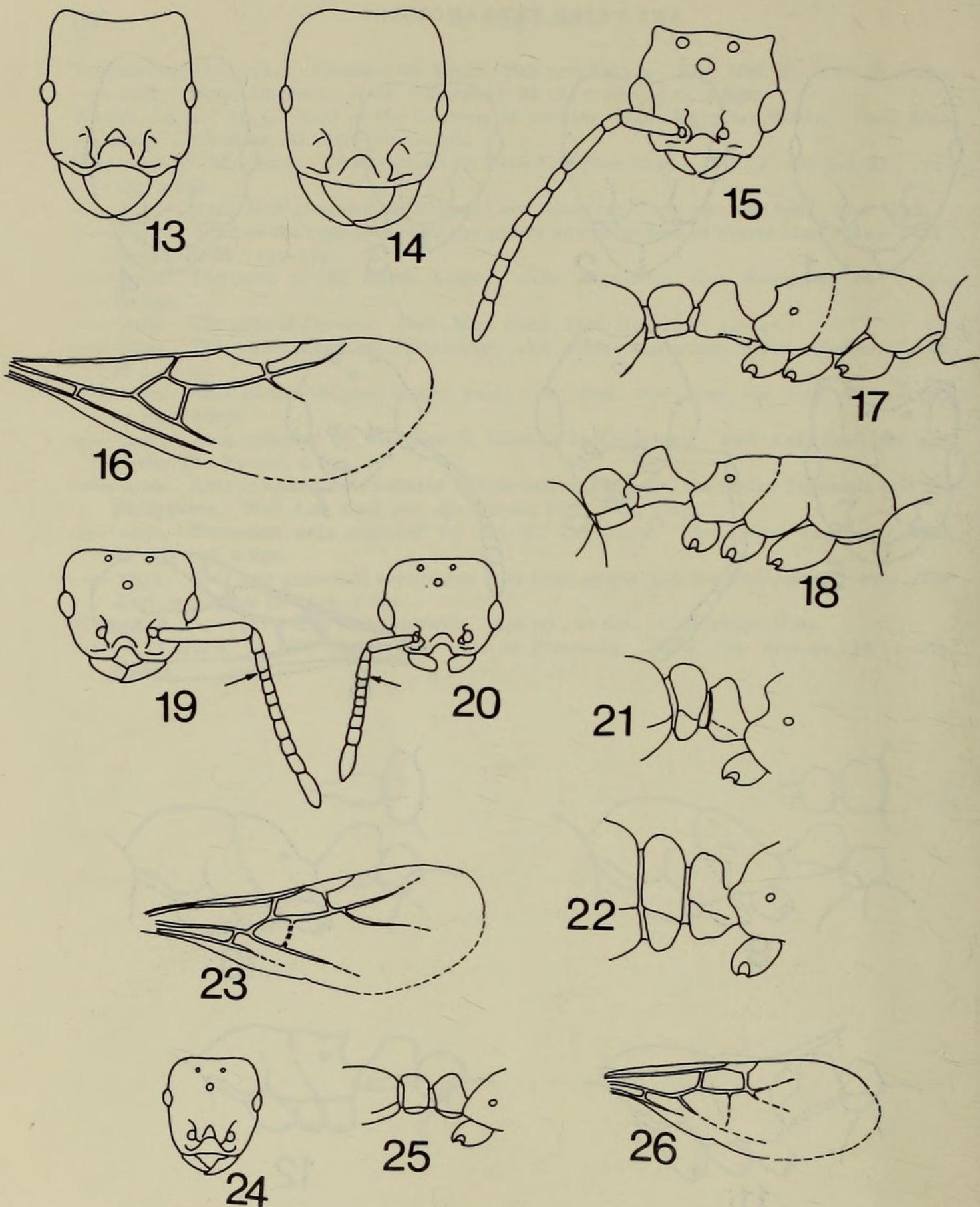
- VIEHMEYER, H. 1914. Ameisen aus Perak, Bali und Ceram. *Ent. Mitt.* **3** : 112-116, 2 figs.
- 1922. Neue Ameisen. *Arch. Naturgesch.* **88** (A) 7 : 203-220, 2 figs.
- WEBER, N. A. 1943. Ants of the Imatong Mountains, Anglo-Egyptian Sudan. *Bull. Mus. comp. Zool. Harv.* **93** : 261-389, 16 pls.
- WHEELER, W. M. 1909. Observations on some European ants. *Jl N. Y. ent. Soc.* **17** : 172-187, 2 figs.
- 1910. *Ants, their structure, development and behaviour*. 663 pp., 286 figs. New York.
- 1911. A list of the type-species of the genera and subgenera of Formicidae. *Ann. N. Y. Acad. Sci.* **21** : 157-175.
- 1914. The ants of the Baltic Amber. *Schr. phys.-ökon. Ges. Königsberg* **55** : 1-142, 66 figs.
- 1919. The ants of Borneo. *Bull. Mus. comp. Zool. Harv.* **63** : 43-147.
- 1920. The subfamilies of Formicidae, and other taxonomic notes. *Psyche, Camb.* **27** : 46-55.
- 1922. Ants of the Belgian Congo, parts 1-8. *Bull. Am. Mus. nat. Hist.* **45** : 1-1139, 23 pls, 76 figs.
- 1927. Ants collected by Professor F. Silvestri in Indochina. *Boll. Lab. Zool. gen. agr. Portici* **20** : 83-106, 9 figs.
- 1929. Ants collected by Professor F. Silvestri in Formosa, the Malay Peninsula and the Philippines. *Boll. Lab. Zool. gen. agr. Portici* **24** : 27-64, 7 figs.
- 1930. Formosan ants collected by Dr. R. Takahashi. *Proc. New. Engl. zool. Club* **11** : 93-106, 2 figs.
- 1935. Two new genera of myrmicine ants from papua and the Philippines. *Proc. New Engl. zool. Club* **15** : 1-9, 2 figs.
- WILSON, E. O. 1971. *The insect societies*. 548 pp., 22 figs. Cambridge, Mass.
- & TAYLOR, R. W. 1967. The ants of Polynesia. *Pacif. Ins. Monogr.* **14** : 1-109, 84 figs.





FIGS 1-12. *Rhoptromyrmex* species. 1-7. Outline of head capsule of (1) *R. globulinodis*, worker, (2) *R. melleus*, worker, (3) *R. critchleyi*, worker, (4) *R. globulinodis*, female, (5) *R. transversinodis*, female, (6) *R. globulinodis*, male, (7) *R. wroughtonii*, male. 8. Right forewing of *R. transversinodis*, male. 9-12. Outline of alitrunk and pedicel in worker of (9) *R. globulinodis* (offset shows pedicel segments in dorsal view), (10) *R. transversinodis* (offset shows pedicel segments in dorsal view), (11) *R. melleus* (12) *R. critchleyi*.



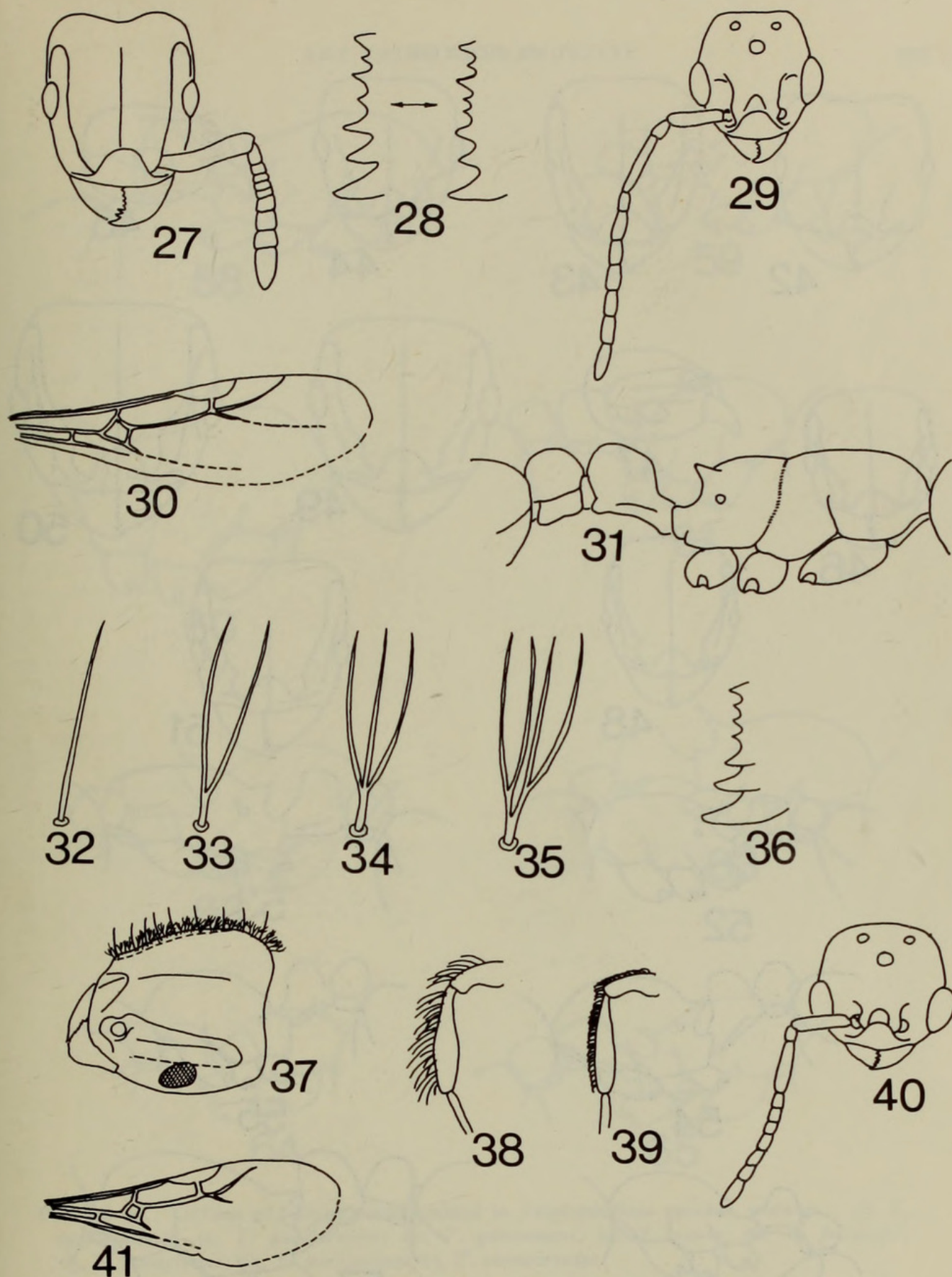


FIGS 13–18. *Strongylognathus* species. 13–15. Outline of head capsule of (13) *S. testaceus*, worker, (14) *S. destefanii*, worker, (15) *S. testaceus*, male. 16. Right forewing of *S. testaceus*, male. 17, 18. Outline of alitrunk and pedicel in worker of (17) *S. testaceus*, (18) *S. destefanii*.

FIGS 19–23. *Anergates atratulus*. 19, outline of head of female; 20, same of male; 21, pedicel of female; 22, same of male; 23, right forewing of female.

FIGS 24–26. *Teleutomyrmex schneideri*. 24, outline of head of female; 25, outline of pedicel of female; 26, right forewing of female.

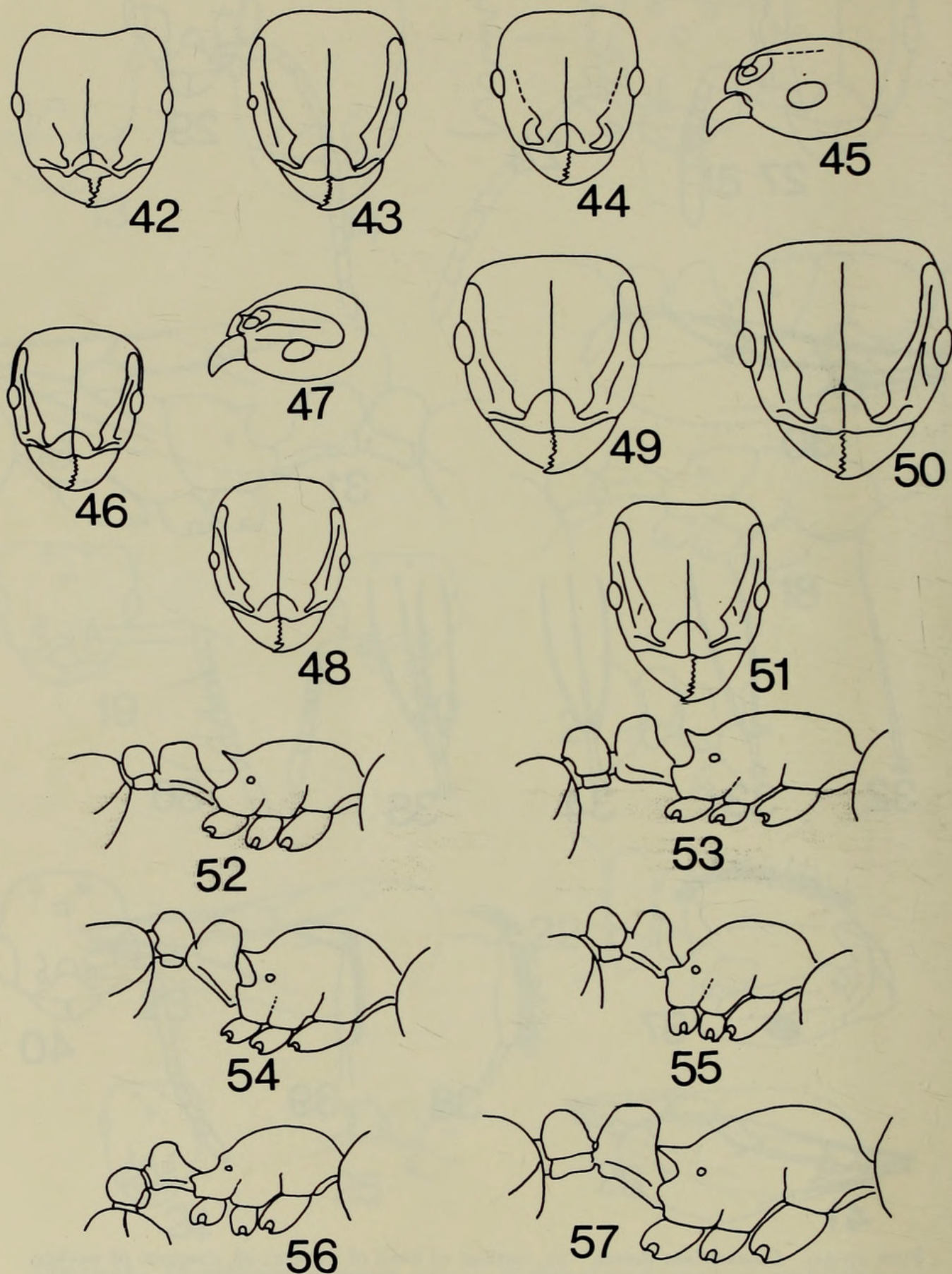




FIGS 27-31. *Decamorium decem*. 27, outline of head of worker; 28, diagram of worker mandible showing variation in denticles; 29, outline of head of male; 30, right forewing of male; 31, outline of alitrunk and pedicel of worker.

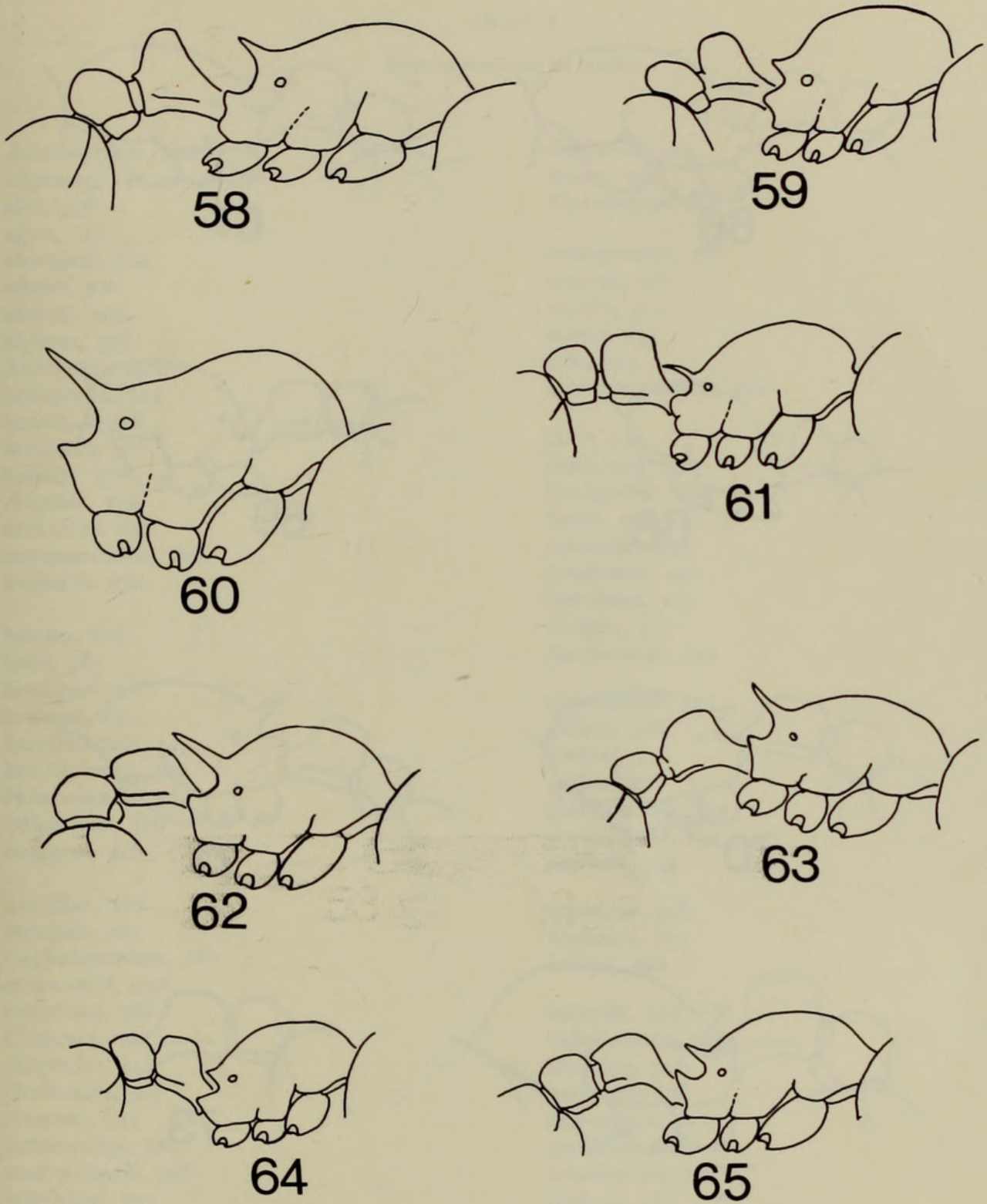
FIGS 32-41. *Triglyphothrix* species. 32-35, forms of hairs encountered in the genus; (32) simple, (33) bifid, (34) trifid, (35) quadrifid. 36, diagram of dentition mostly commonly encountered in the genus. 37, diagram of head to show row of simple long hairs on upper scrobe margins. 38, hind tibial pilosity in *T. obesa* and allies. 39, hind tibial pilosity in *T. pacifica* and allies. 40, outline of head of *T. inezulae*, male. 41, right forewing of *T. menkaura*, female.





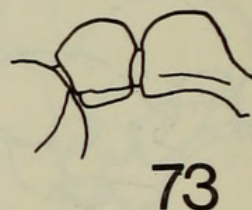
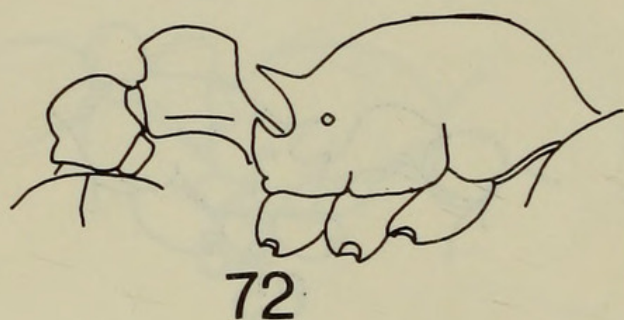
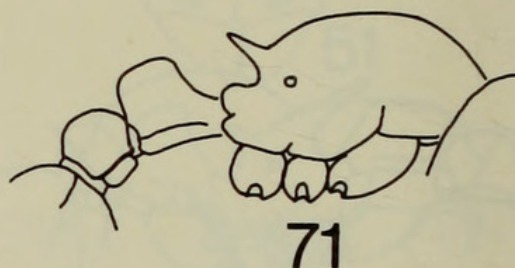
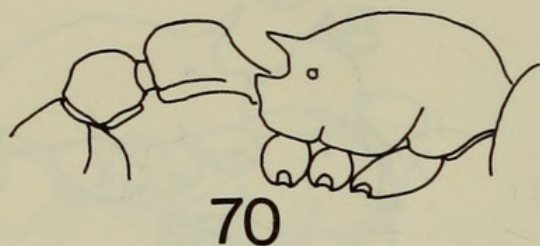
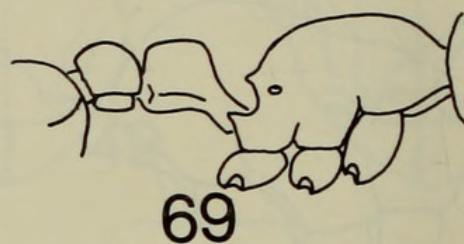
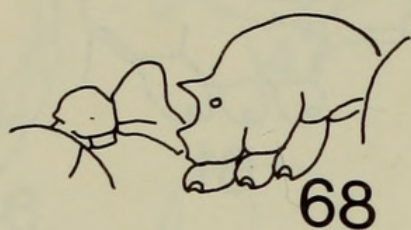
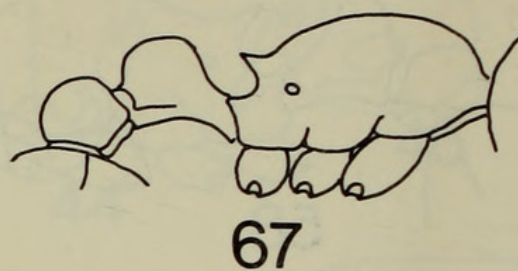
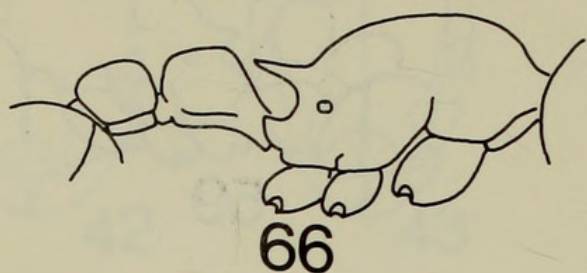
FIGS 42-57. *Triglyphothrix* species. 42-51. Outline of heads of workers of (42) *T. rothschildi*, (43) *T. microps*, (44) *T. eminii*, (45) lateral view of *T. eminii* to show extent of scrobe, (46) *T. menkaura*, (47) lateral view of *T. menkaura* to show extent of scrobe, (48) *T. dedefra*, (49) *T. baufra*, (50) *T. brevispinosa*, (51) *T. meshena*. 52-57. Outline of alitrunk and pedicel of workers of (52) *T. rothschildi*, (53) *T. microps*, (54) *T. eminii*, (55) *T. menkaura*, (56) *T. dedefra*, (57) *T. baufra*.





FIGS 58–65. Outline of alitrunk and pedicel in *Triglyphothrix* species, workers. 58, *T. brevispinosa*; 59, *T. pulcherrima*; 60, *T. gabonensis*; 61, *T. osiris*; 62, *T. fulviceps*; 63, *T. lanuginosa*; 64, *T. parvispina*; 65, *T. coonoorensis*.





FIGS 66-73. Outline of alitrunk and pedicel in *Triglyphothrix* species, workers. 66, *T. adpressa*; 67, *T. meshena*; 68, *T. walshi*; 69, *T. brevidentata*; 70, *T. pnyxis*; 71, *T. kheperra*; 72, *T. chepocha*; 73, *T. vombis*.



## INDEX

Synonyms are in *italics*.

- Acidomyrmex*, 298  
*adpressa*, 344  
*afer*, 306  
*agna*, 317  
*akermani*, 324  
*alberti*, 302  
*alboini*, 306  
*alpinus*, 306  
*Anergates*, 296  
*antennata*, 344  
*antrema*, 318  
*areolatus*, 326  
*arnoldi*, 318  
*Atopula*, 359  
*atratus*, 296  
*auropunctatus*, 329  
*australis*, 350  
  
*baufra*, 319  
*belti*, 362  
*boulognei*, 326  
*braunsi*, 292  
*brevidentata*, 345  
*brevispinosa*, 320  
*bulawayensis*, 329  
*bulgaricus*, 306  
*burgeoni*, 326  
  
*caeciliae*, 307  
*ceconii*, 307  
*Cephalomorium*, 287  
*ceramensis*, 350  
*ceylonica*, 362  
*Chelaner*, 294  
*chepocha*, 345  
*christophi*, 307  
*cinereus*, 324  
*constanciae*, 321  
*conoorensis*, 346  
*critchleyi*, 303  
*cryptica*, 321  
  
*dalmaticus*, 307  
*decamera*, 347  
*Decamorium*, 297  
*decem*, 298  
*dedefra*, 322  
*desertorum*, 323  
*destefanii*, 307  
  
*distincta*, 323  
*diveri*, 306  
*Dyomorium*, 287  
  
*emarginatus*, 306  
*emeryi*, 308  
*eminii*, 324  
*ericae*, 333  
*esta*, 303  
*Eutetramorium*, 293  
  
*felix*, 350  
*flavescens*, 350  
*flavigaster*, 294  
*foreli*, 308  
*formosae*, 355  
*friedlandi*, 297  
*fulviceps*, 347  
*furtiva*, 325  
*fusciventris*, 329  
  
*gabonensis*, 325  
*gallica*, 308  
*gestroi*, 326  
*gibber*, 292  
*globulinodis*, 302  
*grandinodis*, 294  
*guillodi*, 324  
  
*hepburni*, 328  
*hortensis*, 363  
*huberi*, 308  
  
*imbellis*, 327  
*indosinensis*, 348  
*inezulae*, 327  
*insularis*, 308  
*intermedia*, 302  
*Ireneella*, 298  
*Ireneopone*, 292  
*italicus*, 308  
  
*kamerunensis*, 326  
*karawajewi*, 305  
*katypa*, 349  
*kervillei*, 308  
*kheperra*, 349  
*koreanus*, 308  
*kratochvili*, 307  
*kutteri*, 307



- laeviceps*, 303  
*laevidens*, 350  
*lanuginosa*, 350  
*leno*, 302  
*Lobomyrmex*, 359  
*longi*, 302  
*longispina*, 363  
*longispinosa*, 321  
*Lundella*, 287  
  
*Macromischoides*, 359  
*marleyi*, 324  
*marthae*, 324  
*mashonana*, 328  
*mauricei*, 351  
*mayri* (Triglyphothrix), 352  
*mayri* (Rhoptryrmex), 301  
*melleus*, 301  
*menkaura*, 328  
*meshena*, 353  
*microps*, 329  
*minima*, 330  
*mocquerysi*, 293  
*monardi*, 331  
*monodi*, 303  
*monticellii*, 293  
*mucidus*, 326  
*mus*, 324  
*muscorum*, 331  
*musculus*, 358  
*Myrmus*, 304  
  
*nacta*, 353  
*nimba*, 298  
*nion*, 320  
*nodifera*, 362  
  
*obesa*, 354  
*obscurus*, 302  
*opaca* (Romblonella), 294  
*opacus* (Rhoptryrmex), 302  
*orissana*, 350  
*osiris*, 332  
  
*pacifica*, 355  
*palaestinensis*, 309  
*pallens*, 329  
*papuensis*, 302  
*parvispina*, 355  
*paupera*, 333  
*pnysis*, 356  
*pretoriae*, 303  
*pulchella*, 356  
  
*pulcherrima*, 333  
  
*rehbinderi*, 309  
*reptana*, 334  
*rhodesiana*, 329  
*Rhoptryrmex*, 298  
*Romblonella*, 293  
*rossi*, 357  
*rothneyi*, 302  
*rothschildi*, 334  
*ruzskyi*, 309  
  
*schneideri*, 310  
*sericea*, 335  
*silvestrii* (Stronglyognathus), 309  
*silvestrii* (Triglyphothrix), 336  
*simoni*, 292  
*solleri*, 301  
*soyansi*, 326  
*soyauxi*, 326  
*spuria*, 358  
*steini*, 303  
*striatidens*, 350  
*Stronglyognathus*, 304  
*Sulcomyrmex*, 359  
*sumatrensis*, 302  
  
*taivanensis*, 302  
*talpa*, 336  
*Teleutomymex*, 309  
*tenebrosa*, 337  
*Tetramorium*, 359  
*Tetramyrma*, 291  
*Tetrogmus*, 359  
*tessmanni*, 301  
*testaceus*, 306  
*thoth*, 337  
*transversinodis*, 303  
*tricolor*, 351  
*Triglyphothrix*, 310  
*trimeni*, 338  
  
*uelense*, 298  
*ultor*, 298  
  
*vombis*, 358  
  
*walshi*, 358  
*wroughtonii*, 302  
  
*Xiphomyrmex*, 359  
  
*yarthiella*, 338



B. BOLTON, B.Sc., A.R.C.S.  
*Department of Entomology*  
BRITISH MUSEUM (NATURAL HISTORY)  
CROMWELL ROAD  
LONDON SW7 5BD





Bolton, Barry. 1976. "The ant tribe Tetramoriini (Hymenoptera: Formicidae). Constituent genera, review of smaller genera and revision of Triglyphothrix Forel." *Bulletin of the British Museum (Natural History) Entomology* 34, 283–379.

**View This Item Online:** <https://www.biodiversitylibrary.org/item/127476>

**Permalink:** <https://www.biodiversitylibrary.org/partpdf/78329>

#### **Holding Institution**

Natural History Museum Library, London

#### **Sponsored by**

Natural History Museum Library, London

#### **Copyright & Reuse**

Copyright Status: In copyright. Digitized with the permission of the rights holder.

Rights Holder: The Trustees of the Natural History Museum, London

License: <http://creativecommons.org/licenses/by-nc-sa/4.0/>

Rights: <http://biodiversitylibrary.org/permissions>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.