

**SYSTEMATIC STUDIES ON SOME SUBFAMILIES OF  
FORMICIDAE [HYMENOPTERA] OF KERALA  
AT THE ALPHA LEVEL**

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**CERTIFICATE**

This is to certify that this thesis is an authentic record of the work carried out by Sr. KARMALY K.A., from January 1999 to February 2002 under my guidance and supervision in partial fulfilment of the requirements of the Degree of Doctor of Philosophy in Zoology, under the Faculty of Science of the University of Calicut. No part of the thesis has been presented before for any other degree.

It is further certified that the candidate has passed the M.Phil examination of the University of Calicut held in 1996.

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## DECLARATION

I do hereby declare that this thesis is an authentic record of the work carried out by me under the supervision of Professor T.C. Narendran, Department of Zoology, University of Calicut and no part of this has previously formed the basis for the award of any degree or diploma as stipulated in the statutes of Calicut University.

*Karmaly K.A*  
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**Dedicated**

*To*

*The Loving Memory of  
My Late Beloved Parents*

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## INTRODUCTION

The Formicoidea constitute one of the important superfamilies of Hymenoptera. This superfamily was erected by LINNAEUS (1735) based on the genus *Formica* and the type species *Formica rufa* Linn. Recently this superfamily is added to the Superfamily Vespoidea (BROTHERS, 1975) and treated as a family Formicidae under Vespoidea.

Ants belong to one of the most abundant, highly specialised, polymorphic, eusocial group of insects and they are cosmopolitan in distribution. They occupy a position among terrestrial invertebrates equivalent to that of man among vertebrates. This is because of their peculiar habit of manipulating and modifying their immediate surroundings according to their needs. They are well adapted to explore all possible environments and to exploit all possible opportunities.

Ants are very highly developed social animals and have a specialised colonial habit with marked degree of division of labour amongst its various constituent castes. Almost all ants are social and polymorphic. Each colony consists of three castes. Reproductive castes are the queens and the males, and non-reproductive castes are the workers. Each caste is destined to do their own work. Male ants are generally winged and usually keep their wings until death. The male ant's only function is to mate with the queen. He dies, generally within two weeks after mating. A queen is generally the largest individual in the colony. She has wings which she removes after nuptial flight. The primary function of the queen is reproduction, but after establishing a new nest she may also care for and feed the first brood of workers. Once she has produced her first brood, she becomes an "egg-laying machine", cleaned and fed by her offspring. She may live for many years until replaced by a daughter queen. The workers are sterile wingless females who build and repair the nest, care for the brood, defend the

nest, and feed both immature and adult ants, including the queen. There may be workers and soldiers of different sizes that specialize in certain tasks. They may live for about ten years. This longevity is a peculiarity of ants. In some parasitic ants, workers are absent and females are wingless. In some other groups workers possess functional ovaries and produce males by laying haploid eggs. Caste differentiation is usually based on the food sources obtained by the larvae. Poorly proteinaceous diet may lead to the production of workers and highly proteinaceous diet may lead to the development of fertile females (queens). Polymorphism can be seen among individual castes itself. Many ants have monomorphic workers. Some have subcastes based on their size. There may be major and minor workers as in the case of *Camponotus*, *Polyrhachis* etc. and in some groups like *Pheidole*, ants with an enormously enlarged head known as soldiers are present.

Ants are essentially creatures of the ground, their nests are in most cases subterranean. Nests vary widely from a simple cavity in the soil to extremely complex. Ants like *Oecophylla* build large nests by using leaves and silk threads from the larval saliva (BRAIN, 1965). The ant *Formica rufa* Linn. makes nest with sandy and silicious soils (NELMES 1938). The ant *Lasius flavus* Forel builds nest with mineral content (calcareous and clay-rich soil). *Anoplolepis* make their nests with hard soils (STEYN, 1958). Ants like *Crematogaster* may form fine carton nests and some others live inside cavities. In some cases usually the plants may produce such cavities to attract ants. Here both are benefitted in such a way that ants will get nesting place as well as food materials such as nutritive nodules, extrafloral nectaries or honeydew from homopterans living on the tree. The plant may be protected by these ants from herbivores, and ants supply nutrients to their host plants. The ants by their aggressive behaviour may defend the plant even from mammals. For example, protection of *Acacia* plants by *Pseudomyrmex* in

America. Ants of Aenictinae do not build permanent nests. They pass from one nest to another in large swarms.

The ants are the most dominant among other insects. The dominance is due to their social, especially predacious style of life. They owe much of their superiority to terrestrial habits. The ants resemble the bees and wasps, with respect to their social behaviour. However they may be readily distinguished by a series of characters. The most striking character is the differentiation of the abdomen into two strongly marked regions, a slender one or two jointed highly mobile pedicel, and a large, more compact portion, the gaster. In the majority of the genera of Formicidae, the attachment of the pedicel to the median segment in front and to the rest of the abdomen behind is extremely constricted and narrow giving great freedom of movement to both thorax and abdomen. When the pedicel is formed of two segments a similar constriction lies between the two. Another distinguishing character is furnished by the antennae which are elbowed and have the first joint greatly elongate in the female.

Ants are highly adapted and have a dynamic behaviour. Their food source range from plant seeds, fungus, nectar, honey secreted by insects, to other ants and invertebrate animals. Some ants (*Atta* Fabr. and *Messor* Forel) cultivate their food by themselves in their nests. The mandibles of ants are variously modified depending on the food sources they take in.

All ants are social in habit and their colonies live from one year to another. Ants are found everywhere from the arctic region to the tropic, from timberline on the loftiest mountains to the shifting sands of the dunes and seashore and from the dampest forest to the deserts (driest area).

Ants are the most prominent group among social insects. Ants have both beneficial as well as harmful effects. The economic importance of ants is clearly

evident from the fact that they do both good and evil to man. In the positive role as beneficial insects ants maintain a constant check of the excess increase in populations of many harmful insects by predated on them. Apart from this, honey-ants from south-west are used by primitive tribes in India for food and medicinal purposes. Many species deserve our protection, since they are highly beneficial (FOREL 1902). The greatest usefulness of ants lies in their power to hasten the decomposition of organic substances. In many parts of the earth the ants are regarded as useful allies in destroying the insect pests of plantations.

Ants occupy unique position among all insects on account of their dominance as a group. This can be seen in their higher degree of variability as exhibited in the great number of the species and varieties.

Ants hold manifold relationships with plants and other animals including man. The activities of ants may interfere with those of man in three different ways. 1. Through their feeding habits. 2. Through their habit of appropriating certain portions of the earth as nesting sites and 3. Through their aggressive nature, that is stinging and biting habits.

Ants have both beneficial as well as harmful effects. Their harmfulness lies in their stinging and biting habits, as well as their mode of life as pests. Ponerinae, Pseudomyrmecinae and some Myrmicinae have powerful stings and they attack the enemy, by causing painful stinging. Ants of subfamily Dolichoderinae and Formicinae lack these stings, but they have developed a poison gland at the place of stings and spray acid from these gland into body of enemy causing severe itching and pain. A few ants like *Oecophylla smaragdina* [Fabr.] may bite the enemy and pour acid into the wound. *Monomorium phraonis* Linn. is a serious invader of houses, factories, stores, etc. and are really a nuisance. It is found nearly all over the world. *Iridomyrmex humilis* Emery is found to be a serious household pest as well as a destructive ant to crops and is

rapidly becoming cosmopolitan. The most harmful nature of ants is their habit of nurturing pests like aphids and mealy bugs. The leaf cutting ants *Atta* Fabr. and *Acromyrmex* Mayr are serious to man's horticulture. They disfigure flower buds and defoliate garden shrubs and fruit trees, collect pieces of leaves into their nests thereby cultivate fungal spores. Aenictine ants during their march may destroy insects as well as higher forms of animals found in their way.

However ants of different species have very different economic importance. While some are highly beneficial some others are highly injurious to man. A great number may be regarded as negligible organisms. In the beneficial role, ants are effective predators of soil inhabiting larvae, pupae or adult. Some species of ants act on the soil like earthworms and are constantly engaged in renewing the soil. Formic acid prepared from the members of the subfamily Formicinae holds a prominent place in the pharmacopoeia. The huge heads of the soldier ants of the South American ants *Atta cephalotes* Linn. have been employed by the surgeons in closing wounds. Ants are found to be the first used insects as biological control agents. FORSKAL (1775) reported the first record of transportation of insects for control of pests. That is the transportation of beneficial ants by the Date growers of Yemen to control harmful pests. Chinese citrus growers use *Oecophylla smaragdina* [Fabr.] in orange trees to protect trees from attack of foliage feeding insects like *Tessaratoma papillosa* (McCook, 1882). Ants play an important role in controlling the destructive beetles, spiders and other harmful pests. Another ant *Dolichoderus bituberculatus* [Mayr], is employed in Java to protect cocoa plantation from the attack of insects like *Helopeltis*.

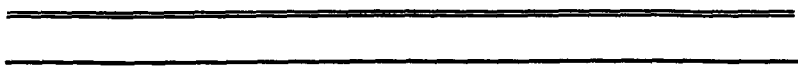
According to PEMBERTON & WILLARD (1918) approximately three fourths of the population of the Mediterranean fruitfly can be controlled by *Pheidole megacephala* F. PHILLIPS (1934) found that the housefly in Hawaii is held down to negligible numbers by the accidentally introduced *Pheidole megacephala* F.

and the increase and spread of many other pests are prevented. TAYLOR's (1937) observations prove that *Monomorium floricola* Jerd. is an important predator of the coconut leaf mining beetle *Premecotheca reichei* in Fiji. *Solenopsis saevissima* Smith is an effective predator. Its venom is useful as an insecticide against those insects which are resistant to other chemicals and also it contains an antibiotic which kills bacteria and moulds (LESTER, A. SWAN, 1964). It is recorded that 75% of the larvae, pupae and adults of South Western Cornborer, *Diatraea triondiogella* species are destroyed by *Solenopsis geminata* var. *diabolica* Wheeler. The ant species *Crematogaster* is effectively used against *Coclenomenodera minuta*, a pest of oil palm in Cameroun (TIMTI, 1991). *Monomorium salomonis* Linn. and *Solenopsis geminata* Fab. are effectively used against termites (ROTHNEY, 1889) in Madras.

The almost human aspects of ant life are well known. A more remarkable fact is that, ants bury the bodies of their comrades and attend the funeral (WOOD, 1994). Another phase of humanity found among those most remarkable insects is the power of utilizing other ants to do their work for them and keeping them as domestic servants (WOOD, 1994). Sterile individuals show a remarkable division of labour which finds analogies among nurses, farmers, builders, soldiers and the like in the human community. As with man, ants have achieved remarkable control over the inanimate world. It is true that they have not acquired the use of tools but instead they are marvellously endowed with a capacity for using their natural equipment of heads, jaws, legs, stomach, stings, etc. to good purpose.

Ants are considered as very good decomposers and scavengers. Aquarium fishes and game birds are fed by the eggs of ants. Some tribal people of China and India eat the ants as a delicious food item. The eggs of *Oecophylla* are used as a constituent of medicine for Malaria by tribes in India. In Philippines *Oecophylla* are eaten by a few people. In Australia some people living in the arid area use honeypot ants (*Camponotus*) as a source of sugar (GULLAN & CRANSTON, 1994).

Considering the great diversity of habits and economic importance of ants, their faunastic studies and taxonomy are poorly done in India particularly in Kerala where a wide variety of ants are present. Only very few attempts have been made in the past by earlier workers for a systematic study of the members of this family. Until the alpha taxonomy of these insects are studied, no further work on their importance in the ecosystem in general and agroecosystem in particular could be fully determined.



# **Chapter I**

## REVIEW OF LITERATURE

The ants are classified as single family Formicidae under the superfamily Vespoidea of the order Hymenoptera. Ants are among the most successful insects. Experts estimates that there could be 20,000 or more species of ants in the world. They have evolved to fill a variety of different ecological niches as predators, herbivores, leaf-cutters, seed harvesting, aphid tenders and fungus growers. Studies on ants have mainly centred around certain specialised fields such as communication, sociobiology, social parasitism, commensalism, behaviour etc. and very little study has been done on their systematics, especially in India. Ants occur in all continents and at present 10,000 species of ants in 297 genera, within 16 subfamilies occur in the world [BOLTON, 1994]. Of these, 10 subfamilies are present in the Oriental Region. Out of these, 9 subfamilies are reported from India. In the present work, a review has been done with special emphasis on Oriental Region on the literature of three subfamilies viz., Formicinae - the most specialised and worldwide subfamily with a large number of species, Dolichoderinae and Cerapachyinae undertaken for the present investigation.

The foundations of the taxonomy of ants were laid in the closing years of the 18th and the opening years of the 19th century by LINNAEUS, FABRICIUS and LATREILLE [WHEELER, 1960]. The taxonomic study of Formicidae started with LINNAEUS in 1735. In his book *Systema Naturae* [first-published, 1758], he developed the ideas about classification and gave the world the notion of the definition of a species. *Systema Naturae* contained definitions of some 6000 plant and 4000 animal species. The novel feature of this book was the treatment of both animal and plant species in a single work. LINNAEUS was followed by FABRICIUS, LATRIELLE, WESTWOOD, MAYR, ROGER SMITH, EMERY,

FOREL, ARNOLD, MANN and many others in the study of Formicidae (*Sen. lato*). In 1920's and 1930's studies on myrmecological investigation started with BRUCH, GALLARDO, and BORGUMIER in S. America, ARNOLD in S. Africa, SMITH and CREIGHTON in N. America. All authors concentrated on their own native ants. Ants of N. America [CREIGHTON, 1850] is a monumental book which contains biological, revisionary and taxonomic works. Another important author to be remembered for the past and present times is WHEELER who contributed much to the Biosystematics of ants. Most successful studies have been done on the latter half of 20th century in which BROWN, BOLTON, WILSON, SMITH, TAYLOR were the dominant workers who enriched taxonomy of ants with detailed revisions, keys, phylogenetic analysis and some other important aspects.

LINNAEUS in his book "*Systema Naturae*" [1735] described the genus *Formica* with *Formica rufa* Linn. as the type species. He briefly described eighteen species. Of these eighteen species, eight were reported from Europe, eight from S. America and two from Egypt. All these species he included in a single genus *Formica* Linn. FABRICIUS later [1793] added one more genus *Dorylus*.

LATREILLE was the most important among the pioneers in myrmecography (1798, 1802). He collected the ants of Europe, studied their habits assiduously and described many species that had been overlooked by his predecessors. He contributed good description of nearly a hundred species which he had himself examined. All these species he placed in the genus *Formica* which he divided into nine "families". They are the *Formica arcuatae* (corresponding to our present genera *Camponotus* and *Polyrhachis*), *Camelinae* (Corresponding to *Formica*, *Lasius*, *Myrmecocystus*, *Oecophylla* and *Dolichoderus* in part), *Atomariae* (*Dolichoderus* in part, *Tapinoma* and *Acantholepis*), *Ambiguae* (*Polyergus*), *Chelate* (*Odontomachus*), *Coaretate* (*Ponera*, *Pachycondyla*, *Neoponera*, *Ectatomma*, *Myrmecia*

etc), *Gibbosae* (*Atta*, *Pheidole*, *Messor*, *Pogonomyrmex* etc.), *Punctoriae* [*Eciton*, *Myrmica*, *Tetramorium*, *Myrmecina*, *Leptothorax*, *Solenopsis* etc.) and *Caperatae* (*Cryptocerus*, *Oecophylla*).

FABRICIUS (1804) described a number of additional species and created four more genera viz. *Lasius*, *Cryptocerus*, *Atta* and *Myrmecia*. He retained the great majority of species in the Linnaean genus *Formica* but divided into two categories which was purely artificial, one for the species with spines on the thorax and the other for the species without spines on the thorax. In 1807 JURINE came into the field with a new genus *Manica*. LEACH (1815) produced a remarkable contribution by creating a new family group name *Dorylidae*.

SYKES [1835, 1836] contributed much to the knowledge of the Indian ants through the description of new species of Indian ants viz. *Myrmica kirbii* and *Atta providens*. In 1839 WESTWOOD described the genera *Pheidole* and *Stenamamma*. In 1840 SCHUCKARD described the genus *Aenictus*. In 1842 contribution by SMITH appeared as Revision of an Essay on the British Formicidae published in the transactions of the society. NYLANDER [1846, 1849] devoted himself to a careful study on the European species. FÖRSTER in 1850 made his contribution on the Formicidae of Germany. In 1851 JERDON published a catalogue of the species of ants found in Southern India. In 1852 SMITH had done a universal study of ants. He described a few species from India with a note on their economic importance and erected the genus *Tetraoponera* with the type species *T. atrata*. SMITH's valuable contributions of 3 genera, *Cataulacus*, *Meranoplus* and *Orectognathus* came in 1853. SCHENCK (1853) collected ants from Germany and made a detailed study. The following years were dominated by the excellent publications of the myrmecologist MAYR (1853) who erected a number of genera and higher categories and produced meaningful descriptions. He started his studies with whole fauna of Europe and extended to the fauna of Asia, Australia,

North and South America and Africa. He (1853a) published two new genera viz. *Aphaenogaster* and *Strongylognathus*. Most of the genera existing today are erected by MAYR. In 1854 JERDON published his second part of the list of ants found in Southern India. CURTIS (1854) made his contribution to the systematics of the studies of ants of Switzerland. MAYR (1855) published four more genera. They are *Formicoxenus*, *Zepto thorax*, *Monomorium* and *Tetramorium*. In 1857 SMITH published a catalogue on the hymenopterous insects of Sarawak, Borneo, Mount Ophir, Malacca and Singapore. GREDLER (1858) made a detailed study of ants of Tirol. SMITH (1858a) published the list of Formicidae in his 6th part of hymenopterous insects in the British Museum. In 1859a SMITH described a new genus *Podomyrma* from Australia. SMITH (1859b) studied the ant fauna of Switzerland. Another genus *Strumigenys* was described by the same author in 1860a with the type species *S. mandibularis*.

MEINERT in 1861 came into the scene with some informations on the Formicidae of Netherlands. MAYR (1861) came with some synonymies and published a new genus in 1862 with the type species. In 1863 MOTSCHOUJSKY published a new species from India. ROGER (1863a) erected new genus *Macromischa*. MAYR (1865) again furnished the formicid systematics with four more genera viz. *Acromyrmex*, *Liomyrmex*, *Sericomyrmex* and *Vollenhoria*. In the same year SMITH also enriched the formicid systematics with the descriptions of some new species from the islands of Sumatra, Sulu, Gilolo, Salwatty, and New Guinea. All these studies were based on the specimens collected by A.R. Wallace. HEER (1867) evident the descriptions of many fossil species preserved in the Baltic and Silican ambers and in the strata of Oeminggen and Radoboj.

MAYR was followed by FOREL and EMERY. Both authors were started with the studies on European fauna. EMERY (1869) studied the ant fauna of Italy. EMERY (1869a) continued his publication with the descriptions of many fossil

species preserved in the Baltic and Silican ambers and in the strata of Oeninigen and Radoboj. FOREL (1874) distinguished the importance of comparative anatomy of gizzard, poison apparatus and anal glands in separating the major subfamilies. EMERY (1877) concentrated to revise, classify and key the species, genera and higher categories and in his great contribution to Wytsman's *Genera insectorum*, he published a unified system, key and complete catalogue of the ants, the most useful work published in myrmecology. In 1879 MAYR published a paper Ameisen-fauna Asiens.

ANDRE [1882-1905] made his contribution on the Formicidae of France, Europe and North Africa. FOREL (1885a) published a catalogue on the Indian ants of Indian Museum, Calcutta and contributed much to our knowledge of the Indian ants. The same author in 1886 published another volume of Indian ants of Indian Museum, Calcutta. NASSNOV (1889) made a contribution to the natural history of the ants (Formicariae). ROTHNEY (1890) published some notes on Indian ants and contributed further knowledge about Indian ants. WASMANN (1891) studied the Formicid fauna of Netherland. EMERY (1892a) continued his publication with the description of two genera *Acanthomyrmex* and *Lophomyrmex*. WROUGHTON in the same year published a journal on his studies about our ants. FOREL (1892j) published a part of his publication on the ants of India and Ceylon with the description of *Camponotus opaciventris*. In 1893 FOREL continued his study and divided Formicidae into 5 subfamilies viz. Camponotinae, Dolichoderinae, Dorylinae, Myrmicinae and Ponerinae. In the same year another contribution was made by FOREL. He published sur la classification de la famille des Formicides, avec remarques Synonymiques.

DALLA TORRE in 1893 prepared a catalogue on the descriptions and synonymies of Formicidae. EMERY (1893a, 1893b) concentrated on the ant fauna of Malai archipelago and Sri Lanka. FOREL [1893b] published second and third

part of his publication on the ants of India and Sri Lanka. In 1894 the same author published his studies on Indian ants. Again FOREL (1894c) published 4th part of his publication on the ants of India and Ceylon. FOREL (1895b) published the ants of India and Ceylon. ANDRE (1895b) concentrated on fossil species preserved in the Baltic and Silican ambers and in the strata of Oenigen and Radolj. In the same year ROTHNEY also produced some notes on Indian ants. At the same time FOREL (1895e) published fifth part of his publication on the ants of India and Ceylon.

GREEN (1896) published his studies on the habits of the Indian ant *Oecophylla smaragdina* [Fabr.]. RUZSKAY (1896) paid his attention to the ant fauna of Russia. EMERY (1896a) studied on analysis of families and genera of Formicidae. The same author in 1897a published two genera viz. *Adelomyrmex* and *Lordomyrmex*. After a period of short interval MAYR (1897) again entered into the field with some informations on the Formicidae of Sri Lanka and Singapore. FOREL (1900a) published sixth part of his paper on the studies of Formicidae of India and Ceylon. EMERY (1901a) made his contribution on the Formicidae of Sri Lanka. FOREL (1901a) published his studies on ants from Java, Natal etc. The same author (1901b) made his contribution on the army ants of India and Ceylon. In 1902 EMERY prepared an analytical key to the genera based on workers. In the same year DODD prepared a notes on the Queensland green tree ants. FOREL (1902a, b) published his report from the studies on the ant fauna of India and Ceylon. The same author in the same year (d) published "Varietes myrmecologiques." ADLERZI (1902) contributed much to the knowledge of the ant fauna of Sweden.

The contribution of BINGHAM (1903) towards the taxonomy of Formicidae was noteworthy. In the series of the Fauna of British India, he followed the same classification of EMERY and FOREL. He published a monograph on the fauna of

ants in India, Ceylon and Burma. It is the only complete work on the fauna of these regions, with key and descriptions of almost all subfamilies, genera and species up to that time. Still now his work helps a great deal in the study of systematics of Indian ants. In the subfamily Formicinae BINGHAM reported about 140 species from 14 genera from India. He reported only 5 subfamilies from Formicidae. In the same year FOREL published his report on the studies of ants of Andaman and Nicobar islands. WHEELER (1903a) published a new genus *Erebomyrma* from Texas. FOREL (1904) published a few species of ants from India. The same author (c) published "Miscellanea myrmecologiques" ASHMEAD (1905) published a skeleton of new arrangement of the families, subfamilies, tribes and genera of Formicoidea. FOREL (1905a) made his contribution to the systematics by the studies of ants of Java. EMERY (1905d) reported *Camponotus maculatus* from palearctic region. The same author (1906b) studied *Prenolepis vividula* Nyl. and published notes on classification, genera and species. FOREL (1906) studied the ants of Himalayas. The same author in 1907a published report on Formicidae of Hongrois National Museum. FOREL (1909) worked and published on the ant fauna of SriLanka. EMERY'S work came through Wytsman's *Genera Insectorum* (1910).

WHEELER (1910) published a text book "Ants their structure development and behaviour" and contributed much towards the knowledge of biosystematics, geographical distribution and identification of species. In the same year (d) he concentrated on the studies of the North American ants of the genus *Camponotus* Mayr and published the result of his work. In 1911, WHEELER published a list of the type species of genera and subgenera of Formicidae. EMERY (1912) published a paper on Hymenoptera, fam: Formicidae, subfam: Doilichoderinae. In the same year (a, b) FOREL made a series of publications which included observation on the ants of Sumatra and Java. He continued his studies in the same year (1912c) and published descriptions of genera, subgenera and species from Oriental

Region. In another work (1912 d) he concentrated and published on the ants of Formosa. WHEELER in 1913 published a paper on ants of Cuba.

FOREL (1913a) studied the ants of Sumatra, Java, Malacca and Sri Lanka and published his result. In the same year (1913b) he also published some new species of ants from India. SANTSCHI another worker in the same year studied the ants of Ethiopian Region and made publication of his result. Studies done by WHEELER on the Baltic amber fauna were very valuable and he could trace a number of extinct genera. By such study he found out an extinct genus *Agroecomyrmex* (1914 a).

A valuable contribution by ARNOLD appeared in part by part in 1915 - 1926. He published "A Monograph of the Formicidae of S. Africa." He treated each subfamily in separate publications and sixth part of his work was concerned with Camponotinae. In 1915 DONISTHORPE published a book named as "British ants, their life history and classification." In the same year (a) in another work he published the description of *Camponotus (Myrmoturba) maculatus* F. EMERY (1915f) also concentrated on the type *Camponotus maculatus (Formica maculata)* F. The contribution of GALLARDO (1916) was a publication on Argentina ants. FOREL in 1917 modified the classification of EMERY (1915a). DONISTHORPE (1917) recorded *Dolichoderus (Hypoclinea) crawleyi* a species of new to science; with a few notes on the genus. WHEELER made taxonomic studies on the genus *Opisthopsis* Emery and published a paper in Bulletin of the Museum of comparative Zoology in 1918. In 1919 MANN studied the ants of British Solomon islands. In the same year (a) WHEELER made taxonomic study on the ants of Borneo and produced an annotated list of the ants of Borneo. In 1920 the same author published the subfamilies and some other taxonomic notes on Formicidae. SANTSCHI (1920) studied and published a paper Fourmis d Indo-China. In 1920b, EMERY published notes on the new subdivisions of the genus *Camponotus*

Mayr. In 1921 MANN again came into the field with his studies on the ant fauna of Fiji islands and published the result of his work. WHEELER (1921c) produced a paper on Professor Emery's subgenera of the genus *Camponotus*. In 1922a WHEELER published a monograph on the ants of American Museum-Congo Expedition. He included in his work the distribution of ants in the Ethiopian Region, and Malagasy Region, key to world genera, and subgenera and synonymic list of ants of the Ethiopian and Malagasy Regions.

CRAWLEY and JACOBSON (1924) made study on ant fauna of Sumatra and published a paper "Ants from Sumatra with biological notes." ARNOLD's in 1924 on Formicidae part-6 contained his observations on the Camponotinae. EMERY (1925a) concentrated his studies on subfamily Formicinae and published his results. In the same year (b) in another work EMERY paid his attention to the European and Oriental species of the genus *Bothriomyrmex*. CLARK (1925a, b) studies the ants of Victoria and published papers in two parts, part I and part 2. CLARK in 1927 continued his work through the studies of the ants of Victoria and published part 3. FOREL (1928) again came into the scene with his comparative studies on the social worlds of the ants and man and published a book "The Social World of the ants compared with that of Man." WHEELER in 1929 studied *Camponotus mermithergate* from Argentina. CARPENTER made a study on fossil ants of N. America in 1930. MUKERJEE in the same year published a report on the collection of ants in Indian Museum. CLARK (1930b) published a paper on "The Australian ants of the genus *Dolichoderus* subgenus *Hypoglinea* Mayr. WHEELER in 1931 published the list of known ants from China. In this he listed 138 species, 54 subspecies and 53 varieties. In the same year (c) WHEELER studied the ant *Camponotus (Myrmepornis)* and published his result. DONISTHORPE (1931a) studied about *Camponotus* subgenus *Tanaemyrmex* and published a new species *Camponotus (Tanaemyrmex) brittini* and it was a new contribution to

science. DONISTHORPE in the same year in another work studied and published a new species of *Camponotus* from Colombia.

In 1932 AGUAYO studied on West Indian ants and published notes on it. In the same year MENOZZI concentrated on African and Oriental Region. He published few pieces of information on the myrmecology of those Regions. KARAVAIEV (1933) studied the Indo-Australian fauna. In 1934 CLARK described a new species and new genus on Australian ants. WHEELER (1935 f) studied the ant genus *Acropyga* Roger of Formicinae and published his description of a new species. KARAVAIEV in the same year revised and reported new information on the Indo-Australian fauna of Formicidae. WHEELER (1935) published two new genera from Papua New Guinea and Philippines. In 1937 DONISTHORPE's effort came into light with the descriptions of a new subgenus and three new species of *Polyrhachis* Smith. Followed by FOREL and EMERY, MORLEY (1938a) came into the field and reported ants from the ancestry of Wasps. STITZ in the same year published on the ants of Indo-Malaysian region DONISTHORPE in 1938 made a contribution on ants from Colombo Museum expedition to Southern India. MENOZZI in 1939 published a paper viz. *Formiche dell Himalaya e del Karakorum raccolte dalla spedizione Italian Comandata da. S.A.R. it Duca di spoletto.*

SMITH (1940b) reported the identity of the ant *Camponotus (Myrmentoma) caryae* (Fitch.). WEBER (1941a) enriched the fauna of Ethiopian and Neotropical Regions by adding four new genera. DONISTHORPE (1942) again came into the scene with the result of his studies on ants from Colombo Museum Expedition to South India. In the same year (a) he published notes on the subgenus *Orthonotomyrmex* Ashmead of *Camponotus* Mayr and made a description on a new species. DONISTHORPE again in 1943a published a list of the type species of

genera and subgenera of ants. In another work in the same year (b) the same author published a new species *Camponotus phragmaticola* from India.

In 1944 WEBER made a study on the Neotropical coccid tending ants of the genus *Acropyga* Roger. DONISTHORPE (1944c) described a new subgenus and three new species of *Polyrhachis* Smith. Again the same author in 1946a described a new genus and new species of ants from Mauritius. SMITH (1947a) provided a generic and subgeneric synopsis of the ants of United States, based on workers in which he included a key to subfamilies and genera. It was considered to be one of the valuable works of SMITH. He made a systematic study on ant from Guatemala and published a new genus and a new species in the same year (1947b). The same author in 1948 again described a new genus and a new species of ants from India. In the same year COLE and JONES made a study of the weaver ant, *Oecophylla smaragdina* (Fab). BROWN (1949c) published a list of synonymies and other notes of Formicidae. In 1949 McAREAVEY described two new genera and few new species of Australian Formicidae. SMITH (1949d) reported a new species of *Camponotus*, subgenus *Colobopsis*, from Mexico. DONISTHORPE (1949e) published a new *Camponotus* from Madagascar and a list of small collection of ants from Mauritius. CREIGHTON (1950) made a revision of the ants of North America which was a useful guide for a quick reference work. BROWN (1950) studied morphological and taxonomical characters and published notes on them. In the same year DONISTHORPE described two new species of ants from Turkey. In 1951 CHAPMAN & CAPCO compiled a check list of the ants of Asia. YASUMATSU & BROWN in the same year prepared a revisional notes on *Camponotus herculeanus* Linn. and close relatives in the Palaearctic Regions. BROWN (1952 d) produced a correction to the synonymy of the ant *Camponotus formosensis* Wheeler. BROWN (1953c) published a paper on characters and synonyms among the genera of ants. In 1954e BROWN made remarks on the internal phylogeny and subfamily classification of the family

Formicidae. He divided Formicidae into two major complexes of subfamilies. They are the Myrmecoid and Poneroid complexes. Within the two complexes eleven families were recognized. In the same year GREGG & ROBERT studied the geographical distribution of *Myrmoteras* Forel and described a new species *Myrmoteras karnyi*, a key to eight species also given.

WILSON (1955) published a monographic revision of the ant genus *Lasius* Fabricius. BROWN in the same year published a good account on the early history of taxonomy of ants. In 1956a BROWN prepared some synonymies in the ant genus *Camponotus*. GREGG & ROBERT in the same year described a new species *Myrmoteras ceylonica* from Sri Lanka. YASUMATSU & BROWN in 1957 studied *Camponotus herculeanus* group in Eastern Asia and published a paper which is known as a second look at the ants of the *Camponotus herculeanus* group in Eastern Asia. HAMANN (1957) published the presence of *Gesomyrmex* Mayr from Java. KEMPF (1958) made some interesting studies on the tribe Cephalotini. BROWN (1958) published a review of the ants of New Zealand. COLLINGWOOD (1958) contributed a key to the species of ants found in Britain. WILSON (1959) studied the adaptive shift and dispersal in a tropical ant fauna. BROWN (1959d) reported variation in the ant *Polyrhachis thrinax* Roger. RAMDAS MENON & PUNJABI (1960) made some observations on the ant fauna and produced few new records from India. COLLINGWOOD (1961) published on Formicid fauna of Afghanistan. TAYLOR & WILSON (1961) have made a publication on ants from three remote oceanic islands. HUNG in 1962 made preliminary studies on the ants of Taiwan. TAYLOR (1962) described new species from Australia. In the same year he again studied the ants of Three Kings Islands. In 1963a KEMPF reported additions to the Neotropical ant genus *Rogeria* Emery, with a key to the hitherto recorded South American species. The same author in another work in the same year (b) made a review of the ant genus *Mycocepurus* Forel. GREGG (1963) published the ants of Colorado. YASUNO (1963) studied the ant

population in the grassland at Mount Hakkoda. WILSON & TAYLOR (1964) have made a contribution on a fossil ant colony. In the same year YASUNO studied the ant population in the grassland at Mount Hakkoda. COLLINGWOOD (1964) reported the distribution of British ants and published a revised key to the species found in Britain. Again in 1964 TAYLOR came into the scene with the publication of taxonomy and parataxonomy of some fossil ants.

BROWN (1965) made an excellent contribution to the reclassification of the tribe Typhlomyrmecini. In 1966 BALTAZAR published a catalogue of the philippine Hymenoptera. WILSON, CARPENTER & BROWN (1967) have made taxonomic studies on first Mesozoic ants and described a new subfamily. In the same year, WILSON & TAYLOR published the ants of Polynesia. WILSON & HUNT (1967) studied the ant fauna of Futuna and Wallis Islands. HUNG in the same year prepared a revision of the ant genus *Polyrhachis* at the subgeneric level.

PISARSKI (1967a, 1967b) studied the ant fauna of Afghanistan and described seven new species and some new records. TAYLOR (1968a) described three new species from Australia with distributional and systematic notes on other species. He in the same year (b) described a new malayan species from Singapore. WING (1968) made a taxonomic revision of the Nearctic genus *Acanthomyops*. In the same year YAMAUCHI and HAYASHIDA have published their taxonomic studies on the genus *Lasius* Fabricius (1968) in Hokkaido with ethological and ecological notes. KEMPF (1969) made a miscellaneous studies on Neotropical ants.

In 1970 HUNG published a revision of ants of the subgenus *Polyrhachis* Smith. OFER in 1970 made study on *Polyrhachis simplex* Mayr the weaver ant of Israel. BARONI URBANI (1971) reported forty eight species of ants from Tuscan Archipelago. WILSON (1971) published a book on social insects. In that book he discussed about the origin, taxonomy, natural history and polymorphism. AYRE

& BLUM (1971) published a paper on attraction and alarm of ants (*Camponotus* spp.) by pheromones. BOLTON (1972) described two new species from Ghana with a key to the world species. BROWN in the same year published the description of a new genus and species from Malaya. GREENLADE (1972) published phenology of the ant species in the Solomon Island. WHEELER & WHEELER (1972) recognized eleven subfamilies among Formicidae. They are Dorylinae, Leptanillinae, Cerapachyinae, Myrmicinae, Ponerinae, Pseudomyrmecinae, Myrmicinae, Aneuretinae, Dolichoderinae and Formicinae. Sphecomyrminae is found to be an extinct subfamily. In the same year MANI divided the family Formicidae into seven subfamilies. They are Dorylinae, Ponerinae, Cerapachyinae, Leptanillinae, Myrmicinae, Dolichoderinae and Formicinae. BOLTON in the same year (a) revised the ant genera of West Africa, including a synonymic synopsis with keys. In the same year (b) in another work BOLTON published the ant genus *Polyrhachis* F. Smith in the Ethiopian Region. HASAMI (1973) revised the Neotropical ant subgenus *Myrmothrix* of genus *Camponotus*. BROWN (1973) listed the world genera of ants and their distribution. SMITH (1973) described two ant genera new to the United States. BOLTON (1974 b) published new synonymy and a new name in the ant genus *Polyrhachis* F. Smith. In the same year (c) the same author described the sexspinosa group of the ant genus *Polyrhachis* F. Smith. FRANCOEUR (1974) published "Notes for a revision of the ant genus *Formica*, new identifications and synonyms for some Nearctic specimens from Emery Forel and Mayr's collections.

Formicidae was known under a separate superfamily till 1975. In 1975 BROTHERS transferred Formicidae into the Superfamily Vespoidea. SNELLING & HUNT (1976) made studies on the ants of Chile and described a new Chilean ant taxa. SMITH (1976) revised the honey ants of the genus *Myrmecocystus* Wesmael. GREENSLADE (1976) stated that the meat-ant *Iridomyrmex purpurans* Smith is a dominant member of ant communities. GOTWALD and SOMEREN

(1976) published taxonomic and behavioral notes on the African ant. In the same year ONOYAMA published a paper viz., "A preliminary study of the ant fauna of Okinawa-Ken, with taxonomic notes" TAYLOR (1976) made a contribution towards the taxonomic study of Superfamily Formicoidea. WILSON (1976) recognized thirteen subfamilies including two fossil forms and eleven living forms. They are Sphecomyrminae, Ponerinae, Nothomyrmecinae, Myrmeciinae, Dorylinae, Ecitoninae, Leptanillinae, Pseudomyrmecinae, Myrmicinae, Aneuretinae, Dolichoderinae, Formiciinae and Formicinae. In the same year, the same author made a comparative study of ant genera from seventeen tropical localities in Melanesia, Sri Lanka and Mexico with respect to biogeographic and ecological prevalence, species diversity, diversity of adaptation and geographic range. Ant genera were evaluated with respect to those elements and the order of rank. *Camponotus*, *Pheidole* and *Crematogaster* are the most prevalent on a global scale. He (1976) published a book viz., "Which are the most prevalent ant genera?." BOLTON's work (1976) on the ant tribe Tetromonini is noteworthy. He revised, redefined, gave possible synonymies and provided key to genera of Tetramorini. BROWN (1976) described a new genus and a new species from Ethiopian Region. KUTTER (1976) described new species from Bhutan. TEWARY & MAITI (1976) published some new records of formicids from India. TEWARY & GUHA (1976) recorded *Polyrhachis hauxwelli* (Formicinae) as new to India. BARLIN, BLUM & BRAND (1976) reported species specificity along with studies on the trail pheromone of the carpenter ant *Camponotus pennsylvanicus* De Geer.

BARONI URBANI & COLLINGWOOD (1977) published the Zoogeography of ants in Northern Europe. BOLTON (1977) revised the genus *Tetramorium* Mayr of the Oriental Region and Indo-Australian Region. Out of eighty nine species he recognized, thirty seven were described as new. ARNOLDI (1977 a) revised the Genus *Messor* Forel of USSR. In another work in the same

year (b) he described ten new subspecies and three new species from USSR. CHOTANI & MAITI (1977) published an annotated list of fifteen species of ants from Andaman Islands. Among these ten species were new to the island fauna. TAYLOR in 1977 described seven new species from Australia and published a key to all known species of *Oryctognathus* Taylor. In the same year SONOBE made a survey on the ant fauna of Japan and examined the change of ant fauna with change in altitude. From his observation he came with a conclusion that except in the subfamily Formicinae the number of species increases with decreasing altitude. WATKINS (1977) made a discussion about the species and subspecies of *Nomamyrmex* Borgmeir, published keys, distribution maps, range of species and bibliography.

KEMPF (1978) published key to the subfamilies of Formicidae occurring in Brazil. ESPADALER & BATLLE in the same year recorded *Leptothorax nadigi* from Spain as the fourth world record. TAYLOR (1978) rediscovered the living fossil ant *Northomyrmecia macrops* from Australia and had given a key to all subfamilies.

SMITH (1979) made a contribution on the Superfamily Formicoidea. In the same year FRANCOEUR ANDRE and SNELLING contributed a systematic study on the ant genus *Formica* Linn. and published notes for a revision of the ant genus *Formica* Linn. They also published a paper viz., "Re-identification for some specimens from the T.W. Cook collection and new distribution Data." LENOIR (1979) made a study of trophallaxis and polyethism in young societies of the ant *Tapinoma erraticum* Linn. BOLTON (1979) revised the genus *Tetamorium* Mayr in the Malagasy Region and in the New World.

In 1980 BOLTON revised the genus *Tetamorium* Mayr in Ethiopian Region. ONOYAMA (1980) studied the ant fauna of Japan and published an introduction to the ant fauna of Japan with a check list. BROWN in the same year erected a new genus *Protalasidris* with the type species *P. armata* from the Neotropical

Region. In the same year GOTWALD & LEUROX studied the taxonomy of African army ant, *A. decolor* (Mayr). URBANI (1980) described fossil gardening ant *Trachymyrmex primaevus* from the collections of Stuttgart for the first time.

MUSTHAK ALI in 1981 published on the fauna of Bangalore with observation on their nesting and foraging habit. In the same year VEPSALAINEN & PISARSKI published a paper on the taxonomy of the *Formica rufa* group. VERGHESE & VEERESH presented a brief review of ants of India in the same year. BOLTON (1981 b) revised six genera from Ethiopian Region, and described a new genus *Baracidris* from Nigeria. PISARSKI & KRZYSZTOFIK (1981) studied Myrmicidae and Formicidae of Mongolia. SNELLING in the same year studied and evaluated the subfamilies of Formicidae.

SMITH (1982b) revised the honey ants of the genus *Myrmecocystus* Wesmael. In the same year SNELLING also made a revision of the honey ants of the genus *Myrmecocystus* and published his first supplement with new distribution data for ten western species along with the description of two new species. PEARSON (1982) made studies on taxonomic status of morphologically anomalous ants in the *Lasius niger* Linn. COLLINGWOOD made study in Himalayan ants of the genus *Lasius* in the same year. BOLTON produced an excellent piece of work in 1982 through the revision of Afro-tropical species of the genera *Cardiocondyla* Emery, *Leptothorax* Mayr, *Melissotarsus* Emery, *Messor* Forel and *Cataulacus* Smith, F.

In the year 1983 KIM & KIM made a systematic study of the genus *Formica* Linn. in Korea on the basis of external fine features. PRENS in the same year reported a new ant genus from Southern Africa. BOLTON (1983) revised the Afro-tropical *Dacetini* ants and published a key to genera and species.

In the year 1984 the following workers IMAI, BARONIURBANI, KUBOTA, SHARMA, NARASIMHANNA, DAS SHARMA, DEODIKAR, VAIDYA & RAJASEKARASHETTY made a karyological survey of Indian ants. TRAGER (1984) made a revision of the genus *Paratrechina* Motschulsky of the continental United States. TORRES (1984b) made a study of diversity and distribution of ant communities in Puerto Rico. BROWN (1985) added a valuable contribution to ant taxonomy of India by describing a new genus and species *Indomyrma dasypyx* from Western Ghats of Peninsular India. WHEELER & WHEELER (1985) produced an alphabetical list of the living genera of ants under tribes and the tribes are placed phylogenetically under subfamilies. Ten subfamilies, sixty one tribes and three hundred and three genera are recognized. WILSON (1985 a) made a study on ants of the Dominican amber. In the same year (b). WILSON in another work published the first fossil army ant from Dominican amber and described a new species *Neivomyrmex ectopus*. COLLINGWOOD (1965) reported Formicidae of Saudi Arabia. He listed and keyed one hundred and sixty four species of Formicidae of which one hundred and fifty six were first records for the actual territory of Saudi Arabia and one hundred and forty six were new records for the Arabian peninsula as a whole. Ten species were described as new. DUMPERT (1985) made a comparative study of *Camponotus (Karavaievia) texens* sp. n. and *Camponotus (Karavaievia) gombaki* sp. n. from Malaysia. WHEELER (1985) published a work entitled "Simplified Conspectus of the Formicidae." WILSON in the same year reported ants of the Dominican amber. In the year 1985 DATTA & RAYCHAUDHURI while working with the aphidicolous ants of Nagaland, North east India, encountered forty species of Formicidae, of which one, *Camponotus horseshoetus* has been described as new.

KIM (1986) made a systematic study of ants in I.S. Ullungdo of Korea on the basis of external fine features. In the same year LEMOLI & MORI presented a paper entitled "The aggression test" as a possible taxonomic tool in the *Formica*

*rufa* group. LUTZ (1986) erected a new subfamily Formicinae from the middle cocene oil shale of the Grube Messel from Germany and two new species viz. *Formicium giganteum* and *Formicium simillimum* are described. DATTA & CHAUDHURI (1987) studied the taxonomy of aphidicolous ants of Sikkim and hilly areas of West bengal. KOHOUT (1987) studied *Polyrhachis sexspinosa* group and described three new species from Philippines. TAYLOR (1987) published a checklist of the ants of Australia, New Caledonia and New Zealand. LATTKE in 1987 made a study on the ant genus *Hypoclinea* Mayr and published the descriptions of three new species.

In the year 1988 KOHOUT reported a new species of *Polyrhachis* (*Polyrhachis*) from Papua New Guinea with a review of the Guinean and Australian species. KOHOUT in another work (1988a) published a paper "New nomenclature of the Australian ants of the *Polyrhachis gab* Forel species complex. KOHOUT (1988c) published another paper "Nomenclature changes and new Australian records in the ant genus *Polyrhachis* Fr. Smith. In the same year a contribution to the knowledge of Formicidae fauna was given by WILSON. He published the bio-geography of the West Indian ants. BARONI URBANI (1989) published a paper on phylogeny and behavioural evolution in ants, with a discussion of the role of behaviour in evolutionary processes. KOHOUT in the same year published a paper the Australian ants of the *Polyrhachis relucens* species. WANG & WU (1989 a) made a taxonomic study on the genus *Camponotus* Mayr in China. The same author in the same year (b) in another work, continued his taxonomic studies on the genus *Camponotus* Mayr in China and came with a conclusion. BENSON, WOODRUFF & HARADA (1989) made a study of local diversity of tropical and temperate ants with respect to evergreen tropical humid forest and deciduous temperate/Wet forest. They concluded that forest ecosystems (evergreen tropical humid forest) to be much richer and more diverse in ants than those sampled in deciduous temperate/wet forest. They reported

that one important factor contributing to the increased diversity of tropical omnivorous ants may be the greater variety of nest sites available for specialization.

In 1990 KOHOUT published a review of the *Polyrhachis Viehmeyeri* species - group. KOHOUT & TAYLOR (1990) produced notes on Australian ants of the genus *Polyrhachis* Fr. Smith, with a synonymic list of the species. In the same year TERAYAMA & SATOH reported a new species of the genus *Camponotus* from Japan viz. *Camponotus (Myrmamblys) yamakin*, with notes on the known forms of the subgenus *Myrmamblys*. VEERESH & MUSTHAK ALI (1990) presented the present status of our knowledge on Indian ants. ROBERTSON (1990) studied the *Camponotus fulvopilosus* species complex and published his result. SHATTUCK (1990) made a revision of the *Dolichoderinae* ant genus *Turneria* Forel. He published workers of recognized species with a distribution map. In 1991 CHANGLU WANG JIAN WU made taxonomic studies on the genus *Polyrhachis* Mayr of China and three species are found new to science. Two former varieties are elevated to specific rank. One new synonym is proposed. Five species are recorded for the first time in China and keyed the genus *Polyrhachis* Mayr in China. SHATTUCK (1991) made a revision of the *Dolichoderinae* ant genus *Axinidris* Weber. BARONI URBANI *et al.* (1992) analysed the phylogeny of Formicidae. In addition to fourteen currently recognized subfamilies three more subfamilies; *Aerictogitoninae* Ashmead (new status), *Apomyrminae* Dlussky & Fedoseeva (new status) and *Liptanilloidinae* Bolton (new subfamily) are introduced. SHATTUCK (1992) published a review of the *Dolichoderinae* ant genus *Iridomyrmex* Mayr with descriptions of three new genera. SHATTUCK (1992b) published a paper on higher classification of the ant subfamilies *Aneuretinae*, *Dolichoderinae* and *Formicinae*. The same author in another work 1992c made a generic revision of the ant subfamily *Dolichoderinae*. BOLTON & BELSHAW (1993) while studying the taxonomy and biology of the ant genus

*Paedalgus* Forel met with six new species and four known species from Sri Lanka and Afro-tropical Regions. SHATTUCK (1993) published a taxonomic catalogue of the ant subfamilies Aneuretinae and Dolichoderinae.

In the year 1994 BOLTON published an excellent identification guide to the ant genera of the world in which key to sixteen subfamilies and two hundred and ninety six genera are provided and this forms the basis of identification of ants in different parts of the world today. KIM, BYUNG, JIN, LIM, and KYUNGHOON made a systematic study of Korean ant *Lasius* on the basis of electrophoretic data. In the same year KIM, BYUNGUN, KIGYUNG and KIM reported two new species, *Camponotus concavus* and *Camponotus fuscus* from Korea. KOHOUT (1994) published new synonymy of three Australian *Polyrhachis* ants. The same author in the same year in another work described *Polyrhachis lama* a new ant from Tibetan plateau of Central Asia. It is suggested that species of the group were in the past more widely distributed and that *Polyrhachis lama* is a relict surviving in isolation on the high plateau of Tibet. A contribution of the following workers KIM, BYUNG, JIN, PARK, JOON & YOUNG in the same year was the systematic study of Korean *Formica* ants on the basis of electrophoretic data. AGOST (1994 a) studied phylogeny of the ant tribe Formicini and described a new genus.

In the year 1995a BOLTON analysed ant taxa of world on a taxonomic and Zoogeographical basis. A table detailing numbers of subfamilies, tribes and genera and the number of species they contain and one analysing the number of species per genus per zoogeographical region, are presented; subfamilies are analysed by number and percentage of genera and species, the most species genera are isolated and listed in terms of absolute size and speciosity per subfamily. Tables detailing total members of genera and species for subfamily per region, and endemic genera per subfamily per region are given, and the endemism and speciosity of genera are tabulated on a regional basis. BOLTON

(1995b) published the complete catalogue of the Formicidae occupying sixteen subfamilies two hundred and ninety six genera and nine thousand five hundred and thirty six species. In the same year TERAYAMA described a new species of the ant genus *Acanthomyrmex* from Thailand based on the worker and female. This is the 12<sup>th</sup> species of the *Acanthomyrmex* and is the first record of this genus from Thailand. SHATTUCK, ARTHUR & AUST (1995) reviewed the generic placements of the five species of Australian ants described by Erichson in 1842. In 1996 McARTHUR and ADAMS made morphological and molecular revision of the *Camponotus nigriceps* group from Australia. McARTHUR, ADAMS & SHATTUCK (1997) published a morphological and molecular review of *Camponotus terebrans* (Lowne). In the same year SHEELA & NARENDRAN described a new genus and new species of Myrmicinae from India. KOHOUT (1998) reported new synonyms and nomenclatural change in the ant genus *Polyrhachis* Fr. Smith. In the same year MACKAY described a remarkable new species of *Paratrechina* from Colima, Mexico. Ants of this genus are common in the New World. *Paratrechina laevigata* new species, is unusual in that it lacks coarse, dark hairs on the thorax and head, which characterize all other New World species of the genus. Superficially it appears to be a member of *Lasius* Fab. with which it could easily be confused. SHEELA & NARENDRAN (1998) described a new species of the genus *Paratopula* Wheeler from India. In the same year the same authors in another work published a paper on five new species of *Tetramorium* Mayr. In 1999 TOHME & TOHME made a redescription of *Camponotus festal* Emery with the description of a new species *Camponotus sanninin* from Mount Febanon. SHEELA, NARENDRAN & TIWARI (2000) redescribed a little known Myrmicine ant *Recuridris recurvespinosa* (Forel). In the same year SNELLING reviewed the *Camponotus montivagus* complex based on an examination of appropriate type material.

## B. SYSTEMATIC STATUS OF THE FAMILY FORMICIDAE

Formicids are found to have a cretaceous origin. The family Formicidae was erected by LATREILLE (1809) who gave the genus group name 'Formicariae' with the type genus *Formica*. STEPHENS (1829) emended the word into 'Formicidae.' Later in 1905 ASHMEAD placed Formicidae under the Superfamily Formicoidea (MANI, 1957). BROTHERS (1975) transferred Formicidae to the Superfamily Vespoidea, thereby eliminating Formicoidea.

The present modern subfamily classification was introduced by FOREL in 1893. He divided Formicidae into five subfamilies viz. Camponotinae, Dolichoderinae, Dorylinae, Myrmicinae and Ponerinae. Though WHEELER in 1920 gave subfamily status to Ceraphachyinae which was erected by FOREL (1893) as a tribe of Ponerinae, its subfamily rank was in confusion until BOLTON (1990) confirmed it. WHEELER in 1923 added one more subfamily Leptanillinae. In 1951 CLARK contributed to the subfamilies Aneuritinae, Myrmicinae and Nothomyrmicinae.

In 1951 BERNARD erected the subfamilies Cerapachyinae, Dolichoderinae, Dorylinae, Formicinae, Leptanillinae, Myrmicinae and Ponerinae into families under Formicoidea. CLARK in the same year revived Cerapachyinae into subfamily level. BROWN (1954) revived all the others as subfamilies. BROWN (1973) elevated a new subfamily Ecitoninae. In 1990, BOLTON separated Aenictinae from Dorylinae and added another subfamily Leptanilloidinae. By the combined effort of BARONI URBANI, BOLTON and WARD (1992) the last two subfamilies Aenictogitoninae and Apomyrminae were formed. Thus there are sixteen subfamilies in total as follows:

- |                     |                      |
|---------------------|----------------------|
| 1. AENICTINAE       | 9. FORMICINAE        |
| 2. AENICTOGITONINAE | 10. LEPTANILLINAE    |
| 3. ANEURETINAE      | 11. LEPTANILLOIDINAE |
| 4. APOMYRMINAE      | 12. MYRMECIINAE      |
| 5. CERAPACHYINAE    | 13. MYRMICINAE       |
| 6. DOLICHODERINAE   | 14. NOTHOMYRMECIINAE |
| 7. DORYLINAE        | 15. PONERINAE        |
| 8. ECTONINAE        | 16. PSEUDOMYRMECINAE |

### C. DIAGNOSIS OF THE FAMILY FORMICIDAE

Minute to large sized. Males possess 4-12 jointed and females possess 9-13 jointed antenna. The antenna is filiform, geniculate between the long basal segment (scape) and the remaining funicular segments. Compound eyes usually present, rarely absent in some species. Ocelli usually present, in some forms ocelli absent. Body is constricted in between thorax and gaster to form a pedicel which consists of petiole (the modified second abdominal segment) or petiole and postpetiole (modified third abdominal segment). Wings of queens deciduous, shed after mating. Metapleural gland generally present on alitrunk, opening above metacoxa.

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**Chapter II**

## MATERIALS AND METHODS

### 1. COLLECTION WORK

The adult specimens were collected alive from the field. Standard entomological collection techniques include using insect nest [Fig.1]. The killing jar or tube [Fig.2] with ethyl acetate was used. The collections of ants were done using a Camelin brush and plastic vials containing 70% alcohol. Adult ants were also collected from their nests.

#### a. STUDY AREA

Specimens for the present work were collected from different parts of Kerala, covering all the fourteen districts of the state [Fig.3]. Specimens from neighbouring regions of Kerala are also included in this study since the formicid fauna of Kerala is not quite isolated from nearby states. The university campus itself provides an excellent habitat for the insect fauna, since it has a rich flora of grasses, herbs, shrubs and trees. The botanical garden, the main focal point of the study in the campus, has a luxuriant growth of flora and thus provided an excellent collection spot.

Kerala is the southernmost state of India and occupies a unique position in the map of the country, with the southern most extremity at Parassala about 56 kms up from the lands end of India. It stretches along the shores of Arabian sea for a distance of about 580 kms with Karnataka state on the North and North-East and Tamil Nadu state on the East and South. In the southern part of Indian peninsula, Kerala occupies a position between 8°18' and 12°48' in the North latitude and 75°2' and 77°24' in the East longitude. Kerala is bordered by Western Ghats in the East and Arabian Sea in the West. The area of the state is 38, 863 sq. kms.

According to the geographical features, Kerala can be divided into 3 regions: High lands, Midlands and Low lands. The High lands slope down from the Western Ghats which rise to an average height of 900 m, with a number of peaks well over 1800 m in height. This is the area of forests and of major plantations like tea, coffee, rubber, cardamom and other spices. The mid lands with extensive undulating hills and valleys, form an area of intensive cultivations of cashew, coconut, arecanut, tapioca, banana, rice, ginger, pepper, sugarcane and vegetables of different varieties. The low lands or the coastal area is formed by the deposition of sediments brought down by the rivers of Western Ghats (there are 44 major rivers in the state) and sand deposited by the waves. It is made up of the river deltas, backwaters and the sea shore of Arabian sea, and is essentially a land of coconut and rice. The area also includes lagoons formed by the excess flood waters accumulating in shallow basins during the seasons, often separated from the sea by only a narrow sand bar.

Western Ghats constitute the high lands and it is one of the 'Hot spot' area of biodiversity in the world. Kerala is blessed with heavy rainfall and warm climate. Kerala has been able to preserve a flora of great diversity, which in turn provides an excellent habitat for insect fauna throughout the year.

Vegetation of Kerala is dominated by tropical, evergreen, semievergreen and moist deciduous type of forests which accounts for approximately 84%. The remaining portion constitutes dry deciduous and subtropical types of vegetation as well as various cultivated agricultural and horticultural plants.

Malabar proper extends along the Arabian sea coast for about 50 miles, lies between 10°15' and 12°18' North latitude and 75°14' and 76°65' East longitude. This region is bordered by Arabian sea in the West, Coorg, Mysore, Nilgiris and Coimbatore in the East, South Kanara in the North and Cochin in the South [Fig. 3].

## b. CLIMATE

Climatically, the area is unusually equable with annual temperature range between a maximum of 35.9°C and a minimum of 23.8°C only. Day temperatures are more or less uniform over the plains throughout the year except during the monsoon months, when the temperature drops by about 3°C - 5°C. The mean relative humidity varies from 60 - 90%, the maximum during the rainy season of June - September. The climate of Kerala can be divided into four alternate seasons. They are the following: 1. Hot season [March - May]. 2. South West Monsoon [June-September]. 3. Post Monsoon [October-November]. 4. North East Monsoon [December - February]. The total annual rainfall is excessive with over 3200 mm, with even more than 70% of it received in the three-month period of South-West monsoon, during June to August. About 20% of the annual rainfall is recovered during three months October to December, ie. during the South East monsoon and the remaining 10% is obtained as occasional showers and pre-monsoon showers in April-May. Within this there may be local variation in climate. The temperature of the region varied within the range of 22°C to 40°C during the study period [1998 - 2001].

## 2. METHODS OF COLLECTION

Ants were collected from the ground as well as from vegetation. Their habitat vary widely. Forest areas are more preferable for rare and new types. They can be collected from beneath stones, logs, hollow stems, barks of trees, foldings of leaves, galls or swollen parts of stems which are left by other insects and from chambers underground etc. Variety of ants can be seen immediately after the first rain. Collection of ants can be made by various methods. These methods are mentioned below.

#### a. PIT-FALL TRAPS

This method is very effective for collecting ground dwelling insects. The trap consists of a plastic or glass jar with a wide mouth opening. The jar is partially filled with 0.05% methyl parathion and buried under ground level (instead of methyl parathion picric acid can also be used, but the natural colour of the specimens may be lost due to staining by picric acid). The ants which walk nearby the trap will slip into the jar, so that they can be collected. Traps were setup between 3 p.m. and 5 p.m. and were collected the next morning. During rainy season trap is protected from rain drops by using a suitable shield set at a little distance above from the ground level. All specimens trapped in the jar were preserved in 70% alcohol.

#### b. NET SWEEPING

Ants were usually collected by this method. This is a very effective method for collecting arboreal ants from vegetations. The sweep net consists of a triangular mouth, a long handle and net bag (Fig. 1). Here a triangular net is used so that the triangular head may increase the surface area of the net in context with ground. The net used in this investigation is a modified form of the model designed by NOYES (1982).

The triangular frame is made up of aluminium and the three sides have a length of 48 x 46 x 48 cm. The handle is also made of aluminium and having about a length of 4 feet long. The frame can be fitted to the end of the handle. The net bag measures 60 cm in length and made up of thin cotton cloth, which allows the easy passage of air. The top of the bag which fits around the frame should be made of canvas.

After sweeping, the specimens obtained in the net bag, were collected using an aspirator and the ants collected within the aspirator were killed using

ethylacetate or chloroform. For that a cotton wad soaked in ethylacetate was put into the aspirator. Then the killed specimens were transferred to 70% alcohol. The debris remaining inside the net bag is collected into a polythene bag containing cotton soaked in ethylacetate. Searching of debris yield different species of ants.

### C. SCENTED TRAP

In this method usually the non-predatory ants were collected by attracting them towards a source of sweets. Any sweet material like sugar, jaggery, chocolate or honey is taken in watch glass in a little quantity. It is then placed anywhere in the ground or on trees. A good quantity of specimens were collected by this method but the drawback is that in most of the cases the specimens attracted to these sources belong to some common species and they will prevent the entry of other types. The ants attracted to the source are immediately put into a polythene bag inside which it is killed and preserved in 70% alcohol.

### d. ALL-OUT SEARCH

An all out search may provide different types of numerous specimens. Ants can be searched any where and every specimen came across could be obtained in sufficient numbers. The materials necessary for such a collection are: Plastic vials containing 70% alcohol, a '0' tip brush and an aspirator.

Ants moving through the ground are sucked into the aspirator. An aspirator can be made by using a conical flask, or a cylindrical glass tube, a plastic tube, a cork and a rubber tube. Both the rubber tube and the plastic tube are inserted into the flask through the holes on the cork [Fig.2]. One end of the rubber tube inside the vessel is covered with a thin cotton cloth so as to prevent the escape of specimens through the tube. In order to collect specimens using aspirator, the plastic tube was placed over the specimen and sucked through the

rubber tube. After collection, outer end of plastic tube was closed in order to prevent escape through this end.

Ants from plants, leaves, twigs, ground etc. could be easily collected by using a brush and vial i.e., the specimens were gently knocked down into the vial containing 70% alcohol using the brush. After collection all specimens were killed, and preserved in 70% alcohol. Tubes containing these specimens were labelled properly from the fields itself so as to record the exact locality, host, biology (if known) etc.

### **3. STORING AND PRESERVATION**

#### ***a. UNMOUNTED MATERIAL***

The unmounted materials were preserved in plastic vials containing 70% alcohol and kept inside refrigerator. The alcohol was changed periodically so as to prevent damage.

#### ***b. RELAXING OF SPECIMENS***

In order to relax specimens they were kept in an atmosphere of acetic acid for 6-8 hours. Relaxing will prevent specimens from breakage, while mounting. Good results are obtained when specimens were placed on a tissues-paper in a glass dish, which is kept over a layer of cotton in a box containing a bottom layer of cotton soaked in acetic acid. The box was then tightly closed using lid.

### **4. MOUNTING OF SPECIMENS**

Mounting of specimens need special skill of taxonomy. The specimens were mounted in such a way that all characters were visible easily. In ants, except mid ventral alitrunk and coxal apex all other parts bear important identification characters.

### *a. MOUNTING ON CARDS*

Here the card mounting method adapted is that of BOUCEK & NOYES (NOYES, 1982) and BOLTON (1994). The well dried specimens were mounted on a rectangular card. The size of the card is altered depending on the size of the specimen. Snow white drawing cards were used for mounting the specimens. They were mounted in such a way that one side of their thorax is glued to the card. Thus the specimen is mounted in profile. In another method, they were mounted on a triangular card in such a way that ventral side of the thorax is glued to the tip of the pointed card, so that full details of the specimen is observed thoroughly. But the specimens mounted on the tip of pointed card need special care because they are easily subjected to damage.

### **MATERIALS REQUIRED FOR CARD MOUNTING**

(1) Microscope (2) Rectangular or triangular pointed cards (3) Blotting paper (4) A fine zero point brush (5) Entomology pins (7) Water soluble glue (8) Table lamp (9) A pair of fine forceps.

It is very important that the glue is completely cold water soluble when dry as well as when wet and also it should have the right consistency.

The specimen to be mounted, either freshly collected or relaxed specimen in alcohol was dried before mounting. For drying, the specimen was placed on a piece of blotting paper so that the blotting paper absorbed the moisture content from the specimen. It was then dried under table lamp. The specimen was placed under microscope, and looked through it, its antennae, labial and maxillary palpi, and legs were spread and properly positioned, by using the brush and pins. Using the tip of a pin a small drop of glue was put on the card at the point where the imaginary lines bisecting the angles at the top corners of the card. The glue should be fine and water soluble. For mounting large specimens thick

glue was used; as the size of specimen decreases concentration of the glue also decreases. With the help of a fine zero point brush, which was moistened by a very small quantity of saliva from the tongue, the specimen was picked up and placed on the glue drop, with the venter of the thorax on the glue, the body lying length wise along the card and the head pointing towards the far end. Then the specimen was gently and firmly pressed down with the brush for good adhesion. Care was taken to keep the antennae, maxillary and labial palpi and legs free from glue. The mounted specimens were held on entomological pins. The pin used here is Newey Goodman & Co's (England) Asta insect pins of size 38 mm x 0.53 mm. The mounted specimens were dried under table lamp, labelled and preserved in specially made insect boxes. Label shows the pieces of information such as country (in capital letters), state, exact locality, name of collector, date of collection and host (if known). Naphthalene balls and thymol crystals were firmly placed inside the boxes containing mounted specimens in order to protect them from attack by other insects and from fungal growth. Besides, the insect boxes containing mounted specimens were periodically subjected to warming by using table lamp to avoid fungal growth.

#### ***b. LABELLING AND REGISTERING***

Temporary labels were written in the field at the time of collecting the specimens. After mounting the specimens, permanent labels indicating the name of the country, state, date of collection etc. were added. Registering of specimens were done after the specimens have been identified atleast upto generic level. The register of specimens contains the following data:

- Collection number
- Scientific name
- Name of locality

- Date of collection
- Name of the host
- Name of the collector
- Remarks

### *c. MOUNTING ON MICROSLIDES*

For detailed studies of certain parts of the body such as antennae, mouth parts, genitalia, legs etc. microscopic slides were prepared. For this purpose the required parts were first removed from the specimen using needles and forceps. Heavily sclerotised structures were subjected to clearing by solutions such as KOH before mounting. The parts were kept in 10% KOH solution for 24-48 hours. After clearing they were washed in glacial acetic acid, followed by distilled water and dehydrated by passing through alcohol series. The dehydrated materials were then mounted on glass slides using DPX.

## **5. OBSERVATIONS**

Hertel and Reuss Optik Kassel Stereozoom (German made) microscope was used for sorting and mounting. Card mounted specimens were observed under Olympus (Japan made) and M3Z WILD Stereozoom (Switzerland made) microscope. Slide mounted specimens were observed under LEITZ WETZLAR (German made) microscope.

### *b. MEASUREMENTS*

All measurements were taken from the LEITZ WETZLAR microscope by using the micrometer.

## 7. ILLUSTRATIONS

The illustrations, which are of specimens mounted on card points, are a blend of accuracy and artistic impression (to convey something of the general appearance of the specimens). They were drawn as seen under a WILD M3Z stereozoom microscope fitted with a camera lucida type drawing tube. The figures then obtained were enlarged using KB enlarger for the model B2M. The original drawings were made in Rotring ink on art paper. The magnification chosen for any one species was generally such that the whole ant could be seen filling a single field of vision. Scale is indicated with each drawing.



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## **Chapter III**

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## TERMS AND ABBREVIATIONS USED

### A. TERMS:

#### Generalised Formicid Worker

#### 1. Head

##### Mandibles (Fig. 5)

The paired heavily sclerotized biting and chewing lateral appendage (first pair of jaws) of the mouth parts between the labrum and maxilla.

##### Palp formula

A standardised way of indicating the number of maxillary and labial palps. The number of maxillary palp segments is given first, the number of labial palp segments second.

##### Maxillary palps (Fig. 4)

The pair of jointed appendages originating from the maxillae.

##### Labial palps (Fig. 4)

The pair of jointed appendages originating from the labium.

##### Clypeus (Fig. 5)

The foremost section of the head capsule, just back of the mandibles, demarcated posteriorly by a transverse suture.

**Antennal socket and toruli (Fig. 5)**

The base of the antenna is set into a small membranous area of the head called the antennal socket (antennal scrobes). The rim of the socket is often strengthened by an internal submarginal ridge called antennal toruli.

**Antennae (Fig. 4)**

The antennae are a pair of jointed appendages articulated with the head in front of the eyes or between them.

**Scape (Fig. 4)**

The first or proximal segment of an antennae is called antennal scape.

**Flagellum (Fig. 4)**

All of the antenna other than the first basal segment (Scape).

**Ocelli (Fig. 5)**

Simple eye, bead-like eyes located in the rear central portion of the head.

**Frons**

The area above the clypeus, approximately in the center of the front of the head; it often includes the frontal triangle, which is roughly triangular in form and demarcated by grooves.

**Eye (Fig. 5)**

Compound eye consists of many quite distinct elements, the ommatidia, the organ of sight.

**Vertex (Fig. 5)**

The upper surface of the head between eyes, frons and occiput.

**Occiput (Fig. 4)**

Hind part of the dorsal surface of the head.

**2. Alitrunk (Mesosoma)**

The second, middle major division of the body, consisting of true thorax to the rear of which is fused the first segment of the true abdomen.

**Pronotum (Fig. 4)**

The dorsal sclerite of the prothorax.

**Mesonotum**

The dorsal part of the mesothorax.

**Epinotum**

Alternative term for propodeum, the first abdominal segment fused to the rear of the thorax.

**3. Petiole (Fig. 4)**

The second abdominal segment, the segment immediately following the alitrunk which is usually reduced and isolated. It is in the form of a node or scale of varying shape and size. The petiole bears the second abdominal spiracle and consists of a distinct tergite and sternite.

#### 4. Gaster (Fig. 4)

The globular terminal four or five segments of the abdomen immediately posterior to the waist.

#### Pygidium

The last complete tergite (upper plate) of the abdomen.

#### Hypopygium

The last sternite (lower plate) of the abdomen.

#### B. ABBREVIATIONS :

DZCU	-	Department of Zoology, Calicut University.
F	-	Funicular segments
W	-	Worker

#### Measurements

TL	-	Total length - Total length of specimen from apex of mandible to apex of gaster.
HL	-	Headlength - Length of head proper excluding mandibles.
HW	-	Head width - Maximum width of head in full face view.
CI	-	Cephalic index ie. $(HW \times 100)/HL$
SL	-	Scape length
SI	-	Scape Index ie. $(SL \times 100)/HW$
ED	-	Eye diameter
PW	-	Pronotal width - Maximum width of pronotum in dorsal view.
F <sub>1</sub> - F <sub>11</sub>	-	Funicular segments

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## **Chapter IV**

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## **Observations and Results**

## OBSERVATIONS AND RESULTS

During the present study, nearly twenty thousand specimens belonging to the various subfamilies of Formicidae were collected from different parts of Kerala (Fig. 3). Since it will be beyond the scope of the present thesis to include all the subfamilies, only three subfamilies viz., Formicinae, Dolichoderinae and Cerapachyinae were selected for the present work. Under these subfamilies sixty one species and thirty three subspecies, belonging to six genera from Formicinae, one genus from Cerapachyinae, three genera from Dolichoderinae were identified. Among these eight species are new to science. All these new species were described in detail. In the case of known species redescriptions were made.

A dichotomous key to subfamilies of Formicidae of India, key to genera of the subfamilies of Formicinae and Dolichoderinae of India, key to Indian species of *Camponotus* Mayr and *Polyrhachis* Smith, key to Oriental species of *Lepisiota* Santschi of Subfamily Formicinae, key to Indian species of *Dolichoderus* Lund and *Technomyrmex* Mayr and key to species of *Tapinoma* Förster of Kerala of subfamily Dolichoderinae are prepared. In addition a checklist of the genera, species and subspecies of the Formicinae, Cerapachyinae and Dolichoderinae dealt with in the present work is also provided. All the type materials are kept in the collections of Systematic Entomology Laboratory, Department of Zoology, Calicut University.

## KEY TO SUBFAMILIES OF FORMICIDAE OF INDIA

(Modified from Bolton, 1994)

1. Body with a single reduced or isolated segment (petiole) between the alitrunk and gaster; first tergite either entirely confluent with second tergite or separated from it only by a narrow girdling constriction, and if the latter then the first tergite is not markedly reduced in size (Fig.4) ...  
..... 2
- Body with two reduced or isolated segments (Fig. 8) (petiole and post petiole), either both segments much reduced or post petiole somewhat larger than petiole, if latter, then post petiole distinctly smaller than the first tergite and separated from it by an extensive deep girdling constriction  
..... 7
2. Apex of gaster with a semicircular to circular acidopore (Fig. 4) formed from hypopygium, this structure often projecting as a nozzle and fringed with setae; sometimes acidopore concealed by a projection of pygidium, but if so antennal insertions located well behind posterior margin of clypeus, sting absent, replaced by an acid-projecting system of which acidopore is the orifice ..... *FORMICINAE*
- Apex of gaster with hypopygium lacking an acidopore, sting present (Fig. 4) or absent; when present usually visible; but when reduced or vestigial (or present but completely retracted) hypopygium forms a smooth posterior margin and antennal sockets about posterior margin of clypeus ..... 3
3. Either pygidium or hypopygium armed with peg like teeth or short spines; if pygidium armed, it is usually, but not always, transversely flattened to impressed and has either a single pair of short, posterolaterally situated

- spines or a marginal row of short spines or peg-like teeth. If hypopygium is armed, then its margin on each side with a row of teeth or spines, generally at apical half, which project dorsally outside pygidium ..... 4
- Pygidium and hypopygium both unarmed. Pygidium transversely convex and rounded lacking either a posterolateral pair of short spines or a marginal row of short spines or peg-like teeth. Hypopygium with its lateral margins smooth and without spines ..... 6
4. Gastral spiracles 3-5 exposed, not overlapped nor concealed by tergites of preceding segments. Metapleural gland orifice overhung and concealed from above by a circular lip or flange, latter extending obliquely upwards and forwards on metapleuron as a rim or ridge. Helcium sternite convex and bulging ventrally, visible in profile ..... 5
- Gastral spiracles 3-5 concealed, overlapped and hidden by tergites of preceding segments. Metapleural gland orifice, not overhung nor concealed from above by a circular lip or flange, and without a rim or ridge extending obliquely upwards and forwards from gland orifice. Helcium sternite reduced and retracted, not visible in profile .....  
..... *PONERINAE*
5. Propodeal spiracles high on side and situated far forward on sclerite, spiracular orifice subtended by a longitudinal impression. Propodeal lobes absent, pygidium with at most a pair of thick bristles laterally, promesonotal suture always distinct ..... *DORYLINAE*
- Propodeal spiracle low on side and usually behind midlength of sclerite, spiracular orifice not subtended by a longitudinal impression, propodeal lobes present, pygidium always with an apical row of short peg-like to teeth

- like spines. Promesonotal suture usually completely absent, only extremely rarely visible ..... *CERAPACHYINAE* (in part)
6. Sting vestigial or absent, in any case not visible without dissection. Tergite of helcium with an extensive U or V shaped emargination dorsally in its anterior margin (Fig.123) ..... *DOLICHODERINAE*
- Sting present and functional, often projecting in dead specimens, in many species sting shaft visible through cuticle of gastral apex ventrally, even when fully retracted. Tergites of helcium entire, its anterior margin dorsally without a U or V shaped emargination ..... *PONERINAE*
7. Pygidium transversely flattened or impressed and armed laterally, posteriorly or both, with a row of short spines or peg like teeth that usually project vertically ..... *CERAPACHYINAE*
- Pygidium transversely rounded, may be very small, not armed laterally or posterior with a row of short spines or peg like teeth ..... 8
8. Frontal lobes either absent or very reduced and vertical; in either case antennal sockets completely exposed in full-face view and not at all concealed or covered by frontal lobes ..... 9
- Frontal lobes present, horizontal to somewhat elevated; antennal sockets always partially or completely covered by frontal lobes in full-face view and never completely exposed ..... 12
9. Eyes present and conspicuous, with many distinct ommatidia ..... 10
- Eyes absent or almost represented by a single ommatidium or small featureless blister ..... 11

10. Promesonotal suture present, freely flexible. Hind tibia with a conspicuous pectinate apical spur. Posterior margin of median portion of clypeus not projecting back between antennal sockets .....  
 ..... *PSEUDOMYRMECINAE* (in part)
- Promesonotal suture vestigial (fused and inflexible) to absent. Hind-tibia without a pectinate apical spur, spur either simple or absent. Posterior margin of median portion of clypeus projecting back between antennal sockets ..... *MYRMICINAE* (in part)
11. Promesonotal suture present and very conspicuous in dorsal view, usually deeply impressed and always freely flexible in fresh specimen ..  
 ..... *LEPTANILLINAE*
- Promesonotal suture vestigial to absent, usually the latter but very rarely a faint transverse line visible in dorsal view; suture never impressed nor flexible ..... *AENICTINAE*
12. Promesonotal suture usually completely absent; rarely with a vestigial remnant of suture in the form of a feeble, transversely arched impression in dorsal view, but pronotum and mesonotum always fused and immobile with respect to each other..... *MYRMICINAE*
- Promesonotal suture present and very conspicuous in dorsal view, pronotum and mesonotum not fused, mobile with respect to each other ..  
 ..... *PSEUDOMYRMECINAE*

### Subfamily 1. FORMICINAE

#### Diagnostic features of worker :

Clypeus broad from front to back. Median portion of clypeus usually not extended backwards between frontal carinae, rarely otherwise. A post clypeal frontal triangle present that may project back between frontal carinae or antennal sockets. Portion of antennal socket margin and torulus closest to the midline of head, on a higher level than the portion of margin most distant from mid line. Frontal carinae usually present, rarely absent. Eyes usually present, only rarely vestigial or absent. Antennae with 8-12 segments. Metapleural gland orifice with numerous guard setae. Propodeal lobes absent; pedicel 1-jointed. Gastral spiracle 2-5 concealed by posterior end of third segment. Pygidium simple, large. Hypopygium with acidopore. Sting absent.

## KEY TO GENERA OF THE SUBFAMILY

### FORMICINAE OF INDIA

(Based on Workers)

(Modified from BOLTON 1994)

1. Antennae 11 segmented (Fig.19) ..... 2
- Antennae 12 segmented (Fig.23) ..... 5
2. Palp formula 5, 3 or less (Fig.19) ..... *ACROPYGA* Roger
- Palp formula 6, 4 (Fig.111) ..... 3
3. Propodeum armed with a pair of spines teeth or tubercles (Fig.80). Petiole usually bispinose or bidentate above, sometimes only emarginate ..... *LEPISIOTA* Santschi
- Propodeum unarmed, petiole neither armed nor emarginate above ..... 4
4. With alitrunk in dorsal view, the mesonotum seen to be separated from the metanotum by a conspicuous transverse groove, the metanotum forms a distinctly isolated sclerite ..... *PLAGIOLEPIS* Mayr
- With alitrunk in dorsal view, the mesonotum seen to be fused with metanotum, the two not separated by a transverse groove, the metanotum not forming an isolated sclerite ..... *ANOPOLEPIS* Santschi
5. Antennal sockets situated close to the posterior clypeal margin and metapleuron with a distinct metapleural gland orifice. The orifice situated above the hind coxa and below the level of the propodeal spiracle ..... 6

- Antennal sockets situated far behind the posterior clypeal margin, or the metapleuron lacking a metapleural gland orifice in the location described above, or sometimes both ..... 11
- 6. Maxillary palp with 2-4 segments, with alitrunk in profile, the mesonotum and anepisternum seen to form together a roughly triangular oblique wedge between pronotum and remainder of alitrunk. Posterolateral angle of pronotum very nearly touching the katepisternal anterior margin. Anterior clypeal margin convex or indented medially, not broadly and evenly concave. Outer margin of mandible shallowly curved in apical half; at full closure the apical tooth directed laterally or anterolaterally ..... *PSEUDOLASIUS* Emery
- Maxillary palp with 6 segments; other characters partially or completely different from the above ..... 7
- 7. Orifice of propodeal spiracle either elongate - oval or elliptical in shape, or an elongate slit, and near vertical or inclined from the vertical. With alitrunk in absolute profile, the propodeal spiracle well in front of the point where the propodeal side rounds into the declivity apical margin of mandible usually with 8 teeth but some times with more, third tooth of mandible, counting from the apex, always distinctly smaller and shorter than the fourth; the fourth tooth larger than all the remaining teeth to the basal angle ..... *FORMICA* Linn.
- Orifice of propodeal spiracle circular to subcircular. With alitrunk in absolute profile, the propodeal spiracle bordering or actually on the curvature where the propodeal side rounds into the declivity other characters are completely different ..... 8

8. Maxillary palp longer than the head length (excluding the mandibles), the third and fourth segments each as long or longer than 2 terminal segments combined. Psammophore usually present though sometimes weakly developed. Workers monomorphic or moderately polymorphic ...  
 ..... *MYRMECOCYSTUS* Wesmael
- Maxillary palp not longer than head length and usually distinctly shorter, its third and fourth segments not disproportionately long, psammophore absent ..... 9
9. With the head in full face view, the eyes at or in front of the midlength of the sides. Head and alitrunk with stout bristles arranged in distinct pairs  
 ..... *PARATRECHINA* Motschulsky
- With the head in full face view, the eyes distinctly behind the midlength of the sides. Hairs on head and alitrunk not distinctly paired and usually not stout bristles ..... 10
10. Mandibles with 6 teeth, very rarely with 7. Anterior face of the first gastral segment broadly and transversely concave throughout its height. Antennal spaces relatively very long. When laid straight back from their insertions at least half their length projects beyond the occipital margin .....  
 ..... *PRENOLEPIS* Mayr
- Mandibles with at least 7 teeth, usually with more than 7. Anterior face of first gastral segment with a small concave area immediately above the petiole-gaster articulation, but the face not broadly transversely concave throughout its height. Antennal scapes much shorter; when laid straight back from their insertions much less than half their length projects beyond the occipital margin ..... *LASIUS* Fabricius

11. Mandibles with 10 or more teeth or denticles in total. Apical tooth disproportionately large and the fourth teeth counting from the apical, larger than the third and fifth teeth. Petiole reduced to an elongate low node (Fig.86), which allows the gaster to be sent forward over the alitrunk, palp formula 5, 4 ..... *OECOPHYLLA* F. Smith
- Mandibles usually with 5-7 teeth atmost, only very rarely with more, if 7 or more teeth present, they decrease in size from apex to base; the fourth tooth is not enlarged as above. Petiole with an erect node (Fig.55) or scale; the gaster not capable of being bent forward over the alitrunk. Palp formula 6, 4 ..... 12
12. Metapleural gland orifice present on side of metapleuron above the hind coxa and below the level of the propodeal spiracle. Orifice usually preceded by a longitudinal impression, which is overhung by a projecting rim of cuticle, the orifice itself usually with a conspicuous tuft of downward directed guard hairs; mandible with more than 5 teeth. Median portion of clypeus much longer than lateral portions, and forming a narrow lobe that projects forward over the mandibles. Metanotal groove an unimpressed transverse line ..... *CAMPONOTUS* Mayr (in part)
- Metapleural gland orifice absent from side of metapleuron. An oblique impression separating metapleuron from propodeum frequently present, but gland orifice as described above is absent; other characters mentioned above may or may not be present ..... 13
13. Tergite of first gastral segment large, accounting for atleast half the length of the gaster in dorsal view (Fig.102) or in profile; the first tergite distinctly much longer than the second. Spines or teeth (Fig.104) present on pronotum, propodeum, petiole or on two or all of these .....  
..... *POLYRHACHIS* F. Smith

- Tergite of first gastral segment shorter, accounting for distinctly less than half the length of the gaster in dorsal view or in profile; the first tergite at most only slightly longer than the second. Spines or teeth usually absent from pronotum, propodeum, and petiole; very rarely one of these locations armed (Fig.23) ..... **CAMPONOTUS** Mayr (in part)

#### **Remarks**

Even though Bingham (1903) has reported *COLOBOPSIS* Mayr from Indian region, it is not included in this key because Bolton (1994) has excluded it from Indo-Malayan key since Bingham's report is erroneous.

## Genus 1. ACROPYGA Roger

*Acropyga* Roger, 1862a. *Berl.. Ent. Zeil.* 6: 242.

Type species: *Acropyga acutiventris* Roger, 1862, *Op. Cit.*, 243, by monotypy.

Subgenera of *Acropyga*: nominal plus *Atopodon* Forel, *Malacomyrma* Emery, *Rhizomyrma* Forel.

### Diagnostic features:

**Worker:** Length 3 mm - 6.6 mm. Mandibles narrowly triangular, with 5 teeth, not overhung by the clypeus. Maxillary palpi 3 jointed; labial palpi 2 jointed. Antennae 11 segmented; eyes small situated in front of midlength of side of head; ocelli absent. Alitrunk not constricted in mesonotal region; propodeum unarmed; petiole with an unarmed scale; acidopore borne on a conical projection of hypopygium surrounded by a fringe of hairs.

**Distribution:** Indo-Malayan region. In India: Western India, Nicobar Islands, Malabar [Aralam Forest].

**Biology:** Unknown.

**Habitat:** Undisturbed.

**Discussion:** This genus comes near to *Plagiolepis* Mayr in the following features: 1 Antennae 11 segmented; 2. Mandibles with 5 teeth; 3. Ocelli absent. However this genus differs from *Plagiolepis* in having. 1 Maxillary palpi 3 jointed; labial palpi 2 jointed (in *Plagiolepis* maxillary palpi 6 jointed; labial palpi 4 jointed);

2. Eyes situated in front of midlength of side of head (in *Plagiolepis* eyes situated in middle of head); 3. Clypeus not projecting over the basal borders of the mandible (in *Plagiolepis* clypeus projecting over the basal borders of the mandibles).

*Remarks:* So far, a single species viz., *Acropyga acutiventris* has been reported from India (Bingham 1903).

### *Acropyga acutiventris* Roger

(Figs. 19, 20)

*Acropyga acutiventris* Roger, 1862a. *Berl. Ent. Zeit.* 6: 243. SRI LANKA.

*Plagiolepis flava* Mayr, 1862. *Verh. Zool - Bot. Ges. Wien* 12: 699.

Current subspecies: nominal plus *bugnioni* Forel, *carinata* Karavaiev, *javana* Karavaiev, *rubescens* Forel.

*Worker:* TL = 4.1 mm; HL = 1 mm; HW = 1.14 mm; CI = 114 mm; SL = 0.96 mm, ST = 84.21 mm; ED = 0.13 mm; PW = 0.61 mm; AL = 1.19 mm.

*Colour:* Reddish yellow; eyes jet black; abdomen shaded with fuscous; hairs and pubescence yellow.

*Sculpture and Hair pattern:* Head, thorax and abdomen minutely rugulose, shining; body clothed with dense long erect hairs; dense pubescence more abundant on antennae and legs.

*Head:* Quadrangular, without mandibles nearly square, slightly emarginate posteriorly, convex anteriorly, sides straight; mandibles narrow,

masticatory margin oblique, 5-toothed; clypeus convex, broader than long, truncate posteriorly, lateral angles rounded, not prominent, slightly and widely emarginate anteriorly without covering the mandibles; frontal area very short, torulus short, rounded, vertical; antennal scrobe very short and distinct; antennal carinae short, parallel and somewhat wide apart posteriorly; antennae short, slender, 11 jointed; antennal scape short extending up to the top of head; all segments of funiculus unequal in length. Relative measurements of length of antennal segments: Scape = 0.96 mm;  $F_1$  = 0.17 mm;  $F_2$  = 0.09 mm;  $F_3$  = 0.09 mm;  $F_4$  = 0.13 mm;  $F_5$  = 0.09 mm;  $F_6$  = 0.09 mm;  $F_7$  = 0.17 mm;  $F_8$  = 0.13 mm;  $F_9$  = 0.13 mm; Club [ $F_{10}$ ] = 0.13 mm. Eyes very small, lateral, situated anterior to midline of head, in side view a little above mandibular base. Ocelli present.

*Thorax:* Short, rounded and convex above, pronotum broader posteriorly, narrowed anteriorly; pro-meso and meso-metanotal sutures very distinct; thorax when viewed from side widely emarginate at latter suture; apical portion of metanotum lightly sloppered with two small rounded projections; legs long, stout and cylindrical; basal joint of tarsus more than half the length of tibia; tarsi with tarsal spines; claws simple.

*Abdomen:* Pedicel nodiform, single noded; petiole node transverse, convex anteriorly flat posteriorly, rounded above; gaster very long, somewhat oval rapidly narrowing posteriorly; apex of gaster very acute; anal orifice on the apex of last gastral segment guarded by guard hairs.

*Plesiotype: Worker.* INDIA: Kerala, Aralam Forest (Kannur), Karmaly K.A., 16.xii.1995 (DZCU).

*Other materials examined:* 10W: with same data as that of plesiotype [DZCU].

***Distribution:*** INDIA: [Kerala: Aralam Forest], Western India [Wroughton], Nicobars; Sri Lanka (Yerbury); Myanmar (Fea).

***Biology:*** Unknown.

***Habitat:*** Undisturbed.

***Discussion:*** Since there is no other species of this genus *Acropyga* is reported from India this species not compared with any other species.

***Remarks:*** The identification at the subspecies level could not be made for want of literature.

## Genus 2 ANOPLOLEPIS Santschi

*Anoplolepis* Santschi 1914 b : *Insects Hymenopteras* 2. Formicidae 41: 123.

Type species: *Formica longipes* Jerdon. 1851. *Madras Jour. Lit. Sci.* 17: 122. by monotypy.

Subgenera of *Anoplolepis* : nominal plus *Mesanoplolepis* Santschi, *Tapinolepis* Emery, *Zealliyella* Arnold.

### Diagnostic features:

**Worker:** Antennae 11 jointed, filiform; antennal scape greatly elongate, over 1.5 times as long as head length excluding mandibles; mandibles somewhat narrow, elongate, masticatory margin with five small acute teeth; maxillary palpi 6 jointed; labial palpi 4 jointed; clypeus broad; eyes large and oval; propodeum and petiole unarmed; petiole node rounded dorsally, not scale like. With alitrunk in dorsal view, the mesonotum seen to be fused with the metanotum, the two not separated by a transverse groove or impression; the metanotum not forming isolated sclerite. Dorsum of mesosoma almost completely devoid of standing pilosity; mesonotum viewed from side weakly concave.

**Distribution:** Throughout India (except in the hot dry portions of Punjab and parts of Central India) [Kerala Pathanamthitta, Idukki, Ernakulam, Malappuram, Kannur]; Karnataka, Lakshadweep Islands, Port Blair - Andaman Islands.

**Biology:** Unknown.

**Habitat:** Disturbed with grassy field, herbs, shrubs, and trees.

**Remarks:** A single species viz., *Anoplolepis gracilipes* has so far been reported under this genus from India.

**Discussion:** This genus comes near to *Plagiolepis* Mayr in the following features: 1. Antennae 11 jointed; 2. Maxillary palpi 6 jointed. 3. Labial palpi 4 jointed; 4. Ocelli absent. However this genus *Anoplolepis* differs from *Plagiolepis* in having: 1. With alitrunk in dorsal view the mesonotum seen to be fused with metanotum, the two not separated by a transverse groove, the metanotum not forming an isolated sclerite (in *Plagiolepis* with alitrunk in dorsal view, the mesonotum seen to be separated from the metanotum by a conspicuous transverse groove, the metanotum forms a distinctly isolated sclerite).

***Anoplolepis gracilipes* [Smith]**

(Figs. 21-22)

*Formica gracilipes* Smith, F. 1857a *Jour. Pro. Linne. Soci. Lond., Zool.* 2: 55.  
SINGAPORE.

Combination in *Prenolepis* Mayr, 1862 *Verh. der. zool.-Bot. Ges in Wien* 698.

Combination in *Plagiolepis* Mayr. 1867a *Tijd. Voor Entom.* (2) 2(10): 73.

Junior Synonym of *longipes* Jerdon Synonymy by Emery by Syntypic workers. 1887 a *Ann. Mus. Civi. Stor. Nat. Genova* (2) 4: 247.

**Worker.** TL = 4.11 mm; HL = 0.92 mm; HW = 0.71 mm; CI = 77 mm; SL = 2 mm; SI = 281 mm; ED = 0.21 mm; PW = 0.71 mm; AL = 1.92 mm.

**Colour.** Head, thorax, node of pedicel, scape of antennae and legs brownish yellow; abdomen dark brown; all segments of funiculus pale yellow; eyes brownish black; hairs reddish yellow; pubescence white.

**Sculpture and Hair pattern:** Head, thorax and abdomen very minutely and closely reticulate and shining; hairs scattered and erect; pubescence very short, adpressed more on antennae and legs.

**Head:** Oval, posteriorly rounded, sides straight; mandibles narrow; masticatory margin 5-toothed, with the apices crossing and folded beneath the margin of clypeus; clypeus broad, convex, carinate, its anterior margin angular, and partially covering the mandibles; frontal lobe fused; frontal area short and convex antennal carinae short, wide apart; antennal scrobe distinct; torulus short, rounded, horizontal; antennae long, filiform, 11 jointed; antennal scape extending beyond the top of the head by more than 3/4 its length; all segments of funiculus longer than broad. Relative measurement of length of antennal segments : Scape = 2 mm; F<sub>1</sub> = 0.25 mm; F<sub>2</sub> = 0.25 mm; F<sub>3</sub> = 0.25 mm; F<sub>4</sub> = 0.28 mm; F<sub>5</sub> = 0.32 mm; F<sub>6</sub> = 0.25 mm; F<sub>7</sub> = 0.25 mm; F<sub>8</sub> = 0.21 mm; F<sub>9</sub> = 0.17 mm; Club [F<sub>10</sub>] = 0.32 mm. Eyes large and prominent.

**Thorax:** Narrow, elongate, mesonotum constricted; pro-mesonotal and meso-metanotal sutures distinct; meso-metanotal suture slightly emarginate; metanotum rounded, convex and gibbous; legs extremely long and slender; first tibiae with both simple and pectinate spur, second and third tibiae with simple spur, claws simple.

**Abdomen:** Pedicel nodiform, single noded, petiole node thick, low, conical, rounded above; gaster broadly oval, short and massive with five visible segments each segment terminating in a silvery edge, apex of last gastral segment with circular anal orifice guarded by guard hairs.

**Plesiotype : worker.** INDIA : Kerala, Calicut University Campus, Karmaly, K.A., 20.ii.95 [DZCU].

**Other materials examined:** 4W: INDIA: Kerala, Thekkady, Karmaly, K.A., 27.ii.1995; 4W: INDIA: Kerala: Aluva, Karmaly, K.A., 3.iii.1995; 10W: INDIA Kerala, Kohinoor (near Calicut University Campus), Karmaly, K.A., 18.iii.1995; 3W. INDIA: Kerala, Calicut University Campus, Karmaly, K.A., 22.iii.1995; 3W. INDIA: Kerala: Kohinoor, Karmaly K.A., 24. iii. 1995; 10W: INDIA: Kerala, Aralam Forest, Karmaly, K.A., 16. xii. 1995; 2W. INDIA: Kerala, Pathanamthitta, Sureshan, P.M., 26.x.2000.

All specimens deposited in the Systematic Entomology Laboratory, Department of Zoology, Calicut University.

**Distribution:** INDIA: [Kerala: Pathanamthitta, Idukki, Ernakulam, Malappuram, Kannur]; Lakshadweep Islands, Port Blair - Andaman Islands, Karnataka.

**Biology:** Unknown.

**Habitat:** Found in disturbed areas.

**Discussion:** So far twenty two species and nine subspecies have been reported under this genus. Among these only a single species viz. *gracilipes* [Smith] represents in Indian subcontinent. In 1851 Jerdon described this species from India under the name *Formica longipes* Emery 1887 synonymised this species with *gracilipes* Smith. In 1995 Bolton transferred it to the genus *Anoplolepis* Santschi.

## Genus *CAMPONOTUS* Mayr

*Camponotus* Mayr., 1861. *Europ. Formicid* 35. WIEN.

Type species: *Camponotus ligniperda*, Bolton, 1995. A new General Catalogue of the Ants of the World : 23.

Following synonymys by Bolton, 1995. A New General Catalogue of the Ants of the world: p.23.

*Condylomyrma* Santschi, 1928c: 72

*Dinomyrmex* Ashmead, 1905b: 384

*Dolophra* Wu and Wang, 1994: 35

*Drymomomyrmex* Wheeler, 1915h: 135

*Hypercolobopsis* Emery, 1920b: 250

*Karavaievia* Emery, 1925b: 115

*Manniella* Wheeler, 1921a: 19

*Mayria* Forel, 1878: 369

*Myrmacraphe* Santschi, 1926c: 607

*Myrmamblys* Forel. 1912i: 90

*Myrmaphaenus* Emery, 1920b: 237

*Myrmentoma* Forel, 1912 i: 92

*Myrmepinotus* Santschi, 1921 f: 312

*Myrmepomis*. Forel, 1912 i: 92

*Myrmespera* Santschi, 1926b: 247

*Myrmeurynota* Forel, 1912i: 92

*Myrmisolepis* Santschi, 1921f: 310

*Myrmobrachys* Forel, 1912i: 91

*Myrmocamelus* Forel, 1914 a: 261

*Myrmocladoecus* Wheeler, 1921a: 19  
*Myrmodirhachis* Emery, 1925 b: 168.  
*Myrmogigas* Forel, 1912i: 91  
*Myrmogonia* Forel, 1912i: 92.  
*Myrmolophus* Emery, 1920b. 237.  
*Myrmomalis* Forel, 1914a. 263.  
*Myrmonesites* Emery, 1920b 242  
*Myrmopalpella* Staercke, 1934: 30  
*Myrmopelta* Santschi, 1921 f: 310.  
*Myrmophyma* Forel, 1912 i: 91  
*Myrmopiromis* Wheeler, 1921a: 17  
*Myrmoplatypus* Santschi, 1921f: 311  
*Myrmoplatys* Forel, 1916: 460  
*Myrmopsamma* Forel, 1914a: 261  
*Myrmopytia* Emery, 1920b: 243  
*Myrmosaga* Forel, 1912i: 92.  
*Myrmosaulus* Wheeler, 1921a: 18  
*Myrmosericus* Forel, 1912i: 91  
*Myrmophincta* Forel, 1912i: 92  
*Myrmostenus* Emery, 1920b: 250  
*Myrmotarsus* Forel, 1912i: 92  
*Myrmotemnus* Emery, 1920b: 246  
*Myrmothrix* Forel, 1912i: 91  
*Myrmotrema* Forel, 1912i: 91  
*Myrmoturba* Forel, 1912i: 91  
*Myrmoxygenys* Emery 1925b: 70  
*Neocolobopsis* Borgmeier, 1928 b: 65  
*Neomyrmamblys* Wheeler, 1921a: 19

*Orthonotomyrmex* Ashmead, 1906: 31

*Orthonotus* Ashmead, 1905b: 384

*Paramyrmanblys* Santschi, 1926c: 604

*Pseudocolobopsis* Emery, 1920b: 249

*Rhinomyrmex* Forel, 1886 f. 192.

*Tanaemyrmex* Ashmead, 1905b: 384

*Thilpsepinotus* Santschi, 1928e. 483.

### **Diagnostic features:**

**Worker.** Mandibles with five to seven stout teeth; clypeus with median portion projecting as a truncated lobe, more obvious in larger workers. Maxillary palpi 6 jointed; labial palpi 4 jointed. Antennae 12 jointed, inserted some distance behind posterior clypeal margin. Frontal carinae converging anteriorly; eyes well developed, situated behind midlength of head; pro-mesonotal suture distinct; mesoscutellum present on dorsal surface of alitrunk in larger worker and in some the metanotum also present on dorsum. Alitrunk unarmed, with spines on pronotum, propodeum abruptly truncated; pedicel with a node, without teeth (spines). Circular acidopore distinct, not concealed by pygidium. Abdomen more or less oval.

**Distribution:** Both hemispheres. In INDIA: Assam, Sikkim, Himalayas, Orissa, Kashmir, Bengal, Delhi, Poona, Hyderabad, Karnataka, Mysore, Malabar, Kerala, Nilgiris.

**Biology:** Nests are formed in rotten wood, in the earth, in rotten branches, twigs of standing trees, directly into living wood by extending the galleries begun by wood-boring beetles. Small to very large ants found in all localities. A number of species are arboreal whilst others are purely nocturnal in habits, but the

majority are diurnal and terrestrial. All are active, fast running ants with powerful mandibles.

**Habitat:** Found in both disturbed and undisturbed habitat.

**Discussion:** This genus comes near to *Polyrhachis* F. Smith in the following features: 1. Antennae 12 jointed; 2. Antennal sockets situated far behind posterior clypeal margin; 3. Maxillary palpi 6 jointed; labial palpi 4 jointed. However this genus *Camponotus* Mayr differs from *Polyrhachis* F. Smith in having: 1. Metapleural gland orifice present on side of metapleuron above hind coxa and below the level of the propodeal spiracle. (in *Polyrhachis* metapleural gland orifice absent); 2. Tergite of first gastral segment shorter (in *Polyrhachis* it is larger); 3. Spines or teeth absent from pronotum, propodeum and petiole (in *Polyrhachis* spines or teeth present on pronotum, propodeum and petiole).

**Remarks:** The genus *Camponotus* Mayr comes under the subfamily Formicinae. In India there are approximately fifteen subgenera, 62 species and 5 subspecies. The following are the subgenera under the genus *Camponotus* Mayr: 1.

*Colobopsis* Mayr, *Condylomyrma* Santschi, *Hypercolobopsis* Emery, *Karavaievia* Emery, *Manniella* Wheeler, *Mayria* Forel, *Myrmacraphe* Santschi, *Myrmambly* Forel, *Myrmaphaenus* Emery, *Myrmentoma* Forel, *Myrmepinotus* Santschi, *Myrmepomis* Forel, *Myrmespera* Santschi, *Myrmeurynota* Forel, *Myrrmisolepis* Santschi, *Myrmobrachys* Forel, *Myrmocladoecus* Wheeler, *Myrmodirhachis* Emery, *Myrmogonia* Forel, *Myrmomalis* Forel, *Myrmonesites* Emery, *Myrmopalpella* Saercke, *Myrmopelta* Santschi, *Myrmopiromis* Wheeler, *Myrmoplatypus* Santschi, *Myrmoplatys* Forel, *Myrmopsamma* Forel, *Myrmopytia* Emery, *Myrmosaga* Forel, *Myrmosaulus* Wheeler, *Myrmosericus* Forel, *Myrmosphincta* Forel, *Myrmostenus* Emery, *Myrmotarsus* Forel, *Myrmotrema* Forel, *Myrmotemnus* Emery, *Myrmothrix*

Forel, *Myrmoturba* Forel, *Myrmoxigenys* Emery, *Neocolobopsis* Borgmeier, *Neomyrmamblys* Wheeler, *Orthonotomyrmex* Ashmead, *Orthonotus* Ashmead, *Paracolobopsis*, *Paramyrmamblys* Santschi, *Pseudocolobopsis* Emery, *Rhinomyrmex* Forel, *Tanaemyrmex* Ashmead, *Thilpsepinotus* Santschi.

## Key to Indian Species of *CAMPONOTUS* Mayr

(Based on workers)

(Modified from Bingham 1903)

1. Thorax viewed from side forming a regular arch without interruption by metanotum (Fig.23) ..... 2
- Thorax viewed from side forming a regular arch interrupted by the metanotum (Fig.58) ..... 49
2. Pubescence on sides of head and beneath long forming a beard, [Kerala] ....  
..... *C. barbatus barbatus* Roger
- Pubescence on sides of head and beneath short not forming a beard ..... 3
3. Head, thorax and abdomen black or pale yellow ..... 4
- Head, thorax and abdomen never all black or all yellow ..... 18
4. Tibiae of the legs prismatic, not compressed (Fig. 23) ..... 5
- Tibiae of the legs not prismatic, but compressed (Fig.55) ..... 10
5. Tibiae with spines beneath (Fig.55) ..... 6
- Tibiae without spines beneath (Fig.53 ) [Kerala] ..... *C. lamarckii* Forel
6. Abdomen covered with long recumbent hairs..... *C. japonicus* Mayr.
- Abdomen with sparse erect hairs ..... 7
7. Worker major : Lenth 11 mm - 16 mm; worker minor with head narrowed posteriorly, not constricted to form a collar [Fig.35] [Kerala] .....  
..... *C. compressus* [Fabricius]
- Worker major: length of 17 mm - 21 mm; worker minor: with the head posteriorly constricted to form a collar [Fig.23]..... 8
8. Anterior margin of clypeus transverse and dentate, [Kerala] .....  
..... *C. angusticollis angusticollis* [Jerdon]

- Anterior margin of clypeus somewhat rounded and feebly dentate ..... 9
- 9. Head and thorax yellowish brown, latter shaded with fuscous above; abdomen dark brown, [Kerala] ..... *C. ashokai* sp. nov.
- Head and thorax yellowish red; abdomen black .....  
..... *C. angusticollis sanguinolentus* Forel
- 10. Abdomen clothed with a thin fine sericeous pubescence ..... 11
- Abdomen not clothed with a thin fine sericeous pubescence ..... 15
- 11. Body with grey pubescence ..... 12
- Body Yellow pubescence [Kerala] ..... *C. parius* Emery
- 12. Worker major : Lengh under 7 mm [Kerala] ..... *C. binghamii* Forel
- Worker major : Length under 12 mm ..... 13
- 13. Abdomen massive, broad and oval with a spot on each side of base ..... 14
- Abdomen narrow and elongate without spot on each side of base [Kerala] ..  
..... *C. strictus* [Jerdon]
- 14. Blackish yellow spot on each side of base of abdomen; node of pedicel very thick, subcubic, longer than broad and notched above ..... *C. longi* Forel.
- Yellow spot on each side of base of abdomen; node of pedicel squamiform, compressed and notched above ..... *C. cotesii* Forel.
- 15. Hind tibiae with spines beneath [Kerala] ..... *C. dolendus* Forel
- Hind tibiae without spines beneath ..... 16
- 16. Eyes small, frontal rather than lateral; pubescence very sparse and erect ..  
..... 17
- Eyes more large, frontal rather than lateral; pubescence short and obtuse  
..... *C. rothmeyji* Forel
- 17. Thorax very convex anteriorly, giving a high shouldered look to the insect, strongly laterally compressed posteriorly [Kerala] ..... *C. invidus* Forel
- Thorax not convex anteriorly, not giving a high shouldered look to the insect, strongly compressed posteriorly ..... *C. crassisquamis* Forel

18. Scape of antennae flat [Fig. 49] ..... 19  
 --- Scape of antennae cylindrical [Fig.47] ..... 20
19. Basal tarsal joint broad and flat; node of pedicel thick with an obtuse margin  
 ..... *C. misturus misturus* [Smith]  
 --- Basal tarsal joint narrow and slightly compressed; node of pedicel thick with  
 an acute margin [Kerala] ..... *C. misturus fornaronis* Forel
20. Abdomen clothed with dense silky pubescence ..... 21  
 --- Abdomen clothed with a thin sparse recumbent pubescence ..... 24
21. Clypeus without a distinct median lobe, its anterior margin transverse  
 [Kerala] ..... *C. mendax mendax* Forel  
 --- Clypeus with a distinct median lobe produced anteriorly ..... 22
22. Dull black; abdomen glaucous green ..... *C. cineraceus* [Fabricius]  
 --- Blood red; abdomen brown ..... 23
23. Node of pedicel not thick, only slightly convex anteriorly; length varies from  
 5 mm - 10 mm [Kerala] ..... *C. rufoglaucus rufoglaucus* [Jerdon]  
 --- Node of pedicel thick, very convex anteriorly; length varies from 5.5 mm -  
 6 mm ..... *C. rufoglaucus tenuis* Forel
24. Tibiae of legs cylindrical, not compressed ..... 25  
 --- Tibiae of legs not cylindrical but compressed ..... 34
25. Tibiae clothed with long erect hairs ..... *C. buddhae* Forel  
 --- Tibiae clothed with widely spread, adpressed hairs ..... 26
26. Apical third of tibiae with a few spines beneath ..... *C. oblongus* [Smith]  
 --- Tibiae without spines beneath ..... 27
27. Median lobe of clypeus with its anterior margin rounded ..... 32  
 --- Median lobe of clypeus with its anterior margin transverse ..... 28
28. Head triangular, lateral occipital angles prominent; legs covered with sparse  
 recumbent hairs [Kerala] ..... *C. variegatus infuscus* Forel

- Head subtriangular, lateral occipital angles not prominent; legs covered with dense recumbent hairs ..... 29
- 29. Worker major: length under 8 mm, worker minor: under 6 mm ..... 30
- Worker major: length over 8 mm, worker minor: over 6 mm ..... 31
- 30. Abdomen without yellow spots on basal two abdominal segments [Kerala] ..  
..... *C. barbatus taylori* Forel
- Abdomen with yellow spots on the basal two abdominal segments .....  
..... *C. albosparsus* Forel
- 31. Head and abdomen fuscous brown; node of pedicel remarkably thick [Fig. 70] [Kerala] ..... *C. variegatus variegatus* (Smith)
- Head black; abdomen red; node of pedicel remarkably thin [Kerala] .....  
..... *C. variegatus somificus* Forel
- 32. Head thorax and abdomen smooth, glabrous and shining ..... 33
- Head thorax and abdomen feebly sculptured and shining .....  
..... *C. aethiops cachmirensis* Forel
- 33. Mandibular teeth obsolete ..... *C. wroughtonii* Forel
- Mandibular teeth not obsolete (Fig.26) [Kerala] ..... *C. apoorvus* sp. nov.
- 34. Tibiae of legs spined beneath ..... 35
- Tibiae of legs not spined beneath ..... 40
- 35. Head thorax and abdomen castaneous red ..... 36
- Head and abdomen black or dark castaneous red; thorax yellow completely or partially ..... 37
- 36. Clypeus without median lobe; worker major: over 15 mm; worker minor: over 10 mm ..... *C. festinus* [Smith]
- Clypeus without median lobe; worker major under 8 mm, worker minor under 5 mm - 6 mm ..... *C. arrogans* [Smith]
- 37. Medial lobe of clypeus long rectangular; lateral angles acute ..... 38

- Medial lobe of clypeus short; lateral angles rounded, [Kerala] .....  
 ..... *C. irritans irritans* [Smith]
38. Head much broader posteriorly than in front ..... 39
- Head only as broad posteriorly as in front, [Kerala] .....  
 ..... *C. sylvaticus basalis* Smith
39. Head, 3rd and following segments of abdomen pitch-black; funiculus,  
 thorax, legs and basal two segments of the abdomen yellow with brown  
 markings ..... *C. dichrous* Forel
- Head, 3rd and following segments of abdomen not pitch-black (only slightly  
 black); funiculus, thorax, legs and basal two segments of the abdomen pale  
 yellow with light brown markings ..... *C. variegatus kattensis* Bingham
40. Head, thorax and abdomen finely rugulose and opaque ..... 41
- Head, thorax and abdomen sparsely punctured, shining, not opaque ..... 43
41. Node of pedicel thick, oval, convex anteriorly, flat posteriorly, in worker  
 minor node of pedicel narrow ..... *C. badius* [Smith]
- Node of pedicel slightly convex anteriorly, rounded above, concave behind,  
 in worker minor node of pedicel conical ..... 42
42. Clypeus weakly carinate and weakly lobed [Kerala] .....  
 ..... *C. nicobarensis nicobarensis* Mayr
- Clypeus distinctly carinate and clearly lobed ..... *C. exiguoguttatus* Forel
43. Thorax dark castaneous brown ..... 44
- Thorax honey yellow ..... 46
44. Pronotum longer than mesonotum, strongly constricted, anteriorly forming a  
 distinct neck [Fig. 33] [Kerala] ..... *C. carin carin* (Emery)
- Pronotum equal in length to mesonotum, only slightly constricted in front  
 not forming a distinct neck [Fig. 43] ..... 45
45. Teeth not obsolete; meso-metanotal suture distinct [Fig.44] [Kerala] .....  
 ..... *C. keralensis* sp. nov.

- Teeth obsolete; meso-metanotal suture indistinct [Kerala] ..... *C. thraso* Forel
46. Distance between the antennal carinae equal to the distance between eyes and antennal carinae ..... 47
- Distance between the antennal carinae distinctly greater than between eyes and antennal carinae ..... *C. irritans pallidus* [Smith]
47. Coxae and base of femora not yellow but yellowish brown ..... 48
- Coxae and base of the femora yellow, not yellowish brown .....  
..... *C. variegatus fuscithorax* Dalla Torre
48. Eyes large, posterior in position; node of pedicel raised and conical [Kerala] ..... *C. timidus* (Jerdon)
- Eyes small, frontal rather than lateral; node of pedicel oval, transverse, convex anteriorly and flat posteriorly [Fig. 51] [Kerala] ..... *C. mitis* [Smith]
49. Regular arch interrupted by the metanotum being truncate [Fig.58] ..... 50
- Regular arch interrupted by the metanotum being raised, rounded above and gibbous or forming an angle with the mesonotum; ..... 58
50. Mandibles toothed on the inner margin as well as as on the masticatory margin ..... *C. gigas* [Latreille]
- Mandibles toothed only on the masticatory margin ..... 51
51. Clypeus anteriorly emarginate in the middle ..... 52
- Clypeus anteriorly not emarginate in the middle ..... 53
52. Head and thorax black; legs brownish red; abdomen dark, castaneous brown ..... *C. marginata marginata* [Latreille]
- Head and thorax black; legs and abdomen reddish yellow .....  
..... *C. marginata himalayanus* Forel
53. Antennal scape flattened ..... *C. radiatus* Forel
- Antennal scape cylindrical ..... 54
54. Length worker major: above 12 mm; worker minor: above 5 mm ..... 57
- Length worker major: below 7 mm; worker minor: below 5 mm ..... 55

55. Head, thorax and abdomen reddish brown ..... 56  
 — Head and thorax black, abdomen castaneous ..... *C. reticulatus yerburyi* Forel
56. Colour brownish red [Kerala] ..... *C. reticulatus reticulatus* Roger  
 — Colour brownish yellow..... *C. reticulatus latitus* Forel
57. Worker major: mandibles 6-toothed; clypeus broad, slightly tectiform,  
 anterior margin transverse, [Fig. 64] [Kerala] ..... *C. siemsseni* Forel  
 — Worker major: mandibles 7-toothed; clypeus subcarinate, trapeziform,  
 anterior margin subcrenulate [Kerala] ..... *C. socrates* Forel
58. Regular arch interrupted by the metanotum being raised, rounded above  
 and gibbous ..... 59  
 — Regular arch interrupted at the meso-metanotal suture by the metanotum  
 forming an angle with the mesonotum; basal portion of metanotum  
 horizontal, flat or slightly concave; apical portion excavate [Fig.62] ..... 65
59. Anterior lateral angles of pronotum dentate or subdentate ..... 60  
 — Anterior lateral angles of pronotum not dentate ..... 61
60. Abdomen clothed with dense, recumbent sericeous golden hairs hiding the  
 sculpture ..... *C. auriventris* Emery  
 — Abdomen not clothed with recumbent hairs, the sculpture distinct .....  
 ..... *C. wasmanii* Emery.
61. Length above 9 mm ..... 62  
 — Length below 9 mm ..... 64
62. Thorax posteriorly and node of pedicel coarsely punctured, cribrate not  
 rugulose ..... *C. holosericeus* Emery  
 — Thorax posteriorly and node of pedicel finely reticulate-punctate, rugulose  
 not cribrate ..... 63
63. Head black ..... *C. camelinus camelinus* [Smith]  
 — Head blood red ..... *C. camelinus singularis* [Smith]

64. Head rather rectangular, a little broader posteriorly than in front, sides straight very slightly convex ..... *C. confucii* Forel  
 — Head large, trapezoidal, broad behind, narrow in front with straight anteriorly covering sides and deeply excised posterior broader. ....  
 ..... *C. megalonyx* Wheeler
65. Tibiae of legs with spines beneath ..... 67  
 — Tibiae of legs without spines beneath ..... 66
66. Basal portion of metanotum submargined rectangular, a little larger than broad, the apical sloping portion obliquely truncate, slightly concave and submargined ..... *C. nirvanae* Forel  
 — Basal portion of metanotum flat, horizontal, backward pointing laminate spines curve inwards like a pair of callipers; apical portion strongly concave, shining, overhung by the metanotal spines ..... *C. selene* (Emery)
67. Length 5 mm to 10 mm; clypeus broad and tectiform [Fig.63] ..... 68  
 — Length 3 mm - 4 mm; clypeus broad and convex [Fig.66] [Kerala] .....  
 ..... *C. varians* Roger
68. Abdomen with a dense recumbent silky golden pubescence hiding the sculpture ..... 69  
 — Abdomen without pubescence, sculpture distinct .....  
 ..... *C. sericeus opaciventris* Mayr
69. Petiole with sides almost straight, rounded and knob like above [Fig. 62] [Kerala] ..... *C. sericeus sericeus* [Fabricius]  
 — Petiole like a scale rather than a node, apex narrowed and rounded, anterior surface slightly concave and sloping, posterior surface upright, slightly concave ..... *C. puniceps* Donisthrope

Species *varius* Donisthorpe, *velox* (Jerdon), *sklarus* Donisthorpe, *luteus* Smith, *gretae* Forel. *phragmaticola* Donisthorpe and subspecies *paradichrous* Emery were excluded from this key since their descriptions are incomplete and lack details.

***Camponotus (Dinomyrmex) angusticollis angusticollis* (Jerdon)**

(Figs. 23 - 24)

*Formica angusticollis* Jerdon, 1851. *Madras Jour. Lit. Sci.* 17: 120. INDIA. [BNMH]

*Formica ardens* Smith, 1858. *Cat. Hym. Brit. Mus.* 6. 17.

*Formica impetuosa* Smith, 1858. *Cat. Hym. Brit. Mus.* 6. 17.

*Formica callida* Smith, 1858. *Cat. Hym. Brit. Mus.* 6. 18.

*Camponotus prismaticus* Mayr, 1862. *verh. Zool - Bot. Ges. Wien* 12: 669.

Combination in *Camponotus* Roger, 1863. *Berl. Ent. Zeit.* 7: 3.

*Camponotus angusticollis* Bingham, 1903. *Fauna, Brit. India. Hymenoptera* 2: 366.

*Camponotus (Tanaemyrmex) angusticollis* Emery, 1925. *Genera Insect* 183: 80.

*Camponotus (Dinomyrmex) angusticollis* Chapman and Capco, 1951. *Monogr Inst. Sci. Tech. Manila.* 1: 229.

*Camponotus angusticollis*. Tiwari et al., 1994. *State Fauna Series.* 3: *Fauna of West Bengal* 8: 272.

**Worker minor.** TL 12.80 mm; HL = 2.84 mm; HW = 2.34 mm; CI = 82.39 mm; SL = 3.70 mm; SI = 158 mm; ED = 0.1 mm; PW = 2.60 mm; AL = 5.80 mm.

**Colour:** Head, mesonotum, metanotum, node of pedicel, gaster, femor of legs trepurpureus (nearly black); pronotum, scape of antennae, coxa, trochanter, tibia and tarsi ferrugineous red; the flagellum of antennae and three apical joints of tarsi reddish brown. Maxillary palp and labial palp yellowish brown. Gastral segments with golden yellow striations.

**General Sculpture and Hair patterns:** Small recumbent whitish hairs on the whole body; head gaster and coxa of legs with moderate number of long erect brownish yellow hairs, tarsal segments with small brownish spines.

**Head:** Small, elongate wider at the anterior margin of the mandibles than vertex; occiput very much constricted and elongated into a neck; mandibles broad, masticatory margin with an apical tooth (apical one largest) followed by 5 small teeth; clypeus broad, anterior margin slightly emarginate, a vertical prominent median carina with a sharp point, clypeus convex, posterior margin distinct, two short carinae below antennal hollows; frontal carinae very strong, pointed antero-laterally, emarginate medially, anterior margin provided with 5 frontal setae; antennal scrobe shallow, opaque reaching almost occiput. Antennae 12 segmented, elongate filiform; antennal scape slender, elongate, cylindrical, funicular segments longer than broad. Relative measurement of length of antennal segments. Scape = 3.7 mm;  $F_1 = 0.6$  mm;  $F_2 = 0.6$  mm;  $F_3 = 0.8$  mm;  $F_4 = 0.7$  mm;  $F_5 = 0.7$  mm;  $F_6 = 0.6$  mm;  $F_7 = 0.5$  mm;  $F_8 = 0.4$  mm;  $F_9 = 0.5$  mm;  $F_{10} = 0.5$  mm; Club ( $F_{11}$ ) = 0.6 mm. Eyes small, rounded, situated at the posterior margin of the head.

**Thorax:** Pronotal angles sharply angulate; pronotum convex, narrow in front, constricted with a neck anteriorly; pro-mesonotal, meso-metanotal suture distinct; metanotal groove absent; metapleural orifice present; metanotal spiracles distinct; legs elongate, slender, tibiae prism like, longitudinally channeled, tarsal segments with tarsal spurs.

**Abdomen:** Petiole with a short peduncle in front, petiolar node thick at front, flat at base, very concave above, upper margin transverse and notched, posteriorly flat and truncate, in dorsal view node lobate, depressed, concave; gaster massive, oval, gastral segments with golden yellow striations, anal orifice at the apex of last gastral segment guarded by guard hairs.

**Plesiotype:** Worker minor: INDIA: Kerala, Kohinoor, (Malappuram), Karmaly, K.A., 24.iii.1995 [DZCU].

**Other materials examined:** 2W. INDIA: Kerala, Calicut University, Sheela. S., 1.v.1992; 1W. INDIA, Kerala, Anakampoil (Calicut), Pramod, 24.vi.1995; 2W. INDIA: Kerala, Manjeri (Malappuram) Razak, 25.v.2000; 1W. INDIA: Kerala, Nilampur (Malappuram), Soumya, 25.viii.2000, 1W. INDIA: Kerala, Calicut University Campus, Vidhupriya 13.x.2000; 1W. INDIA: Kerala, Silent Valley (Palakkad) Alloak, 24.i.2001.

All specimens deposited in the Systematic Entomology Laboratory, Department of Zoology, Calicut University.

**Distribution:** INDIA: [Kerala: Ernakulam, Palakkad, Malappuram, Calicut], Tamil Nadu, Western and Central India, Assam, West Bengal, Darjeeling, Himalaya; Nepal; Mianmar.

**Biology:** Unknown.

**Habitat:** Disturbed.

**Discussion:** *Camponotus angusticollis* (Jerdon) comes close to *Camponotus compresses* Fabr. in the following features: 1. Head elongate; 2. 12 segmented antennae; 3. Antennal scape cylindrical; 4. Mandibles with 5 teeth; 5 Abdomen covered with sparse erect hairs; 6. Circular anal orifice at the apex of last gastral segment guarded by guard hairs. However *Camponotus angusticollis* (Jerdon)

differs from *Camponotus compresses* Fabr in having: 1. Head posteriorly constricted so as to form a collar (in *Camponotus compresses* head posteriorly narrow but not constricted to form a collar); 2. Legs long, rather slender; tibiae prismatic, compressed and longitudinally channeled (in *Camponotus compresses* legs long, tibiae compressed, prismatic, not longitudinally channeled).

**Remarks:** Current subspecies : nominal plus *sanguinolentus* Forel. Jerdon (1851) first described *Camponotus angusticollis* Jerdon under the genus *Formica* in the forests in Malabar. Donisthorpe (1942) also reported this species under the genus *Camponotus* Mayr from South India.

***Camponotus [Myrmentoma] apoorvus sp. nov***

(Figs. 25 - 26)

**Worker:** TL = 6.4 mm; HL = 2 mm; HW = 1.76 mm; CI = 88 mm; SL = 2.05 mm; SI = 116.47 mm; ED = 0.33 mm; PW = 1.33 mm; AL = 2.22 mm.

**Colour:** Dark castaneous brown; legs slightly lighter in colour; tarsal segments more lighter; posterior margins of gastral segments testaceous; hairs light brown.

**Sculpture and Hair pattern:** Head, thorax and abdomen shining, not glabrous, feebly reticulate, punctate; whole body covered with adpressed hairs; funicular segments clothed with thick adpressed hairs; scattered erect light - brown hairs on head, thorax and more on abdomen.

**Head:** Somewhat square, as broad at the articulation of the mandibles as across occiput; occipital angle not prominent; mandibles short and broad, 5-toothed (one apical tooth followed by 4 acute teeth); clypeus broad, with very distinct medial vertical carina, median lobe slightly produced its anterior margin

not rounded in front, entire; frontal lobe short; frontal carinae long, divergent posteriorly; antennal scrobe short; antennal carinae short and close together; antennae long, slender, filiform, 12 jointed; antennal scape cylindrical, long extending the occiput; all segments of funiculus longer than broad; club single segmented thickened and longer than other funicular segments. Relative measurement of length of antennal segments. Scape = 2.05 mm;  $F_1$  = 0.22 mm;  $F_2$  = 0.22 mm;  $F_3$  = 0.27 mm;  $F_4$  = 0.38 mm;  $F_5$  = 0.33 mm;  $F_6$  = 0.27 mm;  $F_7$  = 0.16 mm;  $F_8$  = 0.22 mm;  $F_9$  = 0.22 mm;  $F_{10}$  = 0.16 mm. Club ( $F_{11}$ ) = 0.44 mm. Eyes small, oval, posterior rather than lateral.

**Thorax:** Short, broader; pronotum narrowed anteriorly, broader posteriorly; pro-mesonotal and meso-metanotal suture distinct; metanotum posteriorly truncate; metacoxal spiracle distinct; episternal spiracle also distinct; legs stout; tibiae compressed, longitudinally channeled; tarsi with tarsal spines.

**Abdomen:** Pedicel short, thickened, nodiform; petiolar node biconvex; gaster broad and massive, forming an arch in lateral view; posterior margins of the gastral segments testaceous; last gastral segment ends with circular anal orifice guarded by guard hairs.

**Holotype:** *Worker.* INDIA: Kerala, Iravikulam (Idukki), Sureshan. P.M. 7.v.1993 [DZCU].

**Distribution:** INDIA: (Kerala: Idukki)

**Biology:** Unknown.

**Habitat:** Undisturbed

**Etymology:** The species name is an arbitrary combination of letters.

**Discussion:** This new species comes close to *Camponotus wroughteni* Forel in general appearance and in the following features: 1. Head somewhat square; 2. Antennae slender filiform, 12 jointed; 3. Thorax viewed from side forming a regular arch. However this new species differs from *Camponotus wroughteni* Forel in having: 1. Mandible 5-toothed (in *Camponotus wroughteni* mandibular teeth obsolete); 2. Clypeus not rounded in front (in *Camponotus wroughteni* clypeus rounded in front); 3. Head, thorax and abdomen shining, not glabrous, feebly reticulate and punctate (in *Camponotus wroughteni* head, thorax and abdomen shining and glabrous).

*Camponotus [Dinomyrmex] ashokai* sp. nov.

(Figs. 27 - 28)

**Worker:** TL = 10.8 mm; HL = 2.46 mm; HW = 2.17 mm; CI = 88.21 mm; SL = 1.66 mm; SI = 76.49 mm; ED = 0.06 mm; PW = 1.6 mm; AL = 4.53 mm.

**Colour:** Head and legs yellowish brown; thorax yellowish brown shaded with fuscous brown above; antennal scape reddish brown; all segments of funiculus yellowish brown; node of pedicel fuscous brown; abdomen dark brown; posterior margin of abdominal segments narrow whitish yellow.

**Sculpture and Hair pattern:** Head and abdomen somewhat shining; mandibles, clypeus and head granulate rugulose; legs, thorax, node of pedicel, abdomen rugulose and feebly granulate; body clothed with short silky white adpressed pubescence; pale brown erect hairs distinct only on head and abdomen; tibiae and tarsi spinous beneath.

**Head:** Small elongate, wider at the articulation of the mandibles than vertex, occiput very strongly constricted and elongated into a neck; mandibles

subtriangular<sup>a</sup>, 6-toothed (3 apical teeth followed by 3 acute teeth); clypeus broad with a longitudinal furrow at the middle convex medially and concave laterally, its anterior margin transverse and shortly produced, median lobe prominent, posterior margin with a short depression at medially; frontal lobe short; frontal carinae short and parallel; antennal carinae reduced; antennal scrobe very much short passing above the eye, reaching up to frontal carinae; antennae long, slender, filiform, 12 jointed; antennal scape cylindrical, all segments of funiculus longer than broad; club single segmented. Relative measurement of length of antennal segments : Scape = 1.66 mm; F<sub>1</sub> = 0.86 mm; F<sub>2</sub> = 0.6 mm; F<sub>3</sub> = 0.6 mm; F<sub>4</sub> = 0.53 mm; F<sub>5</sub> = 0.86 mm; F<sub>6</sub> = 0.73 mm; F<sub>7</sub> = 0.2 mm; F<sub>8</sub> = 0.2 mm; F<sub>9</sub> = 0.2 mm; F<sub>10</sub> = 0.2 mm; Club (F<sub>11</sub>) 0.46 mm. Eyes small, rounded situated at the posterior margin of the head.

**Thorax:** Elongate and narrow; pronotum convex, narrowed in front, constricted with a neck anteriorly; pro-mesonotal and meso-metanotal suture distinct; metanotal groove absent; metanotal orifice present; metanotal spiracles distinct; basal region of metanotum along with propodeum steeply slopered and forming a circular region; legs elongate; tibiae compressed, longitudinally channelled, spinous beneath; tarsi with tarsal spines.

**Abdomen:** Pedicel with a short peduncle in front; nodiform, petiolar node thick at front, flat at base, very convex above, upper margin rounded, posteriorly flat and truncate; in dorsal view node lobate, depressed, concave; gaster short, massive, oval; posterior margin of gastral segments with whitish yellow band; last gastral segment ends with circular anal orifice guarded by guard hairs.

**Holotype: Worker.** INDIA: Kerala, Silent Valley (Palakkad, Alloak, 24-i-2001 [DZCU].

**Distribution:** INDIA: [Kerala: Palakkad]

**Biology:** Unknown.

**Habitat:** Undisturbed habitat

**Etymology:** The species name is after Ashoka the wise king of India.

**Discussion:** This new species comes close to *Camponotus angusticollis* (Jerdon) in general appearance and in the following features: 1 Head elongate; 2. Antennae elongate, slender, filiform, 12 jointed; 3. Circular anal orifice at the apex of last gastral segment guarded by guard hairs. However this new species differs from *Camponotus angusticollis* (Jerdon) in having: 1. Anterior margin of clypeus somewhat rounded, not dentate (in *Camponotus angusticollis* anterior margin of clypeus transverse and dentate). 2. Eyes oval, convex, black at the center surrounded by greyish brown (in *Camponotus angusticollis* eyes convex oval, black); 3. Metanotum not gibbous (in *Camponotus angusticollis* metanotum gibbous); 4. Apex of pedicel flattened (in *Camponotus angusticollis* apex of pedicel cylindrical); 5. Node of pedicel convex anteriorly, flat posteriorly, rounded above (in *Camponotus angusticollis* node of pedicel thick at front, flat at base, very concave above, upper margin transverse and notched).

***Camponotus (Colobopsis) badius* [Smith]**

(Figs. 29 – 30)

*Formica badia* Smith, 1857. Jour. Proc. Linn. Soc. London. Zool. 2: 54. SINGAPORE.

Combination in *Camponotus* Roger, 1863. Berl. Ent. Zeit. 7: 3.

*Camponotus (Colobopsis) badius* Chapman and Capco, 1951. Monogr. Inst. Sci. Tech. Manila 1: 222.

*Worker maj:* TL = 8 mm; HL = 3.07 mm; HW = 2.92 mm; CI = 95.11 mm; SL = 2.30 mm; SI = 78.76 mm; ED = 0.46 mm; PW = 2.46 mm; AL = 4 mm.

*Colour:* Head and abdomen black; mandibles, flagellum, thorax, legs reddish brown, shaded with fuscous on thorax above and on tibiae; eyes bronzen brown.

*Sculpture and Hair pattern:* Head and thorax granulated and punctured; abdomen feebly granulate and punctured; pubescence sparse, pale yellow; scattered erect hairs more on abdomen, shining not smooth; legs and antennae clothed with thick adpressed hairs.

*Head:* Little longer than broad, rounded posteriorly, sides convex, occiput slightly emarginate; mandibles triangular with 7 teeth. [1 apical tooth followed by 5 acute teeth]; clypeus broad, tectiform, with a broad median lobe rectangularly produced its anterior margin denticulate, with 3 median setae followed by short setae on either side; frontal lobe short, frontal carinae long, wide apart posteriorly; antennal carinae short close together; antennal scrobe short and shallow, reaching up to frontal carinae; antennae slender, filiform, 12 jointed, antennal scape cylindrical, short not extending beyond the vertex; funicular segments longer than broad; club single segmented. Relative measurements of length of antennal segments: Scape = 2.30 mm; F<sub>1</sub> = 0.53 mm; F<sub>2</sub> = 0.45 mm; F<sub>3</sub> = 0.38 mm; F<sub>4</sub> = 0.38 mm; F<sub>5</sub> = 0.30 mm; F<sub>6</sub> = 0.38 mm; F<sub>7</sub> = 0.38 mm; F<sub>8</sub> = 0.23 mm; F<sub>9</sub> = 0.30 mm; F<sub>10</sub> = 0.23 mm; Club(F<sub>11</sub>) = 0.30 mm. Eyes moderately small, frontal rather than lateral.

*Thorax:* Short, massive; pronotum broad posteriorly, narrowed anteriorly, constricted and connected with occipital condyle; pro-meso and meso-metanotal suture distinct; meso-metanotal spiracle and metanotal spiracle distinct; metanotum posteriorly slopered forming a constriction; legs short, tibiae compressed, longitudinally channeled, with scattered spines beneath.

**Abdomen:** Petiole sessile, nodiform, single noded, petiolar node narrow, convex anteriorly, flat posteriorly, rounded above; gaster broad and massive, posterior margin with narrow dusty white line, last gastral segment with circular orifice guarded by a tuft of hairs.

**Plesiotype: Worker:** INDIA: Kerala, Thiruvananthapuram [Vithura] Karmaly, K.A., 10.iii-2000 [DZCU].

**Other materials examined:** 4W: with the same data as that of plesiotype [DZCU].

**Distribution:** INDIA: Kerala, Mianmar, Sri Lanka, Malaca, Borneo, Singapore.

**Biology:** Unknown.

**Habitat:** Found in disturbed habitats with plains and cultivated crop plants, vegetables garden: etc.

**Variation:** Abdomen shining, not smooth; tibiae with scattered spines beneath. In the description of Bingham (1903) it is stated that abdomen shining and smooth; tibiae without spines beneath. Some specimens of the Worker min: are entirely dark castaneous brown and subopaque all over (Bingham, 1903).

**Discussion:** *Camponotus badius* Smith closely resembles *Camponotus nicobarensis* Mayr in the following features: 1. Head a little longer than broad; check convex; occiput emarginate; 2. Antennae 12 jointed; 3. Mandibles with 7 teeth; 4. Thorax viewed from side forming a regular arch; 5. Petiole sessile and nodiform; 6. Hypopygium with circular anal orifice with guard hairs. However *Camponotus badius* Smith differs from *Camponotus nicobarensis* Mayr in having: 1. Clypeus broad, tectiform; median lobe rectangularly produced; anterior margin denticulate (in *Camponotus nicobarensis* clypeus sub carinate, sub lobed, anterior

margin crenate); 2. Node of pedicel convex anteriorly, flat posteriorly (in *Camponotus nicobarensis* node of pedicel convex anteriorly, concave posteriorly); 3. Abdomen broad and massive (in *Camponotus nicobarensis* abdomen broad and globose).

**Remarks:** Current subspecies nonimal plus *Saginatus* Stitz. This is the first report of this species from Kerala. Smith (1857) originally described it from Singapore. Identification at the subspecies level could not be made for want of literature.

***Camponotus [Myrmoturba] barbatus barbatus* Roger**

*Camponotus barbatus* Roger, 1863. *Berl. Ent. Zeit.* 7: 138, SRILANKA.

*Camponotus barbatus* Bingham, 1903. *Fauna. Brit. India. Hymenoptera* 2: 362.

*Camponotus (Tanaemyrmex) barbatus* Chapman and Capco, 1951. *Monogr. Inst. Sci. Tech. Manila* 1: 243.

**Worker.** TL = 6.7 mm.

**Colour.** Black, antennal joints (especially of the flagellum) and tarsi reddish; coxa and abdomen yellow; legs brown; pubescence yellow.

**Sculpture and Hair pattern:** Head posteriorly polished, very feebly and finely punctured like a net in front; abdomen rugose; erect pubescence, moderately long and dense on head; not dense on thorax; a thick row of hairs on sides of head, and beneath hair is very long and voluminous; tibiae of legs and scape of antennae with erect hairs.

**Head:** Elongate, quadrangular, sides parallel, emarginate posteriorly, slightly transverse behind; mandibles short and massive; clypeus small, sublobed, anterior margin slightly denticulate.

**Thorax:** Broad in front, abruptly, truncate posteriorly; legs stout, tibiae slightly flattened.

**Abdomen:** Pedicel sessile, nodiform; petiolar node polished, oval above, rounded or nearly truncate; gaster globose, last gastral segment ends with circular orifice guarded by guard hairs

**Distribution:** INDIA: Kerala, Sri Lanka, Philippines.

**Biology:** Unknown.

**Habitat:** Unknown.

**Discussion:** *Camponotus barbatus barbatus* Roger closely resembles *Camponotus barbatus taylori* Forel in the following features: 1. Antennae 12 segmented; 2. Pedicel sessile, nodiform; 3. Last gastral segments with circular anal orifice guarded by guard hairs. However *Camponotus barbatus barbatus* Roger differs from *Camponotus barbatus taylori* Forel in having: 1. Head quadrangular (in *Camponotus barbatus taylori* Forel head sub triangular); 2. Petiolar node rounded or nearly truncate (in *Camponotus barbatus taylori* petiolar node transverse, convex in front, flat posteriorly).

**Remarks:** Current subspecies: nominal plus *infuscoides* Bingham, *samarus* Santschi, *taylori* Forel. This specimen is not represented in the collection and the above description is based on Bingham (1903). Donisthorpe (1942) reported this subspecies and mentioned its locality as "Tenamalai, 500-800 ft, Travancore, South India."

***Camponotus [Tanaemyrmex] barbatus taylori* Forel**

*Camponotus maculatus* Fabr. race. *taylori* Forel, 1892. *Jour. Bomb. Nat. Hist. Soc.* 7: 229, 241. INDIA, [MS].

*Camponotus taylori* Bingham, 1903. *Fauna Brit. India, Hymenoptera*, 2: 353.

Combination in *Camponotus (Tanaemyrmex)* Emery, 1925. *Genera insect.* 183: 98.

*Camponotus barbatus* subsp. *taylori* Donisthorpe, 1942. *Ann. Mag. Nat. Hist.*(11) 9:458.

*Camponotus (Tanaemyrmex) barbatus* subsp. *taylori* Chapman and Capco, 1951. *Monogr. Inst. Sci. Teih. Manila* 1:243.

**Worker** maj: 7 mm - 8 mm. Worker min: 5 mm - 5.5 mm.

**Colour:** Castaneous brown; mandibles, antennae, thorax and legs lighter redder brown.

**Sculpture and Hair pattern:** Whole body minutely and closely reticulate, punctate, scattered larger punctures on head and thorax above; pubescence sparse, short, erect, a little more plentiful on anterior portion of head, cheeks and abdomen; legs covered with short, not very dense recumbent pubescence.

**Head:** Sub triangular; mandibles with 7 teeth; clypeus medially vertically carinate, median lobe of clypeus very shortly rectangularly produced; scape of antennae cylindrical; eyes comparatively small, frontal rather than lateral.

**Thorax:** Very broad and short; pronotum nearly as broad as the head; pro-mesonotal and meso-metanotal suture distinct; apex of metanotum steeply slopered; legs comparatively short and stout; tibiae cylindrical.

**Abdomen:** Pedicel sessile nodiform; petiolar node oval, transverse, convex in front, flat posteriorly; gaster short and broad, last gastral segment ends with circular orifice guarded by guard hairs.

**Distribution:** INDIA: Kerala, Tamil Nadu, Maharashtra, Orissa, Sikkim, the N.W. Himalayas and distributed mostly throughout India, Sri Lanka, Mianmar, China.

**Biology:** Unknown.

**Habitat:** Unknown.

**Discussion:** The affinities are discussed under *Camponotus barbatus barbatus* Roger.

**Remarks:** This specimen is not represented in the collection and the above description is based on Bingham (1903). However, Bingham (1903) recorded this species from Nilgiris, South India. Though Donisthorpe (1942) reported *taylori* as a subspecies from Tenamalai, Travancore.

*Camponotus [Myrmotemnus] binghamii* Forel

(Figs. 31 – 32)

*Camponotus binghamii* Forel, 1894. *Jour. Bomb. Nat. Hist. Soc.* 8: 398. MIANMAR.  
[BMNH].

*Camponotus binghamii*: Bingham, 1903. *Fauna Brit. India Hymenoptera* 2. 367.

Combination in *Camponotus (Myrmamblys)* Forel, 1914. *Rev. Sui Zool* 22:  
271.

Combination in *Camponotus (Mymotemnus)* Emery, 1920. *Rev. Zool.  
Africaine* 8: 258.

*Worker*: TL = 4.34 mm; HL = 1.18 mm; HW = 0.78 mm; CI = 56 mm; SL =  
1.5 mm; SI = 192 mm; ED = 0.12 mm; PW = 0.93; AL = 1.75 mm.

*Colour*: Mandibles, anterior portion of cheek, clypeus reddish brown; teeth  
black; remaining part of head dark brown; antennae brown; torulus reddish  
brown; eye piceous (between tawny brown and black). Thorax, node of pedicel,  
gaster, coxa, femora dark brown; tibiae, tarsi yellowish brown; posterior margin  
of gaster segments whitish brown; pubescence pale yellow; short recumbent  
white hairs also distinct.

*Sculpture and Hair pattern*: Mandibles punctured, shagreened and opaque  
towards their base; whole body punctate and striate; pubescence sparse, erect,  
whole body clothed with short thick recumbent hairs.

*Head*: Rectangular, emarginate in front and back, longer than broad,  
subtruncate in front; mandibles triangular, 6-toothed (large apical tooth, 2 basal

tooth and 3 small teeth); clypeus convex, tectiform, medially carinate, anterior margin broader than posterior margin and somewhat transverse, posterior margin crenulate; frontal lobe small, distinct; frontal carinae short, divergent posteriorly; antennal carinae short and fused; antennal scrobe short, distinct, passing above the eyes; antennae long, filiform, slender, 12 jointed; antennal scape longer, cylindrical, extending above occiput; all segments of funiculus longer than broad; club single segmented, thickened. Relative measurements of length of antennal segments. Scape = 1.5 mm;  $F_1$  = 0.18 mm;  $F_2$  = 0.18 mm;  $F_3$  = 0.25 mm;  $F_4$  = 0.25 mm;  $F_5$  = 0.18 mm;  $F_6$  = 0.18 mm;  $F_7$  = 0.18 mm;  $F_8$  = 0.21 mm;  $F_9$  = 0.18 mm;  $F_{10}$  = 0.15 mm; Club ( $F_{11}$ ) = 0.25 mm. Eyes moderate, oval, somewhat in front of the posterior 3rd of the head.

*Thorax:* Pronotum broad posteriorly, narrowed anteriorly; pro-mesonotal suture distinct; meso-metanotal suture indistinct; mesonotum distinct, submargined; legs long; tibiae cylindrical, spinous beneath; tarsi with tarsal spines.

*Abdomen:* Pedicel short, thick sessile, nodiform; node of pedicel thick, less obtuse on its upper margin; gaster with 4 visible segments; fifth gastral segment hidden below the fourth gastral segment with circular anal orifice guarded by guard hairs.

*Plesiotype: Worker:* INDIA: Kerala, Aluva, Karmaly, K.A., 15. x. 1995.

*Other materials examined:* 1W. INDIA: Kerala, Kalamassery, Karmaly, K.A., 22.iii.2000; 1W: INDIA: Kerala, Muthenga Karmaly, K.A., 25.iv.2000; 1W: INDIA: Kerala, Kollam, Karmaly, K.A., 26.vi.1997; 1W: INDIA: Kerala, Kasaragod, Sebastian, 8.x.2000.

**Distribution:** INDIA (Kerala: Kollam, Ernakulam, Wyanad, Kasaragod); upper Mianmar; Mandalay; Tenasserim.

**Biology:** Unknown.

**Habitat:** Disturbed with shurbs, herbs, trees etc.

**Variation:** Length varies from 4.8 mm - 7.8 mm. But in the description of Bingham (1903) it is stated that length varies from 3.5 mm - 7 mm.

**Discussion:** *Camponotus binghamii* Forel comes very close to *Camponotus parius* Emery in general appearance and in the following features: 1. Antennae long slender filiform, 12 jointed; 2. Thorax viewed from side forming a regular arch; 3. Abdomen with a fine thin sericeous pubescence. However *Camponotus binghamii* Forel differs from *Camponotus parsius* Emery in having: 1. Head subtriangular; 2. Clypeus convex, tectiform, medially carinate without teeth (in *Camponotus parius* clypeus convex, bicarinate, ends with two anterior teeth); 3. Petiolar node thick, less obtuse on its upper margin (in *Camponotus parius* petiolar node thin, broader than long, rounded above, posteriorly convex).

**Remarks:** This is the first report of this species from Kerala. Forel (1892) originally described it from Mianmar.

*Camponotus [Dinomyrmex] carin carin* (Emery)

(Figs. 33- 34)

*Camponotus dorycus* r. *carin* Emery, 1889. *Ann. Mus. Civ. stor. Nat. Genova.* 512.  
MIANMAR. [MCSN].

*Camponotus dorycus carin* raised to species by Dalla Torre, 1893. *Cat. Hym.* vii: 223.

*Camponotus carin* Bingham, 1903. *Fauna Brit. India, Hymenoptera* 2: 365.

Species *carin* downgraded subspecies, of *dorycus* Forel, 1915. *Tejd. voor. Ento.* 58: 37.

Subspecies *carin* raised to species, Emery, 1925. *Genera Insect* 183: 90.

**Worker:** TL = 8.65 mm; HL = 2.94 mm; HW = 2 mm; CI = 68.02 mm; SL = 2.11 mm; SI = 71.76 mm; ED = 0.27 mm; PW = 2.44 mm; AL = 3.50 mm.

**Colour:** Head and scape of antennae dark brown, thorax node of pedicel, legs, funicular segments yellowish brown; posterior margins of gastral segments with light yellow striations.

**Sculpture and Hair pattern:** Body granulate, striate; pubescence feeble more on legs; scattered yellowish erect hairs more on head.

**Head:** Elongate, oval, narrowed posteriorly occiput transverse, occipital angles not prominent; mandibles polished, triangular, sub linear 6-toothed (one strong apical teeth followed by 5-acute tooth); clypeus rather narrow, vertically carinate down the middle, median lobe slightly produced, anterior margin rectangularly produced, crenate with stiff hairs; a small depression between frontal area and posterior margin of clypeus; frontal lobe distinct; frontal carinae short wide apart posteriorly; antennal carinae short, fused, torulus rounded,

antennal scrobe groove like extending up to frontal region; antennae slender, filiform, 12 jointed; antennal scape short, extending up to vertex; all segments of funiculus longer than broad. Relative measurement of length of antennal segments. Scape 2.11 mm;  $F_1 = 0.33$  mm;  $F_2 = 0.27$  mm;  $F_3 = 0.27$  mm;  $F_4 = 0.16$  mm;  $F_5 = 0.33$  mm;  $F_6 = 0.27$  mm;  $F_7 = 0.22$  mm;  $F_8 = 0.22$  mm;  $F_9 = 0.22$  mm;  $F_{10} = 0.27$  mm; Club ( $F_{11}$ ) = 0.33. Eyes moderately small, frontal rather than lateral.

**Thorax:** Pronotum narrowed anteriorly forming a neck; pro-mesonotal and meso-metanotal suture distinct; metanotum truncate posteriorly; legs very long; tibiae slightly compressed, longitudinally channeled; tarsi narrowed with tarsal spurs.

**Abdomen:** Pedicel sessile, nodiform, petiolar node very thick at base, low and conical; gaster narrow, oval basal two segments fuscous brown; posterior two segments dark brown, nearly black; 5th gastral segment very small ends with circular orifice guarded by guard hairs.

**Plesiotype: Worker:** INDIA: Kerala, Kohinoor, Karmaly K.A., 1.iii.1995. [DZCU].

**Other materials examined:** 4W: INDIA: Kerala, Calicut University Campus, Karmaly, K.A., 16.v.1999. [DZCU].

**Distribution:** INDIA (Kerala, Malappuram); Myanmar; Tenasserim.

**Biology:** Unknown.

**Habitat:** Collected from disturbed habitats.

**Variation:** All characters are similar to that of *Camponotus carin* (Emery) minor except the number of teeth. This specimen described above is provided

with 6 teeth. In the description of Bingham (1903) it is stated that *Camponotus carin* (Emery) Worker min: with 5 teeth.

**Discussion:** *Camponotus carin* (Emery) closely comes to *Camponotus thraso* Forel in the following features: 1. Antennae 12 jointed, slender and filiform; 2. Thorax viewed from side forming a regular arch; 3. Circular anal orifice at the apex of the hypopygium ventrally guarded by guard hairs. However *Camponotus carin* (Emery), differs from *Camponotus thraso* Forel in having : 1 Head elongate, oval, narrowed posteriorly (in *Camponotus thraso* head rectangular as broad posteriorly as in front); 2. Clypeus vertically carinate down the middle, median lobe slightly produced, its anterior margin rectangularly produced [in *Camponotus thraso* Clypeus carinate, with a short lobe, its anterior margin transverse, not rectangularly produced]; 3. Mandibles 6-toothed (in *Camponotus thraso* mandibular teeth obsolete); 4. Pronotum narrowed anteriorly forming a neck (in *Camponotus thraso* pronotum slightly narrowed not forming a distinct neck); 5. Promesonotal and meso-metanotal sutures are distinct (in *Camponotus thraso* promesonotal suture very distinct, meso-metanotal suture indistinct); 6. Petiolar node very thick at base low and conical (in *Camponotus thraso* petiolar node biconvex, as long as broad).

**Remarks:** This species consist of nominal plus *babiensis* Emery, *tenuisquamis* Forel, *tipunus* Forel. This is the first report of this species from Kerala. Emery (1889) originally reported this species from Mianmar.

*Camponotus [Tanaemyrmex] compressus* (Fabricius)

(Figs. 35 - 36)

*Formica compressa* Fabricius, 1787. *Mant. Insect* 1: 307. INDIA. [BMNH].Combination in *Camponotus* Roger, 1863. *Berl. Ent. Zeit.* 7: 2.*Camponotus maculatus* Fabricius, race *compressus* Forel, 1892. *Jour. Bomb. Nat. Hist. Soc.* 7: 229, 240.*Camponotus compressus*, Bingham, 1903. *Fauna Brit. India, Hymenoptera* 2: 351.*Camponotus (Tanaemyrmex) compressus* Emery, 1925. *Genera Insect.* 183: 98.Combination in *Camponotus (Myrmoturba)*. Santschi, 1929. *Bull. Soci. Hist. Nat. Afri. Nord.* 20: 165.*Camponotus (Tanaemyrmex) compressus*, Chapman and Capco, 1951. *Monogr. Inst. Sci. Tech. Manila* 1. 244.*Camponotus compressus*, Tiwari et al., 1994. *State fauna series 3. Fauna of West Bengal* 8: 273.**Worker minor.** TL = 8.9 mm; HL = 2.1 mm; CI = 95 mm; SL = 2.2 mm; SI = 110; ED = 0.2 mm; PW = 0.7 mm; AL = 3.5 mm.**Colour.** Black, opaque, mandibles, flagellum of antennae and legs castaneous brown; posterior margins of the abdominal segments narrowly testaceous.**Sculpture and Hair pattern:** Whole body covered with recumbent pale white pubescence; pilosity very sparse; long, erect, golden yellow and fuscous

brown hairs on head, thorax and abdomen; node of pedicel with two straight hairs; anterior clypeal margin with a long median seta followed by 4 pairs of short setae on either side, and a few small lateral setae. Head thorax and abdomen very finely punctate and reticulate; node of pedicel and base of abdomen shining; legs finely punctate, reticulate and polished.

*Head:* Triangular; broad posteriorly, posterior margin convex, postero-lateral angles rounded, sides straight; mandibles somewhat linear; masticatory margin with one large apical tooth followed by 6 distinct teeth; clypeus flat with a median carina, the middle portion anteriorly rectangularly produced into a lobe, its anterior margin emarginate, posterior margin tectiform; frontal lobe short, frontal carinae wide apart posteriorly, antennal carinae shortly separate from clypeus; antennal scrobe small, distinct, groove like; torulus rounded; antennae slender, filiform, 12 segmented; antennal scape extending a little beyond occiput, cylindrical slightly thickening towards apex; funicular segments longer than broad; club single segmented. Relative measurements length of antennal segments: Scape = 2.2 mm;  $F_1 = 0.4$  mm;  $F_2 = 0.3$  mm;  $F_3 = 0.3$  mm;  $F_4 = 0.3$  mm;  $F_5 = 0.4$  mm;  $F_6 = 0.4$  mm;  $F_7 = 0.4$  mm;  $F_8 = 0.3$  mm;  $F_9 = 0.3$  mm;  $F_{10} = 0.2$  mm; Club ( $F_{11}$ ) = 0.3 mm. Eyes comparatively small oval, frontal rather than lateral.

*Thorax:* Thorax viewed from side forming a regular arch, pronotum anteriorly narrowed, forming a collar; pro-meso, meso-metanotal sutures prominent; sides of pronotum rounded; metanotum tectiform, basal part of metanotum sloping down; metapleural orifice distinct; legs long; tibiae compressed, prismatic; tibiae and tarsi with simple spurs.

*Abdomen:* Pedicel with sides in dorsal view slightly convex; medially shallowly concave, elongate anteriorly and posteriorly with a small rounded tubercle, petiolar node oval, transverse, convex in front, and flat posteriorly; 2nd

gasteral segment larger than the rest; length in dorsal view almost subequal to breadth; in extended condition distinctly longer than broad; posterior margin testaceous; anal orifice circular, at the apex of hypopygium ventrally, guarded by guard hairs.

*Plesiotype: Worker.* INDIA: Kerala, Thiruvananthapuram, Karmaly, K.A., 22.vi.1997 (DZCU).

*Other materials examined:* 5W: INDIA: Kerala, Thiruvananthapuram, Karmaly, K.A., 23.vi.1997; 2W: INDIA: Kerala, Kollam, Karmaly, K.A., 29.vi.1997; 5W: INDIA. Karnataka, Bangalore, Karmaly, K.A., 28.v.1999.

All specimens deposited in the Systematic Entomology Laboratory, Department of Zoology, Calicut University.

*Distribution:* INDIA: (Kerala: Thiruvananthapuram, Kollam); Tamil Nadu (Salem), Assam, West Bengal, Sri Lanka, Nepal, Myanmar, Philippines, Borneo, Russia, Arabia, Africa.

*Biology:* This is the common black ant in India. The nests are in soil and heaps of earth are brought out in the form of small files. These specimens were collected from soil. Their food is chiefly vegetable secretions, sugar etc. They bite rather severely, but the pain is quite momentary. This species is plentiful where it occurs. It is one of the ants noted for tending and keeping "ant-cattle." (R.N. Tiwari. 1999).

*Habitat:* Found in disturbed habitat such as vegetable gardens and among cultivated crops.

*Discussion:* *Camponotus compressus* [Fabricius] closely resembles *Camponotus siemsseni* Forel in the following features: 1: 12 segmented antennae; 2. Antennal scape cylindrical. 3. Anal orifice on the apex of the last gastral

segment guarded by guard hairs. However *Camponotus compressus* [Fabricius] differs from *Camponotus siemsseni* Forel in having: 1. Thorax viewed from side forming a regular arch, not interrupted by the apex of the metanotum, not being truncate (in *Camponotus siemsseni* thorax viewed from side forming a regular arch, interrupted by the apex of the metanotum, being truncate); 2. Mandibles with 7 teeth (in *Camponotus siemsseni* Forel mandibles with 6 teeth); 3. Pronotum narrowed anteriorly producing a collar (in *Camponotus siemsseni* pronotum narrowed anteriorly, not producing a collar); 4. Tibiae compressed and prismatic (in *Camponotus siemsseni* tibiae slightly compressed, not prismatic); 5. Petiolar node oval, transverse, convex in front, flat posteriorly (in *Camponotus siemsseni* petiolar node cuneiform, broad and transverse above); 5. Abdomen broad and massive (in *Camponotus siemsseni* abdomen high, convex, anteriorly steep and rounded).

**Remarks:** Fabricius (1787) originally described it from Assam. Jerdon (1851) and Donisthorpe (1943) also reported this species from South India under the genera *Formica* Linn. and *Camponotus* Mayr respectively. Negi *et al.* (1930) also reported this species under the genus *Camponotus* Mayr from Tamil Nadu (Salem).

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*Camponotus [Myrmoceriscus] dolendus* Forel

(Figs. 37 - 35)

*Camponotus rufoglaucus* r. *dolendus* Forel. 1892. *Jour. Bomb. Nat. Hist. Soc.* 7: 227, 238 INDIA. [MS].

*Camponotus dolendus* Bingham, 1903. *Fauna Brit. India. Hymenoptera* 2: 304.

Combination in *Camponotus (Myrmoseriscus)* Forel, 1914. *Rev. Suis. Zool.* 22: 268.

*Camponotus (Myrmoseriscus) dolenda* Emery, 1925. *Genera Insect* 183: 106.

*Camponotus (Myrmoseriscus) dolenda*, Chapman and Capco, 1951. *Monogr. Inst. Sci. Tech. Manila* 1: 238.

*Camponotus rufoglaucus dolenda* Tiwari et al., 1994. *State Fauna Series* 3: *Fauna of West Bengal* 8: 274.

**Worker minor.** TL = 12.77 mm; HL = 3.55 mm; HW = 4.61 mm; CI = 129.85 mm; SL = 2.33 mm; SI = 50.54 mm; ED = 0.38 mm; PW = 244 mm; AL = 4.6 mm.

**Colour:** Dead black; flagellum and legs reddish brown; posterior margin of abdominal segments narrowly testaceous; eyes metallic black.

**Sculpture and Hair patterns:** Whole body except gaster finely punctate, rugulose; gaster feebly punctate, polished. Thorax with vertical and horizontal striations; mandibles deeply granulate, polished. Head with transverse striations. Body with suberect reddish brown hairs more on gaster; pubescence sparsely. Antennae and legs with minute adpressed pubescence; tibia with scattered spines underneath, tarsi with tarsal spines.

**Head:** Subtriangular, medially broad than front and back; cheeks more convex; corners not sharply rounded; posterior margin medially slightly concave, laterally convex, widely emarginate; mandibles subtriangular, stout, polished, masticatory margin with a large apical tooth followed by 4 teeth; clypeus broad, with a median lobe distinctly rectangularly produced, emarginate, anterior margin with two long medial setae followed by short setae on either sides, its posterior margin crenulate; frontal lobe distinct; torulus much depressed; antennal scrobe deep, running above the eye, reaching to the frontal region; antennae short, slender, 12 segmented. Relative measurement of length of antennal segments: scape = 2.33 mm; F<sub>1</sub> = 0.55 mm; F<sub>2</sub> = 0.33 mm; F<sub>3</sub> = 0.33 mm; F<sub>4</sub> = 0.66 mm; F<sub>5</sub> = 0.44 mm; F<sub>6</sub> = 0.33mm; F<sub>7</sub> = 0.44 mm; F<sub>8</sub> = 0.33 mm; F<sub>9</sub> = 0.33mm; F<sub>10</sub> = 0.22 mm; Club (F<sub>11</sub>) = 0.33. Eyes moderate, posterior rather than lateral.

**Thorax:** Short, broad; pronotum anteriorly narrow; pro-meso and meso-metanotal sutures distinct; pronotum, mesonotum and basal half of the metanotum forms a gentle curve, apical half of the metanotum steeply sloped and truncate; mesopleural and metapleural gland orifice distinct; legs short, stout, compressed; tibiae with scattered spines underneath; tarsi with abundant tarsal spines.

**Abdomen:** Petiole flattend basally, conical above with 4 straight brown bristles; spiracles on peduncle situated in front of middle line; petiole postero-ventrally with a projection connecting to the gaster; gaster elongate oval, hypopygium with a round slit guarded by guard hairs.

**Plesiotype: Worker.** INDIA: Kohinoor. Karmaly, K.A., 20.iii.1999. [DZCU].

**Other materials examined:** 3W: INDIA: Karnataka, Bangalore, Karmaly, K.A., 28.v.1999; 5W: INDIA, Karnataka, Bangalore, Karmaly, K.A., 14. vi. 2001.

All specimens deposited in the Systematic Entomology Laboratory, Department of Zoology, Calicut University.

**Distribution:** INDIA: [Kerala: Malappuram], Karnataka, Tamil Nadu, Sikkim, N.W. Himalayas, West Bengal.

**Biology:** Unknown.

**Habitat:** Mixed crop area, disturbed by human interference.

**Variation:** This species exhibits the following variation. 1. Length ranging from 5.68 mm - 12.77 mm. In the description of Bingham [1903] it is stated that Length W. maj: 8 mm - 9 mm, W. min. 6 mm - 7 mm. 2. Medial lobe of clypeus triangularly produced. In the description of Bingham (1903) medial lobe of clypeus is stated as rectangularly produced.

**Discussion:** *Camponotus dolendus* Forel resembles *Camponotus parius* Emery in the following features: 1. Thorax viewed from side forming a regular arch; 2. Head, thorax and abdomen black; 3. Head subtriangular; 4. Mandibles with 5 teeth; 5. Antennae with 12 segments; 6. Hypopygium with a round slit guarded by guard hairs. However, *Camponotus dolendus* Forel differs from *Camponotus parius* Emery in having: 1. Body without lustrous silky pubescence (in *Camponotus parius* body clothed with lustrous silky pubescence); 2. Body with suberect reddish brown hairs (in *Camponotus parius* body sparsely with yellow erect hairs); 3. Petiole basally flattened, conical above (in *Camponotus parius* petiole broader than long, thin, rounded above).

**Remarks:** This is the first report of this species from Kerala. Forel (1892) originally described from India (N.W. Himalayas).

***Camponotus [Myrmoturba] invidus* Forel**

(Figs. 39 - 40)

*Camponotus invidus*. Forel, 1892. *Jour. Bomb. Nat. Hist. Soc.* 7: 234 INDIA. [MS].Combination in *Camponotus (Myrmoturba)* Forel, 1914. *Rev. Sui. Zool.* 22: 267.Combination in *Camponotus (tanaemyrmex)* Emery, 1925. *Genera. Insect.* 183: 93.*Camponotus invidus* Bingham, 1903. *Fauna. Brit. India. Hymenoptera.* 2: 367.**Worker minor:** TL = 7 mm; HL = 1.7 mm; HW = 1.1 mm; CI = 64 mm; SL = 2 mm; SI = 182 mm; ED = 0.2 mm; PW = 1.6 mm; AL = 2.3 mm.**Colour:** Pale yellow; pubescence yellowish; head, antennal scape, tarsi reddish yellow; flagellum, thorax node of pedicel, abdomen, legs pale yellow; eyes dark brown.**Sculpture and Hair patterns:** Mandibles, frontal feebly granulate, shining with adpressed hairs; clypeus granulate and rugulose; cheek, vertex and occiput with transverse striations granulate and wrinkled; some distinct punctures at the apex of the mandible; body with striations; pubescence very spars and erect; antennae and legs clothed with thick adpressed hairs. Scattered pubescence more on abdomen. Anterior margin of clypeus with bristles.**Head:** More or less elongate, oval; occiput constricted, sides straight; clypeus comparatively broad, marginate, median carina indistinct, median lobe scarcely produced, anterior margin concave at middle and convex on either side,

posterior margin somewhat 'V' shaped at middle; frontal lobe short; frontal carinae large divergent front to back, a small gap between posterior margin and frontal lobe; antennal carinae short, joined together; torulus rounded, small; antennal scrobe short, passing above the eyes, reaching up to frontal lobe; frontal region as a whole somewhat raised; mandibles triangular with three apical tooth followed by three basal teeth; antennae large, cylindrical, filiform; antennal scape passing beyond the head. Relative measurement of length of antennal segments : Scape = 2 mm; F<sub>1</sub> = 0.31 mm; F<sub>2</sub> = 0.22 mm; F<sub>3</sub> = 0.4 mm; F<sub>4</sub> = 0.31 mm; F<sub>5</sub> = 0.36 mm; F<sub>6</sub> = 0.27 mm; F<sub>7</sub> = 0.27 mm; F<sub>8</sub> = 0.22 mm; F<sub>9</sub> = 0.22 mm; F<sub>10</sub> = 0.22 mm; Club (F<sub>11</sub>) = 0.31. Eyes small, frontal rather than lateral.

*Thorax:* Very convex anteriorly, giving a high shouldered look to the insect, strongly laterally compressed posteriorly; pro-mesonotal suture distinct; meso-metanotal suture indistinct; pro-meso and metanotum more curved, apex of metanotum steeply sloping and forming a circle connected with node of pedicel; legs stout, large, tibiae somewhat cylindrical.

*Abdomen:* Pedicel short, thick, sessile, nodiform; petiolar node low, convex anteriorly, flat behind; gaster long and massive, last gastral segment with circular anal orifice guarded by guard hairs.

*Plesiotype: Worker.* INDIA, Kerala, Trissur, Usha, 28.v.1998 [DZCU].

*Other materials examined:* 4W: INDIA, Kerala, Trissur, Usha, 28.v.1998; 1W: INDIA: Kerala, Kasaragod, Sebastian, 8.x.2000; 1W: INDIA, Kerala, Kasaragod, Karmaly, K.A., 8.x.2000.

All specimens deposited in the Systematic Entomology Laboratory, Department of Zoology, Calicut University.

*Distribution:* INDIA: [Kerala: Trissur, Kasaragod]; Orissa.

**Biology:** Unknown.

**Habitat:** Disturbed.

**Variation:** Length ranging from 5 mm - 7 mm. But in the description of Bingham (1903) it is stated that length ranging from 5 mm - 6 mm.

**Discussion:** *Camponotus invidus* Forel resembles *Camponotus lamarckii* Forel in the following features: 1. Head oval; 2. Antennae slender filiform; 12 jointed; 3. Antennal scape cylindrical; 4. Eyes frontal in position; 5. Apex of metanotum steeply sloping and forming a circle connected with node of pedicel; 6. Node of pedicel convex anteriorly and flat-behind; 7. Last gastral segment with circular orifice guarded by a tuft of guard hairs. However *Camponotus invidus* Forel differs from *Camponotus lamarckii* Forel in having: 1. Tibiae somewhat cylindrical (in *Camponotus lamarckii* tibiae prismatic and longitudinally channeled); 2. Mandibles with 6 teeth (in *Camponotus lamarckii* mandibles with 5 teeth).

**Remarks:** This is the first report of this species from Kerala. Forel (1892) originally described it from Orissa.

***Camponotus [Myrmoturba] irritans irritans [Smith]***

(Figs. 41 - 42)

*Formica irritans* Smith, 1857. F. Proc. Linn. Soc. ii : 55. WEST MALAYSIA.

*Camponotus agnatus* Roger, 1863. Bull. ent. zeit. 7: 137.

*Camponotus maculatus* Fabr race *irritans* (Smith), Forel, 1892. Jour. Bomb. Nat. Hist. Soc. Vii: 230, 242.

*Camponotus (Tanaemyrmex) irritans* Fr. Smith. Chapman and Capco, 1951. *Monogr. Inst. Sci. Tech. Manila* 1: 246.

Current subspecies : nominal plus *carensis* Emery, *carinifer* Viehmeyer, *cliens* Forel, *croceomaculatus* Emery, *curtus* Emery, *fatuus* Forel, *hongkongensis* Forel, *inferior* Emery, *kubaryi* Mayr, *melanogaster* Stitz, *pallidus* Smith, *procax* Santschi, *tincuts* Smith.

*Worker maj*: TL = 10.5 mm; HL = 2.85 mm; HW = 1.70 mm; CI = 59.64 mm; SL = 2.71 mm; SI = 159.41 mm; ED = 0.35 mm; PW = 2.42 mm; AL = 4.14 mm.

*Colour*: Head and abdomen dark castaneous brown; antennae, thorax, node of pedicel and legs honey yellow.

*Sculpture and Hair pattern*: Mandibles feebly reticulate punctate, shining; head thorax and abdomen finely, lightly reticulate punctate; coxa and femora reticulate punctate; frontal, vertex, thorax node of pedicel and abdomen above with sparse erect light brown hairs; cheek devoid of pubescence; antennae and legs with thick adpressed short hairs.

*Head*: Subtriangular; convex in front, sides straight, occiput rounded; mandibles triangular 7 - toothed (apical tooth followed by 3 acute teeth and 3 denticles); clypeus tectiform, raised along the median carinae, median lobe extremely short, its anterior margin transverse, posterior margin concave in the middle, straight in the sides; frontal lobe indistinct; frontal carinae short, wide apart posteriorly; antennal carinae short and jointed together, antennal scrobe short, passing above the eye, reaching up to the frontal carinae; antennae long, slender, filiform, 12 jointed, antennal scape cylindrical; club thick and single segmented; all segments of funiculus longer than broad. Relative measurement of length of antennal segments. Scape = 2.71 mm; F<sub>1</sub> = 0.35 mm; F<sub>2</sub> = 0.5 mm; F<sub>3</sub> =

0.42 mm;  $F_4 = 0.35$  mm;  $F_5 = 0.35$  mm;  $F_6 = 0.42$  mm;  $F_7 = 0.35$  mm;  $F_8 = 0.42$  mm;  $F_9 = 0.5$  mm;  $F_{10} = 0.5$  mm; Club ( $F_{11}$ ) = 0.35 mm. Eyes moderately small, frontal rather than lateral.

**Thorax:** Pronotum broader posteriorly, narrowed anteriorly; pro-mesonotal suture distinct; meso-metanotal suture feebly distinct; propodeum steeply sloping from ventral base of petiole forming a circle; legs comparatively long, tibiae slightly compressed, with scattered short spines beneath; tarsi with tarsal spines.

**Abdomen:** Pedicel short, sessile, nodiform; petiolar node conical, convex in front, flat posteriorly; gaster short, narrower than head; posterior margins of gaster with scanty white band; last gastral segment ends with circular anal orifice, guarded by guard hairs.

**Plesiotype: Worker.** INDIA: Kerala, Aluva, Karmaly, K.A., 19.x.1995 [DZCU].

**Other materials examined:** 1W: INDIA, Kerala, Kovalam (Kollam), Karmaly, K.A., 14.xi.1995; 1 W: INDIA, Kerala, Vithura, Karmaly, K.A., 8.iii.2000; 1W: INDIA : Kerala, Kasaragod, Sebastian, K.A., 8.x.2000; 1W: INDIA: Kerala, Calicut University Campus, Karmaly, K.A., 11.x.2000; 5W: INDIA: Hyderabad, Tenali (Andhra) Mary, 10.viii.2000.

All specimens deposited in the Systematic Entomology Laboratory, Department of Zoology, Calicut University.

**Distribution:** INDIA (Kerala; Thiruvananthapuram, Kollam, Ernakulam, Malappuram, Kasaragod), Hyderabad, Sri Lanka, Malay Peninsula, Bangkok.

**Biology:** Unknown.

**Habitat:** Collected from disturbed habitat with grass, shrubs, herbs and trees.

**Variation:** Length varies from 8.11 mm - 10.5 mm. In the description of Bingham (1903) it is stated that length varies from 8 mm - 10 mm.

**Discussion:** *Camponotus irritans* [Smith] comes very close to *Camponotus basalis* Smith in general appearance and in the following features: 1. Antennae long, slender, filiform and 12 jointed; 2. Thorax viewed from side forming a regular arch; 3. Tibiae compressed; spinous beneath. However *Camponotus irritans* Smith differs from *Camponotus basalis* Smith in having: 1. Head subtriangular (in *Camponotus basalis* Smith, head somewhat rectangular); 2. Clypeus tectiform raised along the medial carinae, median lobe extremely short; (in *Camponotus basalis* clypeus broadly produced in the middle into a lobe); 3. Node of pedicel narrow, conical, convex in front, flat posteriorly (in *Camponotus basalis* node of pedicel oval, transverse, convex in front, flat posteriorly).

**Remarks:** This is the first report of this species from Kerala. Smith [1857] originally described it from West-Malaysia under the genus *Formica* Linn.

***Camponotus* [Tanaemyrmex] keralensis sp. nov.**

(Figs. 43-44)

**Worker.** TL = 5 mm; HL = 1.2 mm; HW = 0.94 mm; CI = 78.33 mm; SL = 1.03 mm; SI = 109.57 mm; ED = 0.23 mm; PW = 0.73 mm; AL = 1.9 mm.

**Colour:** Very dark cartaneous brown; antennae, pedicel, legs lighter than remaining parts; basal half of the scape, 1st funicular segment, coxa, trochanter, tarsi, pale yellowish brown; pronotum reddish brown.

**Sculpture and Hair pattern:** Whole body very minutely reticulate punctate; pubescence almost absent; very scanty scattered erect hairs visible; abdomen shining.

**Head:** Rectangular, as broad posteriorly as in front; cheeks straight; occiput rounded; mandibles moderately broad, 6-toothed (one apical tooth followed by 5 acute teeth); clypeus carinate with a short lobe, its anterior margin transverse, posterior margin concave; frontal lobe distinct; frontal carinae short, wide apart posteriorly; antennal carinae short, moderately close together, divergent posteriorly; antennal scrobe very short; antennae slender, filiform, 12 jointed, antennal scape extending above the vertex; all segments of funiculus longer than broad; club single segmented, longer than other funicular segments. Relative measurement of length of antennal segments. Scape = 1.03 mm;  $F_1 = 0.23$  mm;  $F_2 = 0.23$  mm;  $F_3 = 0.23$  mm;  $F_4 = 0.33$  mm;  $F_5 = 0.28$  mm;  $F_6 = 0.23$  mm;  $F_7 = 0.19$  mm;  $F_8 = 0.14$  mm;  $F_9 = 0.23$  mm;  $F_{10} = 0.19$  mm; Club ( $F_{11}$ ) = 0.38 mm. Eyes small, situated above the midlength of head, postero-lateral.

**Thorax:** Viewed from side forming a regular arch, somewhat depressed in front, strongly compressed posteriorly; pronotum anteriorly rounded, narrow, posteriorly broad; pro-mesonotal suture distinct; meso-metanotal suture indistinct; propodeum steeply sloping from ventral base of petiole; legs short; tibiae compressed, not prismatic, destitute of spines beneath; basal region of tarsi rounded, slightly curved, tibial spurs visible.

**Abdomen:** Pedicel sessile, nodiform; petiolar node convex anteriorly flat posteriorly; gaster laterally forming an arch, elongate, last gastral segment ends with circular anal orifice guarded by guard hairs.

**Holotype: Worker.** INDIA: Kerala, Bharanaganam [Kottayam], Sureshan P.M., 28.x.2000 [DZCU].

**Paratype:** 1W: With the same data as that of holotype [DZCU].

**Distribution:** INDIA: [Kerala: Kottayam].

**Biology:** Unknown.

**Habitat:** Collected from disturbed habitats.

**Etymology:** Named after the locality of collection.

**Discussion:** This new species comes close to *Camponotus thraso* Forel in the following characters: 1. Head rectangular; 2 Clypeus carinate with a short lobe, its anterior margin transverse; 3. Antennae slender filiform, 12 jointed; 4. Thorax viewed from side forming a regular arch; 5. Circular anal orifice at the apex of the hypopygim ventrally guarded by guard hairs. However it differs from *Camponotus thraso* Forel in having: 1. Teeth not obsolete (in *Camponotus thraso* teeth obsolete); 2. Meso-metanotal suture distinct (in *Camponotus thraso* meso-metanotal suture indistinct); 3. Petiolar node convex in front, flat posteriorly (in *Camponotus thraso* petiolar node biconvex as long as broad).

***Camponotus [Myrmoturba] lamarckii* Forel**

(Figs. 45 - 46)

*Camponotus lamarckii* Forel, 1892. *Jour. of Bomb. Nat. Hist. Soc.* 7: 236. INDIA.  
[BMNH].

*Camponotus lamarckii* Bingham, 1903. *Fauna. Brit. India. Hymenoptera* vol.2, 365.

Combination in *Camponotus (Myrmoturba)* Forel, 1914. *Rev. Sui. Zool.* 22:  
267.

Combination in *Camponotus (Tanaemyrmex)* Emery, 1925. *Genera Insect.* 183:  
94.

*Camponotus (Tanaemyrmex) lamarckii* Chapman and Capco, 1951. *Monogr. Inst.*  
*Sci. Tech. Manila* 1: 248.

**Worker min:** TL 7.36 mm; HL = 2.05 mm; HW = 1.89 mm; CI = 92.19 mm;  
SL = 1.7 mm; SI = 89.94 mm; ED = 0.26 mm; PW = 1.78 mm; AL = 3 mm.

**Colour:** Reddish testaceous to dark brownish black; funiculus, legs  
yellowish brown; tarsi reddish brown; eyes brown; pubescence yellowish brown.

**Sculpture and Hair pattern:** Mandibles punctured, polished; clypeus  
reticulate, punctate; frontal rugulose, punctate; cheek, antennal scrobe granulate;  
vertex rugulose, somewhat shining; short adpressed hairs more on antennae and  
legs; few on head thorax and abdomen; erect pubescence more on head and  
abdomen.

**Head:** Long, triangular, broadest below the vertex, cheek straight, vertex  
convex, occiput rounded, concave lateral angle prominent, rounded; mandibles,

triangular, 5-toothed (one acute tooth-sharp and curved followed by 4 basal teeth, equal in size); clypeus convex vertically carinate down the middle, middle lobe slightly produced, its anterior margin distinctly but very slightly and widely emarginate, posterior margin immediately connected to frontal lobe, medially concave; frontal carinae short, wide apart posteriorly; antennal scrobe short, groove like, passing above the eyes reaching up to frontal carinae; antennal carinae short and fused; antennae short, filiform, 12 jointed; antennal scape not extending beyond the occiput; all the segments of funiculus longer than broad, club single segmented, thickened. Relative measurement of length of antennal segment. Scape = 1.21 mm;  $F_1 = 0.26$  mm;  $F_2 = 0.26$  mm;  $F_3 = 0.26$  mm;  $F_4 = 0.21$  mm;  $F_5 = 0.21$  mm;  $F_6 = 0.21$  mm;  $F_7 = 0.21$  mm;  $F_8 = 0.28$  mm;  $F_9 = 0.15$  mm;  $F_{10} = 0.21$  mm; Club ( $F_{11}$ ) = 0.26 mm. Eyes moderate, rounded, frontal rather than lateral.

*Thorax:* Arched in lateral view; pronotum broad posteriorly, narrowed anteriorly, connected to occiput; pro-mesonotal suture and meso-metanotal suture distinct; apical region of metanotum steeply sloping forming circular at the ventral base of petiole; legs long; tibiae prismatic, longitudinally channeled, spinous beneath; tarsi with tarsal spurs.

*Abdomen:* Pedicel sessile, nodiform; petiolar node thick narrow anteriorly at base, flat above, slightly convex, margin transversely rounded; gaster large, oval, massive with 4 visible segments, 5th one hidden by 4th segment, and ends with circular anal orifice guarded by guard hairs. Posterior margin of gastral segments with narrow whitish yellow band.

*Plesiotype: Worker.* INDIA: Kerala, Kohinoor, Karmaly, K.A., 22.ii.1995, [DZCU].

**Other materials examined:** 3W: With the same data as that of plesiotype [DZCU].

**Distribution:** INDIA: (Kerala: Malappuram), Northern India (Smythies), Sikkim (Möller).

**Biology:** Unknown.

**Habitat:** Disturbed with herbs, shrubs, trees etc.

**Discussion:** *Camponotus lamarckii* Forel resembles to *Camponotus invidus* Forel in general appearance and in the following features: 1. Head oval; 2. Antennae slender filiform, 12 jointed; 3. Antennal scape cylindrical; 4. Eyes frontal in position; 5. Apex of metanotum steeply sloping and forming a circle connected with node of pedicel; 6. Petiolar node convex anteriorly and flat behind; 7. Last gastral segment with circular orifice guarded by a tuft of guard hairs. However *Camponotus lamarckii* Forel differs from *Camponotus invidus* Forel in having: 1. Tibiae prismatic and longitudinally channeled; (in *Camponotus invidus* tibiae somewhat cylindrical); 2. Mandibles 5-toothed (in *Camponotus invidus* mandibles 6-toothed).

**Remarks:** This is the first report from Kerala. Forel (1892) originally described it from Northern India (Smythies).

***Camponotus [Orthanotomyrmex] mendax mendax* Forel**

(Figs. 47 - 48)

*Camponotus sericeus* var *mendax* Forel, 1895. *Jour. Bomb. Nat. Hist. Soc.* 9: 454.  
ORISSA. [MS].

*Camponotus mendax* Bingham, 1903. *Fauna Brit. India Hymenoptera*, 2: 370.

*Camponotus (Orthonotomyrmex) Sericeus var mendax* Chapman and Capco, 1951.  
*Honogs. Inst. Sci. Tech. Manila* 1. 242.

**Worker:** TL = 9.18 mm; HL = 2.16 mm; HW = 3.07 mm; CI = 142.12 mm; SL = 2.46 mm; SI = 80.13 mm; ED = 0.30 mm; PW = 1.53 mm; AL = 3.15 mm.

**Colour:** Mandibles and scape of antennae dark reddish brown; clypeus, head, legs dull red; thorax node of pedicel and abdomen brown, funicular segments yellowish brown.

**Sculpture and Hair pattern:** Head sparsely clothed with silky pubescence; mandibles, lower side of head, antennae, thorax, abdomen, femora, tibiae and tarsi densely covered with a silky golden recumbent pubescence; fairly thick setae pale yellow erect hairs also distinct; mandible feebly sculptured, number of small foveola distinct, and shining; head rugulose, granulate; thorax, node of pedicel, abdomen and legs rugulose.

**Head:** Somewhat subquadrate, massive, broad at the occiput, lateral angles round, prominent, cheek convex, mandibles triangular with 6 teeth (a large apical tooth followed by 5 acute teeth); clypeus broad, tectiform without carinae, not lobed, its anterior margin transverse, concave at the middle, feebly denticulate; posterior margin immediately connected with the frontal lobe; frontal carinae long and divergent; antennal carinae short and fused; antennal scrobe shallow reaching up to frontal region; toruli short and horizontal; antennae short, slender and filiform; antennal scape cylindrical extending beyond the occiput, antennal segments longer than broad. Relative measurements of antennal segments: Scape = 2.46 mm; F<sub>1</sub> = 0.38 mm; F<sub>2</sub> = 0.38 mm; F<sub>3</sub> = 0.46 mm; F<sub>4</sub> = 0.46 mm; F<sub>5</sub> = 0.38 mm; F<sub>6</sub> = 0.46 mm; F<sub>7</sub> = 0.30 mm; F<sub>8</sub> = 0.23 mm; F<sub>9</sub> = 0.38 mm; 10 = 0.30 mm; Club (F<sub>11</sub>) = 0.36 mm. Eyes moderately small, frontal rather than lateral.

*Thorax:* Forming a regular arch in lateral view; pronotum broad posteriorly, slightly narrowed anteriorly, connected with occipital condyle; pro-mesonotal suture distinct; meso-metanotal suture feebly distinct; metanotum remarkably broad, its basal portion forming a regular curve, with pro and mesonotum, apical half more steeply sloped, obliquely truncate; legs comparatively long; tibiae compressed, not channeled; tarsi with tarsal spines.

*Abdomen:* Petiole sessile, nodiform, petiolar node very thick, biconvex, transverse above; gaster large and massive; posterior margins of gastral segments with whitish brown; anal orifice at the apex of hypopygium guarded by guard hairs.

*Plesiotype: Worker:* INDIA: Kerala, Kasaragod, Sebastian, K.A. 8. x. 2000 [DZCU].

*Other materials examined:* 1W: INDIA: Kerala, Wyanad, Karmaly, K.A., 8.vii.1995; 3W: INDIA: Kerala, Kasaragod, Sebastian, K.A., 8.x.2000; 1W: INDIA: Kerala, Kareekad [Ernakulam], Salini, 8.x.2000.

All specimens deposited in the Systematic Entomology Laboratory, Department of Zoology, Calicut University.

*Distribution:* INDIA: [Kerala: Ernakulam, Kasaragod, Wyanad), Karnataka (Mysore).

*Biology:* Unknown.

*Habitat:* Found both in undisturbed and disturbed habitats.

*Variation:* Length varies from 9.18 mm - 13.2 mm; hind tibia not channeled. But in the description of Bingham (1903) it is stated that length 10 mm; hind tibiae channeled.

**Discussion:** *Camponotus mendax* Forel closely resembles *Camponotus rufoglaucus* [Jerdon] in the following features: 1. Antennae 12 jointed; 2. Antennal scape cylindrical; 3. Thorax forming a regular arch in lateral view; 4. Tibiae of legs compressed; 5. Circular anal orifice at the apex of hypopygium ventrally and guarded by guard hairs. However *Camponotus mendax* Forel differs from *Camponotus rufoglaucus* [Jerdon] in having: 1. Head subquadrate (in *Camponotus rufoglaucus* head subtriangular); 2. Clypeus without median lobe, its anterior margin transverse, feebly denticulate (in *Camponotus rufoglaucus* clypeus with distinct median lobe produced anteriorly, its anterior margin crenate); 3. Mandibles [Worker maj] with 7 teeth (in *Camponotus rufoglaucus* (Worker maj) mandibles with 6 teeth); 4. Petiolar node very thick, biconvex, transverse above (in *Camponotus rufoglaucus* petiolar node of thick, slightly convex anteriorly).

**Remarks:** Current subspecies nominal plus *intiger* Forel. This is the first report of this species from Kerala. Forel (1895) originally described it from Orissa. Bingham (1903) reported this species from Mysore, Southern India. But Chapman and Capco (1951) recorded this species as a variety from the same locality of South India.

***Camponotus [Myrmotarsus] misturus fornaronis* Forel**

(Fig. 49 - 50)

*Camponotus mistura* subsp. *fornaronis* Forel, 1892. *Jour. Bomb. Nat. Hist. Soc.* 7: 232, INDIA. [MS].

Combination in (*Myrmotarsus*) Emery, 1925. *Genera Insect* 183: 135.

*Camponotus fornaronis* Bingham, 1903. *Fauna. Brit. India Hymenoptera* 2: 360.

Sub species of *misturus* Forel, 1911. *Sitz. der. konig. Bayer. Akademic der Wissen Mathe. Physika klasse* 290.

*Worker maj*: TL = 14.54 mm; HL = 4.81 mm; HW = 3.54 mm; CI = 73.59 mm; SL = 2.63 mm; SI = 74.29 mm; ED = 0.54 mm; PW = 2.18 mm; AL = 5.09 mm.

*Colour*: Head reddish brown; mandibles dark brown; eyes greyish brown; scape of antennae dark brown; thorax, legs, funiculus, petiole pale yellow; gaster fuscous with yellowish tinch; pubescence and pilosity yellow.

*Sculpture and Hair pattern*: Head granulate, feebly reticulate; posterior angles of the head and thorax somewhat shining; thorax and abdomen very feebly rugulose. The whole body covered with short indistinct yellow pubescence; long yellow pilosity more on gaster.

*Head*: Subtriangular, broader than long; posterior margin emarginate; clypeus tectiform almost quadrangular, anterior margin of clypeus concave with well developed setae, crenate, median lobe shortly produced forward, clypeal margin emarginate; mandibles linear, strongly curved near their apex, armed with 6 teeth, [apical tooth strong and curved followed by 5 teeth]; frontal lobes small, frontal carinae short and parallel, long setae in the posterior end of frontal lobe, medially also with setae of some length; torulus circular; antennal carinae distinct; antennal scrobe short, shallow, reaching up to frontal lobes; antennae 12 jointed; antennal scape somewhat wider and compressed; funicular segments longer than broad. Relative measurements of length of antennal segments : Scape 2.63 mm; F<sub>1</sub> = 0.45 mm; F<sub>2</sub> = 0.54 mm; F<sub>3</sub> = 0.63 mm; F<sub>4</sub> = 0.54 mm; F<sub>5</sub> = 0.63 mm; F<sub>6</sub> = 0.45 mm; F<sub>7</sub> = 0.45 mm; F<sub>8</sub> = 0.45 mm; F<sub>9</sub> = 0.36 mm; F<sub>10</sub> = 0.36 mm; Club (F<sub>11</sub>) = 0.63 mm. Eyes small, oval, situated at the middle, more towards the frontal region; vertex rounded.

**Thorax:** Viewed from side forming a regular arch; pronotum anteriorly narrowed connected with occipital condyle; pro-mesonotal and meso-metanotal sutures distinct; lateral corners rounded; propodeum truncate; propodeal spiracle distinct; lateral sides finely margined; legs long, powerful; tarsi narrow with tarsal spurs.

**Abdomen:** Petiole with short peduncle in front; petiolar node small, convex in front, flat posteriorly, connected with 1st gastral segment; gaster oval and massive, last gastral segment with circular anal orifice guarded by guard hairs.

**Plesiotype: Worker:** INDIA: Kerala: Calicut University Campus, Karmaly, K.A., 16.v.1999.

**Other materials examined:** 5W: INDIA: Kerala, Calicut University Campus, Karmaly, K.A., 16.v.1999; 2W: INDIA: Kerala, Thekkady, Karmaly, K.A., 27.ii.1995; 3W: INDIA: Kerala, Kochi, Karmaly, K.A., 8.vi.1995.

All specimens deposited in the Systematic Entomology Laboratory, Department of Zoology, Calicut University.

**Distribution:** INDIA: [Kerala, Idukki, Ernakulam, Malappuram].

**Biology:** Unknown.

**Habitat:** Collected from both disturbed and undisturbed habitat.

**Variation:** Length varies from 8 mm - 14.54 mm. In the description of Bingham (1903) it is stated that length varies from 12 mm - 13 mm).

**Discussion:** *Camponotus misturus fornaronis* Forel closely resembles *Camponotus misturus* [Smith] in the following features: 1. The whole insect very finely and densely punctured granulate and moderately covered with erect hairs; 2. Antennae 12 jointed; 3. Mandibles with 6 teeth; 4. Antennal scape

quadrangular; 5. The clypeus very feebly carinate, the median lobe is very shortly produced, and its anterior margin is notched in the middle; 6. Circular anal orifice at the apex of the hypopygium guarded by guard hairs. However, *Camponotus fornaronis* Forel differs from *Camponotus misturus misturus* [Smith] in having: 1. Thorax more arched (in *Camponotus misturus* thorax simply arched; 2. Sculpture much feebler (in *Camponotus misturus* finely sculptured; 3. Petiolar node is thicker and has an obtuse margin (in *Camponotus misturus* petiolar node is thicker and has an acute margin); 4. Has only an extremely short fine indistinctly yellow pubescence (in *Camponotus misturus* has a distinct though sparse, rather long recumbent pubescence); 5. Antennal scape is somewhat wider and more depressed (in *Camponotus misturus* antennal scape is wider and depressed).

**Remarks:** Bingham (1903) raised *Camponotus mistura* sub. sp. *fornaronis* Forel to species *Camponotus fornaronis* Forel. Forel (1911) downgraded this species as subspecies of *misturus* Forel.

***Camponotus [Myrmoturba] mitis* [Smith]**

(Figs. 51- 52)

*Formica mitis* Smith, 1858. *Cat. Hym. Brit. Mus.* 6: 20. SRILANKA. [MS].

*Formica ventralis* Smith, 1858. *Cat. Hym. Brit. Mus.* 6.20.

*Camponotus maculatus* Fabr, 1892. race *mitis* Forel, *Jour. Bomb. Nat. Hist. Soc.* 7: 230, 242.

*Camponotus mitis* Bingham, 1903. *Fauna Brit. India. Hymenoptera* 2: 355.

*Camponotus mitis* Negi et al., 1930. *Jour. Bomb. Nat. Hist. Soc.* 34(1): 186.

*Camponotus (Tanaemyrmex) variegatus* var. *mitis* Chapman and Capco, 1951.  
*Monogr. Inst. Sci. Tech. Manila* 1: 252.

**Worker min:** TL = 7.39 mm; HL = 1.78 mm; HW = 1.43 mm; CI = 80.33 mm;  
SL = 1.08 mm; SI = 75.52 mm; ED = 0.30 mm; PW = 1.65 mm; AL = 3 mm.

**Colour:** Head, antennal scape, abdomen dark fuscous brown; flagellum and legs testaceous brown; pronotum light brown; mesonotum and metanotum shaded with fuscous brown; node of pedicel yellowish brown; tarsi reddish brown; pubescence light yellowish brown; eyes black.

**Sculpture and Hair patterns:** Mandibles shagreened with small scattered fovea; body granulate, rugulose, with adpressed hairs; pubescence erect, sparse on the head and thorax, more plentiful on abdomen; short fairly close, recumbent hairs on legs and antennae.

**Head:** Rectangular, sides parallel, occiput emarginate, rounded, narrowed; mandibles triangular with 6 teeth (one apical tooth followed by two acute and two small teeth); clypeus medially vertically carinate, middle portion anteriorly rectangularly produced into a lobe, anterior margin transverse, posterior margin crenulate, small depression in between posterior margin of clypeus and frontal lobe; frontal lobe distinct, small, frontal carinae long and divergent posteriorly; antennal carinae short, fused; torulus horizontal; antennal scrobe short, passing above the eye, reaching up to frontal carinae; antennae long, slender, filiform, 12 segmented; antennal scape cylindrical, long and passing beyond the vertex of the head; funicular segments longer than broad. Relative measurements of length of antennal segments: Scape = 1.08 mm; F<sub>1</sub> = 0.30 mm; F<sub>2</sub> = 0.30 mm; F<sub>3</sub> = 0.39 mm; F<sub>4</sub> = 0.34 mm; F<sub>5</sub> = 0.30 mm; F<sub>6</sub> = 0.34 mm; F<sub>7</sub> = 0.26 mm; F<sub>8</sub> = 0.21 mm; F<sub>9</sub> = 0.34

mm;  $F_{10} = 0.26$  mm; Club ( $F_{11}$ ) = 0.30 mm. Eyes small, oval rather frontal than lateral.

*Thorax:* Stout; pronotum broad posteriorly, narrow anteriorly; pro-meso, meso-metanotal sutures distinct; metanotum posteriorly slopered without declivity; legs moderately long; femora slightly compressed; tibiae prismatic, longitudinally channeled; tarsi with thick tarsal spurs.

*Abdomen:* Pedicel sessile, nodiform; petiolar node oval, tranverse, convex infront, flat posteriorly; abdomen long, massive; gaster with four visible segments; apical margin of hypopygium forming a circular emargination anal orifice guarded by guard hairs.

*Plesiotype: Worker:* INDIA: Kerala, Vithura [Thiruvananthapuram] Karmaly, K.A., 8.iii.2000. [DZCU].

*Other materials examined:* 1W: INDIA: Kerala: Kohinoor, Karmaly. K.A., 1.iii.1995; 5W: INDIA: Kerala, Aluva, Karmaly. K.A., 10.ii.1995; 2W: INDIA: Kerala, Anakampoil, Pramod, 24.vi.1995; 2W: INDIA, Kerala, Wyanad, Karmaly. K.A., 8.vii.1995; 1W: INDIA: Kerala, Silent Valley (Palakkad). Alloak, 24.i.2001.

All specimens deposited in the Systematic Entomology Laboratory, Department of Zoology, Calicut University.

*Distribution:* INDIA: [Kerala: Thiruvananthapuram, Ernakulam, Palakkad, Malappuram, Calicut, Wyanad], Tamil Nadu; Sri Lanka, China, Indonesia (Java, Sumatra, Timor, Celebes), New Guinea, Prince Island.

*Biology:* Unknown.

*Habitat:* Disturbed.

*Variation:* Length varies from 6 mm - 7.5 mm.

**Discussion:** *Camponotus mitis* (Smith) resembles *Camponotus pallidus* Smith in the following features: 1. Thorax viewed from side forming a regular arch; 2. Head rectangular, sides parallel, occiput rounded, and narrowed; 3. Antennae with 12 segments; 4. Mandibles with 6 teeth; 5. Median lobe of clypeus rectangularly produced; 6. The apex of hypopygium forming circular anal orifice guarded by guard hairs. However *Camponotus mitis* (Smith) differs from *Camponotus pallidus* Smith in having: 1. Distance between the antennal carinae equal to distance between eyes and antennal carinae (in *Camponotus pallidus* distance between antennal carinae distinctly greater than between eyes and antennal carinae); 2. Tibiae prismatic, longitudinally channeled (in *Camponotus pallidus* tibiae subcylindrical not longitudinally channeled); 3. Abdomen comparatively broad long and massive (in *Camponotus pallidus* abdomen oval somewhat large and massive).

**Remarks:** This is the first report of this species from Kerala. Smith (1858) originally described from Sri Lanka. Negi *et al.* (1930) reported this species from Salem - Tamil Nadu, South India.

***Camponotus [Myrmothrix] nicobarensis nicobarensis* Mayr**

(Figs. 53 - 54)

*Camponotus nicobarensis* Mayr, 1865. *Novara Reise Formicid.* 1. NICOBARIS. [NHMW].

*Camponotus nicobarensis* Bingham, 1903. *Fauna Brit. India, Hymenoptera* 2: 364.

Combination in *Camponotus (Myrmothrix)* Forel, 1914. *Rev. Sui. Zool.* 22: 269.

Combination in *Camponotus (Myrmoturba)* Emery, 1920. *Rev. Zool. Afric* 8: 255.

Combination in *Camponotus (Tanaemyrmex)* Emery, 1925. *Genera. Insect.* 183: 95.

*Camponotus (Tanaemyrmex) nicobarensis* var. *exiguogattatus* Forel, Chapman and Capco, 1951. *Monogr. Inst. Sci. Tech. Manila* 1: 249.

**Worker maj:** TL = 6.2 mm; HL = 2.2 mm; HW = 1.8 mm; CI = 31.8 mm; SL = 1.7 mm; SI = 77 mm; ED = 0.26 mm; PW = 1.4 mm; AL = 2.7 mm.

**Colour:** Head, thorax, petiolar node brownish red, subcoriaceous; legs lighter brown; 1st tarsal segment, mandibles, scape of antennae dark brown, posterior portion of the abdomen shaded with fuscous.

**Sculpture and Hair pattern:** Mandibles feebly rugulose, somewhat shining; head granulate, rugulose; striations on the thorax; node of pedicel, gaster and tibiae feebly granulate; body covered with short hairs; pilosity restricted to some sparse, suberect, strong, brownish yellow hairs on gaster; very few on head, thorax, and pedicel; body completely clothed with thin appressed silky pubescence, thick on flagellum of antennae and on legs.

**Head:** Subtriangular; longer than breadth (length and breadth subequal); broader posteriorly than in front; occiput emarginate; cheek slightly convex; mandibles short and broad with 7 teeth, articulation of mandibles distinctly but slightly remote from the lower corner of the cheeks; masticatory margins longer than inner margin with large acute apical tooth followed by 6 teeth; clypeus carinate, sublobed, anterior margin crenulate; antennal scrobe short, shallow, running above the eyes, almost reaches up to posterior margin of the eye; frontal lobe parallel; frontal carinae distinct; torulus circular; antennal carinae distinct; antennae long, slender, filiform, 12 jointed; funiculus longer than broad; antennal scape reaching up to posterior margin of head. Relative measurement

of length of antennal segments: Scape = 1.7 mm;  $F_1$  = 0.4 mm;  $F_2$  = 0.26 mm;  $F_3$  = 0.4 mm;  $F_4$  = 0.33 mm;  $F_5$  = 0.4 mm;  $F_6$  = 0.26 mm;  $F_7$  = 0.26 mm;  $F_8$  = 0.26 mm;  $F_9$  = 0.33 mm;  $F_{10}$  = 0.26 mm; Club ( $F_{11}$ ) = 0.46 mm. Eyes moderate, oval, situated above the middle line of head.

**Thorax:** Arched above, moderately broad; pronotum narrowed anteriorly; pro-mesonotal suture prominent; meso-metanotal suture feebly distinct; propodeum convex; propodeal spiracle present, propodeum steeply sloping from ventral base of petiole; legs short, tibiae very distinctly flattened and longitudinally channeled.

**Abdomen:** Petiole sessile, nodiform, petiolar node convex anteriorly rounded above, concave behind, petiole posteriorly connected with gaster; gaster sub globose, last gastral segment ends with circular anal orifice guarded by guard hairs; posterior region of the abdomen shaded with fuscous brown.

**Plesiotype: Worker:** INDIA: Kerala, Malappuram. Calicut University Campus, Karmaly, K.A., 16.v.1999 [DZCU].

**Other materials examined:** 1W: INDIA, Kerala, Calicut University Campus, Karmaly. K.A., 8.iv.1995 [DZ CU].

**Distribution:** INDIA: [Kerala: Calicut]; Assam, Singala, Kalimapong, Eastern Himalayas; Nicobars, Kobo, Cochin-China, Myanmar.

**Biology:** Unknown.

**Habitat:** Mixed crop area, disturbed by human interference.

**Variation:** Length varies from 6.2 mm - 8 mm. However in the description of Bingham (1903) it is stated that length ranges from 7 mm - 8 mm.

**Discussion:** *Camponotus nicobarensis* Mayr closely resembles *Camponotus badius* [Smith] in the following features: 1. Head a little longer than broad, cheek convex, occiput emarginate; 2. Antennae 12 jointed; 3. Mandibles with 7 teeth; 4. Thorax viewed from side forming a regular arch; 5. Petiole sessile and nodiform; 6. Hypopygium with circular anal orifice with hairs. However *Camponotus nicobarensis* Mayr differs from *Camponotus badius* [Smith] in having: 1. clypeus subcarinate sublobed, anterior margin crenate (in *Camponotus badius* clypeus broad, tectiform, median lobe rectangularly produced, anterior margin denticulate); 2. Petiolar node convex anteriorly, concave posteriorly (in *Camponotus badius* petiolar node convex anteriorly, flat posteriorly); 3. Abdomen broad and globose (in *Camponotus badius* abdomen broad and massive).

**Remarks:** Current subspecies: nominal plus *monticola* Bingham, *rabbani* Emery. This is the first report of this species from Kerala. Mayr (1865) originally it from Nocobaris. According to the description of Bingham (1903) var. *exiguoguttatus* Forel, and var. *monticola* Emery, are darker coloured varieties of *Camponotus nicobarensis* Mayr. This species is fairly common in the hills in Mianmar.

### *Camponotus [Myrmocenicus] parius* Emery

(Figs. 55 - 57)

*Camponotus micans* Nyl. race *paria* Emery, 1889. *Ann. Mus. Civ. Stor. Nat. Genova* 27: 513. MIANMAR [MCSN].

*Camponotus rufoglaucus*, race *paria* Forel, 1892. *Jour. Bomb. Nat. Hist. Soc.* 7: 226, 228.

*Camponotus paria* Bingham, 1903. *Fauna Brit. India Hymenoptera* 2: 364.

Combination in *Camponotus (Myrmosesicus)* Forel, 1913. *Zool. Jahr. Abte. fur. Syst. Geogra. und Biol. der. Tiere* 36. 129.

Raised to species by Donisthorpe. 1929. *Ann. Mag. of Nat. Hist* (10) 4: 448.

*Camponotus (Myrmosericus) rufoglaucus* subsp. *paria*. Chapman and Capco, 1951. *Monogr. Inst. Sci. Tech. Manila* 1: 238.

**Worker** : TL = 5.5 mm; HL = 1.7 mm; HW = 1.1 mm; CI = 64.7 mm; SL = 1.9 mm; SI = 172 mm; ED = 0.3 mm; PW = 1 mm; AL = 2.5 mm.

**Colour:** Head, thorax, node of pedicel, coxa, trochanter, femora, black; tibiae, tarsi, antennae brownish red; mandibles with masticatory apparatus brownish yellow; gaster black with yellow posterior margin; tarsal spur brown; anterior portion of head pale yellow; masticatory margin black.

**Sculpture and Hair patterns:** Body completely punctured; covered with a very fine small silky pilosity and sparsely with yellow erect hairs.

**Head:** Subtriangular, posterior margin almost concave; posterolateral corner rounded; cheeks almost convex; mandibles sublinear with 5 teeth; (one apical tooth followed by 4 acute teeth). Clypeus convex, bicarinate; carinae ends in two anterior teeth; a long single median seta followed by small setae on either sides; frontal lobes small sub parallel; frontal carinae feebly distinct; antennal carinae short and fused; antennal scrobe feebly distinct, shallow, reaching up to frontal region, passing above the eyes; torulus short and rounded; antennae long slender, filiform 12 segmented; antennal scape cylindrical; all the segments of funiculus longer than broad; club thick formed of single segment. Relative measurement of length antennal segments : Scape = 1.9 mm; F<sub>1</sub> = 0.37 mm; F<sub>2</sub> = 0.25 mm; F<sub>3</sub> = 0.31 mm; F<sub>4</sub> = 0.31 mm; F<sub>5</sub> = 0.31 mm; F<sub>6</sub> = 0.18 mm; F<sub>7</sub> = 0.25 mm; F<sub>8</sub>

= 0.18 mm;  $F_9$  = 0.18 mm;  $F_{10}$  = 0.25 mm; Club ( $F_{11}$ ) = 0.31 mm. Eyes small, oval, frontal rather than lateral.

**Thorax:** Pronotum forming convexity; pro-mesonotal suture distinct; metanotal groove indistinct; mesometanotal suture not visible; propodeum situated in a level below pro-mesonotum; epinotum evenly arcuate in petiole without distinct base and declivity; legs slender, elongate; tarsi with simple spur.

**Abdomen:** Petiole sessile, nodiform; petiolar node broader than long, thin rounded above, posteriorly convex, joined to gaster with a constriction; gaster large and massive, posterior margins with testaceous yellow.

**Plesiotype: Worker.** INDIA: Kerala, Kalamassery [Ernakulam], Karmaly. K.A., 22.iii-2000 [DZCU].

**Other materials examined:** 5W: INDIA. Kerala, Aluva [Ernakulam], Karmaly. K.A., 16.iii.2000; 5W: INDIA. Kerala, Calicut University Campus, Karmaly. K.A., 25-vii-2000; IW: INDIA: Kerala, Manalikkad [Trissur], Karmaly. K.A., 23.vi.1995; 1W: INDIA: Kerala, Kottekkad. Vidhupriya, 5-viii-2000; 1W: INDIA: Kerala, Thalassery [Kannur], Sheela. S., 14-iii-1992; 5W: INDIA: Kerala, Cherkala, Sebastian, K.A., 8.x.2000.

All specimens deposited in the Systematic Entomology Laboratory, Department of Zoology, Calicut University.

**Distribution:** INDIA: [Kerala: Thiruvananthapuram, Kollam, Idukki; Kottayam, Ernakulam, Thrissur, Palakkad, Malappuram, Calicut, Kannur, Kasaragod]; Nilgiri, Karnataka, Assam, Mianmar, Sri Lanka.

**Biology:** Unknown.

**Habitat:** Found both in undisturbed and disturbed habitats, plains and cultivated crop fields.

**Discussion:** *Camponotus parius* Emery closely resembles *Camponotus rufoglaucus* [Jerdon] in the following features: 1. Body covered with fine silky pilosity and sparsely with yellow erect hairs; 2. Head subtriangular; 3. Antennae 12 segmented; 4. Petiole sessile and nodiform; 5. Hypopygium with circular anal orifice guarded by guard hairs. However *Camponotus parius* Emery differs from *Camponotus rufoglaucus* [Jerdon] in having: 1. The anterior margin of the median lobe of clypeus rounded and produced (in *Camponotus rufoglaucus* the anterior margin of the median lobe of clypeus transverse, not produced); 2. Petiolar node of pedicel broader, thinner and flatter (in *Camponotus rufoglaucus* petiolar node thick and slightly convex); 3. Silky pilosity more dense and equally distributed; (in *Camponotus rufoglaucus* silky pilosity sparse and unequally distributed).

**Remarks:** Donisthorpe (1942) reported this species and mentioned its locality as "Nadangayam, Malabar."

***Camponotus [Colobopsis] phragmaticola* Donisthorpe**

*Camponotus phragmaticola* Donisthorpe, 1943. *Ann. Mag. Nat. Hist.* (11) 10: 205.  
INDIA. [BMNH].

*Camponotus (Colobopsis) phragmaticola* Chapman and Capco, 1951. *Monogr. Inst. Sci. Tech. Manila.* 1: 225.

**Material examined:** Nil

**Distribution :** INDIA : Kerala.

**Remarks:** The material of this species could not be available for this study. Donisthorpe (1943) first described this species and mentioned its locality as "Tenamalai, 500 - 800 ft. Travancore, South India."

***Camponotus [Myrmotemnus] reticulatus reticulatus* Roger**

(Figs. 58 - 59)

*Camponotus reticulatus* Roger, 1863. *Berl. Ent. Zeit.* 7: 139. SRILANKA. .

**Worker min:** TL = 3.17 mm; HL = 0.94 mm; HW = 0.84 mm; CI = 89.36 mm; SL = 0.8 mm; SI = 95.23 mm; ED = 0.14 mm; PW = 1.02 mm; AL = 1.28 mm.

**Colour.** Brownish red.

**Sculpture and Hair pattern:** Head granulate, feebly reticulate; mesonotum and metanotum concentrically striate; abdomen reticulate, polishing; pubescence sparse, studded with short erect white hairs.

**Head:** Longer than broad, as broad in front posteriorly; occipital angles not prominent, rounded; occiput transverse; mandibles triangular, 5-toothed; clypeus narrow, slightly convex, not carinate, without distinct lobe; frontal lobe short; frontal carinae short, divergent posteriorly; antennal scrobe short and shallow; antennae short, slender, filiform, 12 jointed; antennal scape cylindrical short reaching up to vertex; all segments of funiculus longer than broad. 1st funicular segment; longer than other funicular segments, club single segmented and thickened. Relative measurement of length of antennal segments. Scape = 0.8 mm; F<sub>1</sub> = 0.22 mm; F<sub>2</sub> = 0.11 mm; F<sub>3</sub> = 0.14 mm; F<sub>4</sub> = 0.08 mm; F<sub>5</sub> = 0.14 mm; F<sub>6</sub> =

0.11 mm;  $F_7 = 0.11$  mm;  $F_8 = 0.14$  mm;  $F_9 = 0.11$  mm;  $F_{10} = 0.17$  mm; Club ( $F_{11}$ ) = 0.2 mm. Eyes small rounded, frontal rather than lateral.

**Thorax:** Pronotum anteriorly narrowed, posteriorly broad; pro-mesonotal and meso-metanotal suture distinct; concentric striations on meso-notum and meta-notum above; transverse striations on episternum; basal half of metanotum. Slightly flat and depressed, its side finely longitudinally striate, apical half obliquely truncate; legs stout; tibiae cylindrical; tarsi with tarsal spurs.

**Abdomen:** Pedicel sessile, nodiform; petiolar node thick, transverse above, convex posteriorly; gaster elongate, massive, polishing, feebly striate; circular anal acidopore at the apex of hypopygium ventrally guarded by guard hairs.

**Plesiotype: Worker.** INDIA: Kerala, Calicut University Campus, Karmaly, K.A., 25.vii.1995 [DZCU].

**Other materials examined:** 2W: INDIA: Kerala, Calicut University Campus, Sheela. S., 16.ii.1992; 1W: INDIA: Kerala, Muthukulam (Alapuzha), Sheela, S., 24.vii.1995; 1W: INDIA: Kerala, Calicut University Campus, Karmaly, K.A., 18.vii.1995; 1W: INDIA: Kerala, Kohinoor, near Calicut University Campus. Karmaly. K.A., 24.iii.1995.

All specimens deposited in the Systematic Entomology Laboratory, Department of Zoology, Calicut University.

**Distribution:** INDIA (Kerala - Alapuzha, Malappuram, Calicut); Sri Lanka.

**Biology:** Unknown.

**Habitat:** Collected from disturbed habitat with shrubs herbs and trees.

**Variation:** Length varies from 2.88 mm - 4.33 mm. In the description of Bingham (1903) is stated that length under 5 mm.

**Discussion:** *Camponotus reticulatus* Roger closely resembles to *Camponotus yerburyi* Forel in the following features: 1. Antennae slender, filiform, 12 jointed; 2. Regular arch of the thorax interrupted by the apex of the metanotum being truncated; 3. Tibiae cylindrical; 4. Apical half of metanotum obliquely truncate. However *Camponotus reticulatus* Roger differs from *Camponotus yerburyi* Forel in having: 1. Head longer than broad, occiput transverse (in *Camponotus yerburyi* head rectangular, occiput, widely emarginate; 2. Mandibles 5-toothed (in *Camponotus yerburyi* mandibles 6-toothed); 3. Clypeus narrow, slightly convex, without carinae and distinct lobe (in *Camponotus yerburyi* clypeus indistinctly carinate down the middle, median lobe slightly produced); 4. Petiolar node thick, transverse above, convex posteriorly (in *Camponotus yerburyi* petiolar node laminate, broad, flatter in front than posteriorly).

**Remarks:** Current subspecies: nominal plus *fullawayi* Wheeler, *gestiens* Forel, *imparilis* Forel, *jagori* Stitz, *latitans* Forel, *mackayensis* Forel, *sericellus* Viehmeyer, *yerburri* Forel. This is the first report of this subspecies from Kerala. Roger (1863) originally described it from Sri Lanka.

***Camponotus [Myrmosericus] rufoglaucus rufoglaucus* (Jerdon)**

(Figs. 60 – 61)

*Formica rufoglaucus* Jerdon, 1851. *Madras Jour. J. Lit. Sci.* 17: 124. INDIA. [BMNH].

*Camponotus redtenbacheri* Mayr, 1862. *Verh. Zool. Bot. Ges. Wien.* 12: 667, 770.

*Camponotus rufoglaucus* Bingham, 1903. *Fauna Brit. India, Hymenoptera* 2: 363.

*Camponotus (Myrmosericus) rufoglaucus* Emery, 1925. *Genera Insect* 183: 105.

*Camponotus (Myrmosericus) rufoglaucus* Donisthorpe, 1943. *Ann. Mag. Nat. Hist.* (11) 10: 204.

*Camponotus (Myrmosericus) rufoglaucus* Chapman and Capco, 1951. *Monogr. Inst. Sci. Tech. Manila* 1: 238.

**Worker major.** TL = 7.2 mm; HL = 2 mm; HW = 1.5 mm; CI = 75 mm; SL = 1.5 mm; SI = 75 mm; ED = 0.3 mm; PW = 1.8 mm; AL = 2.5 mm.

**Colour.** Head and thorax blood red; abdomen brownish black; legs little paler, funiculi, cheeks, clypeus, mandibles and tarsi castaneous brown; gastral segments with dull yellowish, posterior margins.

**Sculpture and Hair patterns:** Whole body with very fine, short silky pilosity and sparsely with erect hairs; pubescence dull yellowish, slightly golden on the gaster, feebly converging at mid dorsal line on posterior portion of second and third segments. Head, thorax and abdomen very finely and densely reticulate and punctate.

**Head:** Subtriangular, occiput widely emarginate, clypeus carinate, median lobe shortly, anteriorly produced, its margin crenate; mandibles sublinear, comparatively small with two apical teeth followed by 5 basal teeth, equal in size; frontal lobe small, parallel, frontal carinae distinct, antennal carinae elongate; antennal scrobe distinct, groove like, passing above the eye; antennae 12 segmented; antennal scape cylindrical. Relative measurement of length of antennal segments : Scape 2.13 mm; F<sub>1</sub> = 0.33 mm; F<sub>2</sub> = 0.26 mm; F<sub>3</sub> = 0.33 mm; F<sub>4</sub> = 0.33 mm; F<sub>5</sub> = 0.4 mm; F<sub>6</sub> = 0.26 mm; F<sub>7</sub> = 0.26 mm; F<sub>8</sub> = 0.33 mm; F<sub>9</sub> = 0.33 mm; F<sub>10</sub> = 0.2 mm; Club (F<sub>11</sub>) = 0.4 mm. Eyes small in size, situated towards frontal area than the sides.

**Thorax:** Forming a regular arch in lateral view; pronotum anteriorly narrow; pro-mesonotal suture distinct; epinotum evenly arcuate in profile without distinct base and declivity; meso-metanotal suture feebly distinct; petiolar node slightly thin and convex anteriorly; legs short; tibiae slightly compressed, tarsi with tarsal spurs.

**Abdomen:** Large, massive; pedicel sessile, nodiform, single segmented, larger than broad, posterior region of petiole connected with gastral segments; gaster large, oval, massive, gastral segments with very narrow, dull yellowish posterior margins; last segment ends with circular anal orifice guarded by guard hairs.

**Plesiotype: Worker.** INDIA: Kerala, Palode (Thiruvananthapuram), Karmaly. K.A., 10.iii.2000. (DZCU).

**Other materials examined:** 1W: INDIA: Kerala, Calicut University Campus, Sheela, S., 7.i.1992; 1W: INDIA: Kerala, Muthukulam (Alapuzha) Nimisha, 7.i.1992; 1W: INDIA: Andhra, Hyderabad, Karmaly. K.A., 26.v.1999, 1W: INDIA: Kerala, Peerumadu (Idukki) Karmaly. K.A., 10.v.1998; 1W: INDIA: Kerala, Kottekad (Palakkad) Vidhupriya, 5.viii.2000.

**Distribution:** INDIA: [Kerala: Thiruvananthapuram, Alapuzha, Idukki, Ernakulam, Palakkad, Malappuram, Calicut], Delhi, Central India (Schur), the Deccan (Wroughton), Calcutta, Assam (Smythies), Hyderabad, Sri Lanka (Yerbury); upper Mianmar (7 ca, Bingham).

**Biology:** Unknown.

**Habitat:** Found both in disturbed and undisturbed habitats, such as gardens, forests, vegetable garden, among cultivated crops etc.

**Variation:** This species exhibits great variations in colour. In most forms head is blood red; in a few, it is black. In all forms abdomen is pilose.

**Discussion:** *Camponotus rufoglaucus* [Jerdon] closely resembles *Camponotus parius* Emery in the following features: 1. Body covered with fine silky pilosity and sparsely with yellow erect hairs; 2. Head subtriangular; 3. Antennae 12 segmented; 4. Petiole sessile; 5. Last gastral segment ends with circular anal orifice with guard hairs. However *Camponotus rufoglaucus* [Jerdon] differs from *Camponotus parius* Emery in having: 1. The anterior margin of the median lobe of clypeus transverse, not produced (in *Camponotus parius* the anterior margin of the median lobe of clypeus rounded and produced); 2. Petiolar node thick and slightly convex (in *Camponotus parius* the petiolar node broader, thinner and flatter); 3. Silky pilosity sparse and unequally distributed (in *Camponotus parius* silky pilosity more dense and more equally distributed).

**Remarks:** Current sub species: nominal plus *controversus* Santschi, *fae* Emery, *latericus* Stitz, *syphax* Wheeler, *tenius* Forel, *zanzibaricus* Forel, *zulu* Emery.

Jerdon (1851) first described this species under *Formica* Linn. and found this ant only in Karnataka in small societies living in hole in ground. Later on, Bingham (1903) and Donisthorpe (1943) also reported this species under the genus *Camponotus* Mayr from Kerala, South India.

***Camponotus [Orthonotomyrmex] sericeus sericeus* (Fabricius)**

(Figs. 62 – 63)

*Formica sericeus* Fabricius, 1798. *Suppl. Emt. Syst.* 279. SENEGAL. [BMNH].*Formica aurulenta* Latreille, 1802. *Hist. Nat. des Fourmis* 114. (Roger 1863 Synonymized).*Formica cinerascens* Jerdon, 1851. *Madras. Jour. Lit. Sci.* 17. 123.*Formica obtusa* Smith, 1858. *Cat. Hym. Brit. Mus.* 6: 30 Egypt (Roger 1863 synonymized).*Camponotus apaciventris* Mayr, 1878. *Verh. Zool - Bot. Ges. Wien* 28: 648.*Camponotus sericeus* Forel, 1892. *Jour. Bomb. Nat. Hist. Soc.* 7: 223, 231.*Camponotus sericeus* Bingham, 1903. *Fauna Brit. India Hymenoptera* 2: 376.*Camponotus (Orthonotomyrmex) Sericeus* Emery 1925, *Genera Insect.* 183: 125.*Camponotus sericeus* Tiwari et al., 1994. *State Fauna series 3: Fauna of West Bengal* 8L 275.

**Worker min:** TL = 6.25 mm; HL = 1.77 mm; HW = 1.5 mm; CI = 75 mm; SL = 1.3 mm; SI = 86 mm; ED = 0.5 mm; PW = 1.5 mm; AL = 2.8 mm.

**Colour:** Antennae, mandibles and legs rusty brown with a blackish tint; head thorax, petiolar node and abdomen black; head with a brownish tint.

**Sculpture and Hair pattern:** On head pubescence abundant on clypeus; thorax and node of pedicel with very sparse pubescence; abdomen with a dense, recumbent, silky golden pubescence hiding the sculpture; silvery erect pilosity

present frequently on dorsal side of metanotum, pedicel and posterior and inferior portion of abdomen, very rare on the other parts, almost absent on head; whole body with a granular appearance, abdomen very minutely punctured.

**Head:** Very broad and massive; occiput a little emarginate; cheeks convex; mandibles sublinear; masticatory margin with 5 teeth (one large apical tooth followed by 4 acute teeth), thick, longitudinally striate and punctate; clypeus broad, tectiform, anterior margin of clypeus straight, broadly emarginate in the middle, with a silky long pubescence; frontal area depressed, triangular, two small depressions on the side of the clypeus above the base of mandibles; antennal scrobe shallow; antennal carinae 'S' shaped, wide apart; antennae situated remote from the posterior margin of clypeus; antennae 12 segmented; antennal scape extending a little beyond the occiput; funicular segments longer than broad, first segment the longest, second the shortest, segments third, sixth, and eighth equal in length, segments fourth, seventh, ninth and tenth equal in length and shorter than the others except second segment, club formed of single segment, thickened and equal to fifth segment in length. Relative measurement of length of antennal segments : Scape = 1.3 mm;  $F_1 = 0.44$  mm;  $F_2 = 0.22$  mm;  $F_3 = 0.27$  mm;  $F_4 = 0.22$  mm;  $F_5 = 0.33$  mm;  $F_6 = 0.27$  mm;  $F_7 = 0.22$  mm;  $F_8 = 0.27$  mm;  $F_9 = 0.22$  mm;  $F_{10} = 0.22$  mm; Club ( $F_{11}$ ) = 0.33 mm. Eyes moderate, oval, situated above the middle line of head.

**Thorax:** Broad, anteriorly, becoming narrow posteriorly, laterally compressed and truncate on the metanotum; pronotum broad, pro-mesonotal suture distinct; mesonotum anteriorly broad, posteriorly narrow; meso-metanotal suture distinct; the continuous arch of thorax interrupted at their suture; basal part of the metanotum horizontal, flat, anteriorly narrow and broader at the transverse posterior margin, concave from the base to the apex; legs stout; tibiae cylindrical, spinose beneath, spurs slightly pectinate, tarsi also thickly spinose; claws simple.

**Abdomen:** Petiole with sides almost straight, rounded and knob like above; gaster broad, globose, gastral tergi constricted in dorsal view, in extended condition longer than broad, first two segments subequal; hypopygium small with circular orifice ventral in position, guarded by guard hairs.

**Plesiotype: Worker:** INDIA: Kerala, Malappuram, Calicut University Campus, Sheela. S., 30.1. 1992 [DZCU].

**Other materials examined:** 5W: INDIA: Kerala, Thiruvananthapuram (Vithura) Karmaly. K.A., 8.iii.2000; 1W: INDIA, Kerala, Calicut (Anakampoyil), Pramod 24.vi.1995; 5W: INDIA: Kerala, Ernakulam (Aluva) Karmaly. K.A., 18.x.1995; 3W: INDIA: Kerala, Malappuram (Kohinoor), Karmaly. K.A., 25.iii.1995; 3W: INDIA: Kerala, Trissur (Kodungallor), Rani. K.A. 16.iv.1995; 5W: INDIA: Kerala, Calicut University Campus, Karmaly. K.A., 3.viii.2000; 1W: INDIA: Kerala, Wyanad (Muthenga) Karmaly. K.A., 7.v.2000; 1W: INDIA: Kerala, Kottayam, (Bharanaganam), Sureshan. P.M., 28.x.2000; 5W: INDIA: Karnataka, Bangalore, (G.K.V.K.) Karmaly. K.A., 12.vi.2000; 10W: INDIA: Kerala, Kasaragod, (Cherkala), Sebastian. K.A., 8.x.2000.

All specimens deposited in the Systematic Entomology Laboratory, Department of Zoology, Calicut University.

**Distribution:** INDIA: (Kerala: Thiruvananthapuram, Kollam, Kottayam, Alleppy, Ernakulam, Trissur, Malappuram, Calicut, Wyanad, Kasaragod, Tamil Nadu, Karnataka, West Bengal; Myanmar, Sri Lanka, Indo-china, Arabia, Egypt and Tropical Africa.

**Biology:** Unknown.

**Habitat:** Collected from disturbed areas with grass, shrubs, herbs, and trees.

**Variation:** This species exhibits great variation in colour. In most forms head is black in a few others it is reddish black. In most forms pubescence abundant on clypeus; thorax and node of pedicel with very sparse pubescence; abdomen with a dense recumbent silky golden pubescence hiding the sculpture. Whole body is with granular appearance. In a few others pubescence are sparse on clypeus. Thorax and node of pedicel are with abundant pubescence and abdomen is with sparse recumbent silky golden pubescence not hiding the sculpture. In a few forms body is with feeble granules. Length varies from 6.6 mm - 8.4 mm. But in the description of Bingham (1903) length has been given ranging from 5-7 mm. According to the description of Bingham (1903) *Camponotus opaciventris* Mayr is clearly a variety of *Camponotus sericeus* Fabricius having no pubescence on the abdomen. *Camponotus sericeus* Fabricius comes quite close in general appearance to *Camponotus (orthonotomyrmex) puniceps* Donisthorpe, but the epinotum and pedicel are quite different.

**Discussion:** *Camponotus sericeus* [Fabricius] resembles *Camponotus varians* Roger in the following: 1. Regular arch of the thorax interrupted at the meso-metanotal suture by the metanotum forming an angle with the mesonotum; basal portions of metanotum horizontal, flat, slightly concave; apical portion excavate; 2. Tibiae of legs spinous beneath; 3. Mandibles with 5 teeth; 4. 12 segmented antennae; 5. Hypopygium with a rounded anal opening guarded by guard hairs. However, *Camponotus sericeus* [Fabricius] differs from *Camponotus varians* Roger in having: 1. Black and opaque (in *Camponotus varians* black and shining.); 2. Clypeus broad and tectiform (in *Camponotus varians* clypeus convex, not tectiform); 3. Petiolar node thick, globose (in *Camponotus varians* petiolar node broader than long. Somewhat flat.

**Remarks:** Current subspecies : *nominal plus*, *euchrow* Santschi, *opiventris* Mayr, *peguensis* Emery, *sanguiniceps* Donisthorpe, *sulgeri* Santschi. This is the first

report of this subspecies from Kerala. Fabricius (1798) originally described it from Sengal. Jerdon (1851) reported *Formica cinerascens* Fabr. from Karnataka, South India which was later considered as a synonym of *Camponotus sericeus* (Fabricius) by Bingham (1903). Subsequently Donisthorpe (1941) also reported this species under the genus *Camponotus* (*Orthonotomyrmex*) from Tamil Nadu. South India.

***Camponotus* [*Myrmoturba*] *siemsseni* Forel**

(Figs. 64 - 65)

*Camponotus siemsseni* Forel, 1901. *Jahrb. Hamburg. Wissen. Anstalt*, 18: 70.  
SUMATRA. [MS].

*Camponotus siemsseni* Forel, 1902. *Ann. Soc. Ent. Belge*. 46: 287.

*Camponotus siemsseni* Bingham, 1903. *Fauna Brit. India Hymenoptera* 2: 361.

Combination in *Camponotus* (*Myrmoturba*) Forel, 1913. *Zool. Jahr. Abte. Fur. Syst. Geogra. und. Biol. der. Tiere* 36: 129.

Combination in *Camponotus* (*Tanaemyrmex*) Emery, 1925. *Genera Insect* 183: 102.

*Camponotus* (*Tanaemyrmex*) *siemsseni* Forel, Chapman and Capco, 1951. *Monogr. Inst. Sci. Tech. Manila*. 1: 250.

**Worker maj:** TL = 14.44 mm; HL = 5 mm; HW = 4.45 mm; CI = 89 mm; SL = 3.22 mm; SI = 64.4 mm; ED = 0.45 mm; PW = 4.66 mm; AL = 5.44 mm.

**Colour:** Black; scape of antennae at base, flagellum and legs chestnut red; eyes copper brown.

*Sculpture and Hair pattern:* Head and abdomen very minutely, thorax more distinctly rugulose, abdomen not polished; pilosity very sparse, represented by only a few scattered pale reddish brown hairs; pubescence very fine and sparse, more on antennae and leg, mandibles feebly rugulose with scattered foveolate.

*Head:* Large, somewhat square, broader posteriorly than in front; vertex straight; occiput widely emarginate; lateral angle rounded, project out; mandibles broad, subtriangular, anterior margin somewhat rounded; masticatory margin strongly dentate with 6 teeth (apical one followed by 5 acute teeth), apical tooth strong and curved inward; clypeus broad, slightly tectiform, medial lobe shortly produced, anterior margin transverse, posterior margin shorter than anterior margin with a concave surface at middle; frontal lobe small, distinct; frontal carinae long and wide apart posteriorly; antennal carinae short and fused; antennal scrobe short and groove like, extending up to frontal region, passing above the eyes; antennae short, slender; antennal scape of antennae not extending to the top of head (extending up to the vertex); flagellar segments longer than broad. Relative measurement of length of antennal segments: Scape = 3.22 mm;  $F_1 = 0.66$  mm;  $F_2 = 0.33$  mm;  $F_3 = 0.55$  mm;  $F_4 = 0.66$  mm;  $F_5 = 0.55$  mm;  $F_6 = 0.55$  mm;  $F_7 = 0.44$  mm;  $F_8 = 0.33$  mm;  $F_9 = 0.33$  mm;  $F_{10} = 0.22$  mm; Club ( $F_{11}$ ) = 0.44 mm. Eyes small oval, rather frontal than lateral.

*Thorax:* Short, pronotum broad posteriorly, narrowed anteriorly, connecting to the occipital condyle; pro-mesonotal suture well distinct; meso-metanotal suture slightly distinct; in profile arched above the apex of metanotum, truncate; legs long; posterior tibiae almost cylindrical, slightly compressed; tarsi with tarsal spurs.

*Abdomen:* Pedicel sessile, nodiform, petiolar node cuneiform, broad and transverse above, convex dorsally, flat ventrally; abdomen high convex, anteriorly

steep and rounded; circular anal orifice on the apex of hypopygium guarded by guard hairs; posterior margins of abdominal segments broadly transparent white.

**Plesiotype:** *Worker:* INDIA: Kerala, Thiruvananthapuram (Vettukad), Karmaly. K.A. 23.iv.1997 [DZCU].

**Other materials examined:** 5W. With the same data as that of Plesiotype [DZCU].

**Distribution:** INDIA: [Kerala, Thiruvananthapuram], Himalayas; Siam and extending to Malayan sub region.

**Biology:** Nests are formed in the earth.

**Habitat:** Disturbed. Specimen collected from flower garden.

**Variation:** 1. Length varies from 12 mm - 14.44 mm. 2. Head and abdomen very minutely, and thorax more distinctly rugulose, abdomen not polished. In the description of Bingham (1903) it is stated that length varies from 12 mm - 13 mm; head, thorax and abdomen smooth and shining.

**Discussion:** *Camponotus siemsseni* Forel resembles to *Camponotus compressus* [Fabricius] in the following characters: 1. antennae with 12 segments; 2. Antennal scape cylindrical; 3. presence of circular anal orifice on the apex of hypopygium guarded by guard hairs. However *Camponotus siemsseni* Forel differs from *Camponotus compressus* [Fabricius] in having: 1. Thorax viewed from side forming a regular arch, interrupted by the apex of the metanotum, being truncate (in *Camponotus compressus* thorax viewed from side forming a regular arch, not interrupted by the apex of the metanotum, not being truncate); 2. Mandibles with 6 teeth (in *Camponotus compressus* mandibles with 7 teeth), 3. Pronotum narrowed anteriorly, not producing a collar (in *Camponotus compressus* pronotum narrowed anteriorly producing a collar.) 4. Tibiae slightly

compressed, not prismatic (in *Camponotus compressus* tibiae compressed and prismatic); 5. Petiolar node cuneiform, broad and transverse above (in *Camponotus compressus* petiolar node oval, transverse, convex in front, flat posteriorly); 6. Abdomen high convex, anteriorly steep and rounded (in *Camponotus compressus* abdomen broad and massive).

***Camponotus [Colobopsis] strictus (Jerdon)***

*Formica stricta* Jerdon, 1851. *Madras. Jour. Lift. Sci.* 17: 123. INDIA. [BMNH].

Combination in *Colobopsis* Mayr, 1863. *Verh. Zool. Bot. Ges. Wien.* 13: 403.

*Colobopsis stricta* Bingham, 1903. *Fauna Brit. India. Hymenoptera* 2: 343.

*Camponotus (Colobopsis) strictus* Chapman and Capco. 1951. *Monogr. Inst. Sci. Tech. Manila* 1: 227.

**Worker:** TL = 11 mm - 12 mm.

**Colour:** Black; antennae, thorax and legs very dark castaneous brown; hairs brown; pubescence grey.

**Sculpture and Hair pattern:** Lower portion of head above truncation longitudinally striate; cheeks on either side of depressed portion acutely ridged and coarsely obliquely striate; pubescence sparse, scattered; very thin soft chiefly on abdomen.

**Head:** Very large and massive, a little narrower in front than across the vertex, truncated and depressed anteriorly; basal portion of clypeus being bent downwards and inwards; antennae slender, filiform, 12 jointed.

**Thorax:** Narrow, a shallow transverse, rather broad sulcus marking the meso-metanotal suture; basal portion of metanotum rounded above and posteriorly, apical portion obliquely truncate, legs stout, posterior tibiae very slightly compressed.

**Abdomen:** Petiolar node bluntly conical; gaster narrow, elongate.

**Distribution:** INDIA: (Kerala: Malabar); Mianmar, Borneo.

**Biology:** Found on flowers.

**Habitat:** Unknown.

**Discussion:** This species *Camponotus strictus* (Jerdon) closely resembles *Colobopsis pubescens* Mayr in the following characters: 1. Antennae, thorax and legs very dark castaneous brown; 2. Basal portion of clypeus being bent downwards and inwards; 3. Tibiae of legs compressed. However *Camponotus strictus* (Jerdon) differs from *Colobopsis pubescens* Mayr in having: 1 Body clothed with a thin grey pubescence (in *Colobopsis pubescens* body clothed with a dense yellow pubescence); 2. In the thorax being emarginate at the meso-metanotal suture (in *Colobopsis pubescens* in the thorax not being emarginate at the meso-metanotal suture); 3. Thorax narrow, apical portion obliquely truncate (in *Colobopsis pubescens* thorax cylindrical, apical portion without truncation); 4. Abdomen narrow, elongate (in *Colobopsis pubescens* Mayr. abdomen massive).

**Remarks:** This specimen is not represented in the collection and the above description is based on Bingham (1903). Jerdon (1851) first described this species under the genus *Formica* from Malabar. He (*op.cit*) also mentioned that he had found this ant on flowers. Later on, Bingham also mentioned its distribution as "Malabar; Mianmar; extending to Borneo."

*Camponotus [Tanaemyrmex] thraso* Forel

*Camponotus maculatus* Fabr. race *thraso* Forel, 1893. *Jour. Bomb. Nat. Hist. Soc.* 7: 432. SRILANKA. [MS].

*Camponotus thraso* Bingham. 1903. *Fauna Brit. India. Hymenoptera*, 2: 356.

*Camponotus (Tanaemyrmex) thraso* Chapman and Capco, 1951. *Monogr. Inst. Sci. Tech. Manila* 1. 251.

**Worker maj:** 6.5 mm - 8 mm; min: 4 mm - 6 mm.

**Colour:** Very dark castaneous, almost black.

**Sculpture and hair pattern:** Body very minutely reticulate - punctate, shining; pubescence almost absent, reduced to very scanty scattered erect hairs.

**Head:** Rectangular, as broad posteriorly as in front; mandibles moderately broad, teeth obsolete; clypeus carinate, with a very short lobe, its anterior margin transverse; antennal carinae short, moderately close together, divergent posteriorly, antennae slender, filiform, 12 jointed.

**Thorax:** Viewed from side forming a regular arch, somewhat depressed in front, strongly compressed posteriorly; pro-mesonotal suture very distinct, meso-metanotal suture indistinct; legs short; tibiae compressed, not prismatic, and destitute of spines beneath.

**Abdomen:** Pedicel sessile; nodiform; petiolar node biconvex, as long as broad; gaster moderately massive, last gastral segment with circular orifice guarded by guard hairs.

**Materials examined:** Nil

**Distribution:** INDIA: Kerala, Sri Lanka, Mianmar.

**Biology:** Unknown.

**Habitat:** Unknown.

**Discussion:** *Camponotus thraso* Forel, closely resembles *Camponotus carin* (Emery), in the following features: 1. Antennae slender, filiform; 12 jointed; 2. Thorax viewed from side forming a regular arch; 3. Circular anal orifice at the apex of the hypopygium ventrally guarded by guard hairs. However *Camponotus thraso* Forel differs from *Camponotus carin* (Emery), in having: 1. Head rectangular as broad posteriorly as in front (in *camponotus carin* head elongate, oval, narrowed posteriorly); 2. Clypeus carinate, with a very short lobe, its anterior margin transverse, not rectangularly produced; (in *Camponotus carin* clypeus vertically carinate down the middle, median lobe slightly produced, its anterior margin rectangularly produced); 3. Mandibular teeth obsolete (in *Camponotus carin* mandible 6-toothed). 4. pronotum slightly narrowed in front, not forming a distinct neck (in *Camponotus carin* pronotum narrowed anteriorly forming a neck); 5. Pro-mesonotal suture very distinct, meso-metanotal suture indistinct (in *Camponotus carin* pro-mesonotal and meso-metanotal sutures are distinct).

**Remarks:** No material of this species could be available for this study. The above description is based on Bingham (1903). Donisthorpe (1943) first reported this species from India (Travancore, South India) which was later recorded in the checklist by Chapman and Capco (1951).

*Camponotus [Myrmepomis] timidus* (Jerdon)

*Formica timida* Jerdon, 1851. *Madras. Jour. Lit. Sci.* 17: 124. INDIA. [BMNH].

Combination in *Camponotus* Roger, 1863. *Berl. Ent. Zeit* 7: 3.

*Camponotus (Myrmepomis) timidus* Chapman and Capco, 1951. *Monogr. Inst.Sci. Tech. Manila.* 1: 236.

**Worker:** TL: = 0.1 mm.

**Colour:** Dingy rufous head darker, abdomen tinged with dusky.

**Sculpture and Hair pattern:** Thorax smooth; whole body covered with long scattered hairs.

**Head:** Oblong, oval; mandibles triangular, strongly toothed; eyes large, posterior rather than lateral.

**Thorax:** Smooth.

**Abdomen:** Petiolar node raised and conical.

**Material examined:** Nil.

**Distribution:** INDIA: Kerala (Malabar Coast).

**Biology:** This ant chiefly feed on vegetable secretions. It builds its nest under ground. It is being very timid, and if touched, dropping to the ground at once and hiding itself [Jerdon, 1851].

**Habitat:** Disturbed area.

**Remarks:** No material of this species could be available for this study. The above description is based on the paper of Jerdon (1851).

***Camponotus [Myrmamblys] varians* Roger**

(Figs. 66 - 67)

*Camponotus varians* Roger, 1863. *Berl. Ent. Zeit.* vii: 138, SRI LANKA. [MNHU].

*Camponotus varians* Bingham, 1903. *Fauna, Brit. India. Hymenoptera* Vol. II: 37.

Combination in *Camponotus (Myrmotemnus)* Emery, 1920. *Rev. Zool. Africane*: 258.

*Camponotus (Myrmamblys) varians* Chapman and Capco, 1951. *Monogr. Inst. Sci. Tech. Manila*. 1: 235.

**Worker.** TL = 4.25 mm; HL = 1.06 mm; HW = 1. mm; CI = 94.33 mm; SL = 1.06 mm; SI = 106 mm; ED = 0.18 mm; PW = 0.75 mm; AL = 1.78 mm.

**Colour.** Head and thorax brown; abdomen dark brown (nearly black); antennae and legs brownish yellow; the articulations, mandibles, clypeus, coxae and tarsi bright yellow; teeth dark brown; eyes black.

**Sculpture and Hair pattern:** Head with shallow net-like punctures, more lightly transversely rugose posteriorly, very shining; frontal area finely rugulose, shining; mandibles with scattered punctures; thorax very finely transversely rugose; sides of the pronotum finely striate; sides of the meso and metanotum deeply longitudinally striate, sculpture on sides of the meso and metanotum dense, coarse, nearly granulate; node of pedicel concentrically striate; abdomen thickly transversely rugose, shining.

**Head:** Somewhat rectangular sides straight, vertex slightly rounded; occiput not constricted; mandibles triangular, sublinear, 5-toothed (one apical

tooth followed by 4 acute teeth); clypeus broad, convex, anterior margin shortly produced, rounded, not carinate, not emarginate, not lobed; posterior margin narrower than anterior margin; frontal lobe prominent, divergent anteriorly leaving a 'V' shaped space between posterior margin of clypeus and anterior margin of frontal lobes; frontal carinae short and divergent posteriorly, toruli short, rounded, antennal scrobe short, groove like, antennal carinae small and fused; antennae short, slender, filiform, 12 jointed; antennal scape cylindrical, not passing beyond the occiput; apex of scape slightly flattened; all the segments of funiculus longer than broad, club single segmentd, thickened. Relative measurement of length of antennal segments: Scape = 1.06 mm; F<sub>1</sub> = 0.18 mm; F<sub>2</sub> = 0.15 mm; F<sub>3</sub> = 0.15 mm; F<sub>4</sub> = 0.15 mm; F<sub>5</sub> = 0.12 mm; F<sub>6</sub> = 0.12 mm; F<sub>7</sub> = 0.15 mm; F<sub>8</sub> = 0.12 mm; F<sub>9</sub> = 0.15 mm; F<sub>10</sub> = 0.12 mm; Club (F<sub>11</sub>) = 0.18 mm. Eyes small, oval, convex frontal rather than lateral.

*Thorax:* Thorax viewed from side arched, above broad and more or less flat; pronotum narrowed anteriorly, broad posteriorly, rounded at sides; pro-mesonotal suture distinct by a crescentic line, anterior angles with acute margins; mesonotum transverse, flat posteriorly, sharply emarginate; metanotum laterally strongly compressed, above about one third are broad as pronotum, longitudinally quadrangular, apex of metanotum abruptly truncate and slightly concave; legs short, tibiae cylindrical, spinose beneath; tarsi with tarsal spurs.

*Abdomen:* Pedicel sessile, nodiform, single noded; petiolar node lower than metanotum, oval, rounded above, convex in front, concave behind, flat basally with a sharp margin on the sides; gaster convex dorsally with 4 visible segments, last segment hidden by the 4th segment. Posterior margins of gastral segments with dirty white striations; apex of last gastral segment with circular anal orifice with guard hairs.

**Plesiotype: Worker:** INDIA: Kerala, Calicut University Campus. Sheela. S., 5. v. 1992 [DZCU].

**Other materials examined:** 1W: INDIA: Kerala, Calicut University Campus, Sheela, S., 4. XII. 1991. [DZCU].

**Distribution:** INDIA: (Kerala: Malappuram); Sri Lanka.

**Biology:** Unknown.

**Habitat:** Collected from disturbed habitat.

**Variation:** Length varies from 4.25 mm to 4.8 mm; colour of abdomen nearly black. In the description of Bingham (1903), it is stated that length 3.4 mm; basal two abdominal segments yellow.

**Discussion:** *Camponotus varians* Roger closely resembles *Camponotus nirvanae* Forel, in the following characters: 1. Head rectangular; 2. Regular arch of the thorax interrupted at the meso-metanotal suture by the metanotum forming an angle with the mesonotum; basal portion of metanotum slightly concave; 3. Antennae slender, filiform, 12 jointed. However *Camponotus varians* Roger differs from *Camponotus nirvanae* Forel in having: 1. Mandibles 5-toothed (in *Camponotus nirvanae* mandibles 5-6 toothed); 2. Clypeus convex (in *Camponotus nirvanae* clypeus rectangularly rounded). 3. Antennal carinae short and fused (in *Camponotus nirvanae* antennal carinae long, distinct divergent); 4. Tibiae of legs not spinose beneath (in *Camponotus nirvanae* tibiae of legs spinose beneath); 5. Node of pedicel oval, rounded above, convex in front, concave behind, sharp margin on the sides (in *Camponotus nirvanae* node of pedicel very broad, twice as broad as high, upper margin obtuse and transverse).

**Remarks:** This is the first report of this species from Kerala. Roger (1863) originally described from Sri Lanka.

***Camponotus [Myrmoturba] variegatus variegatus (Smith)***

(Figs. 68 - 69)

*Formica variegatus* Smith, 1858. *Cat. Hym. Brit. Mus.* 6: 19. SRI LANKA. [OXUM].

Combination in *Camponotus* Mayr, 1862. *Verh. Zool. Bot. Ges. Wien*, 12: 656.

*Camponotus variegatus* Bingham, 1903. *Fauna. Brit. India. Hymenoptera*, 2: 359.

*Camponotus (Tanaemyrmex) variegatus* Chapman and Capco, 1951. *Monogr. Inst. Sci. Tech. Manila*. 1: 251.

**Worker:** TL = 7 mm; HL = 1.55 mm; HW = 1.22 mm; CI = 77.41 mm; SL = 2.27 mm; SI = 189.16 mm; ED = 0.13 mm; PW = 2 mm; AL = 2.77 mm.

**Colour:** Reddish yellow without lusture, head and abdomen fuscous, flagellum of antennae and legs paler than thorax, pubescence pale yellow.

**Sculpture and Hair pattern:** Generally punctate and rugulose; petiole and gaster feebly punctate and rugulose. Entire body shining covered with erect strong pale yellow hairs; pubescence sparse, pale yellow and erect. Anterior margin of clypeus with forwardly pointing hairs. Antennae and legs clothed with very small flat pubescence; pilosity more on gaster.

**Head:** Subtriangular; elongate, postero-lateral angles not prominent, posterior margin rounded, posteriolateral margin provided with backwardly pointing strong pale yellow hairs, sides straight; mandibles triangular, lateral corner rounded, masticatory margin broad with a long apical tooth followed by 5 small teeth; clypeus tectiform with a short median lobe, its anterior margin transverse, emarginate; frontal lobe short extending behind the posterior margin

of clypeus, anteriorly tectiform; frontal carinae distinct widen apart posteriorly. Toruli distinct; antennal scrobe distinct; antennae slender, filiform, 12 jointed, antennal scape cylindrical, funicular segments longer than broad. Relative measurement of length of antennal segments: Scape = 1.8 mm; F<sub>1</sub> = 0.33 mm; F<sub>2</sub> = 0.22 mm; F<sub>3</sub> = 0.38 mm; F<sub>4</sub> 0.33 mm; F<sub>5</sub> = 0.38 mm; F<sub>6</sub> = 0.33 mm; F<sub>7</sub> = 0.33 mm; F<sub>8</sub> = 0.33 mm; F<sub>9</sub> = 0.27 mm; F<sub>10</sub> = 0.16 mm; Club (F<sub>11</sub>) = 0.38 mm. Eyes small, rounded, prominent posterolateral in position.

*Thorax:* Narrow, somewhat compressed; pronotum entirely narrow, posteriorly broad; pro-meso and meso-metanotal sutures distinct; propodeal spiracles distinct; metaplural lobes low and rounded; legs long delicate and fine; tibiae cylindrical, non-spinous; tarsi with small tarsal spurs.

*Abdomen:* Pedicel sessile, nodiform; petiolar node small thick, convex anteriorly, flat posteriorly; gaster broadly oval; hypopygium with circular acidopore guarded by group of hairs.

*Plesiotype: Worker:* INDIA: Kerala, Kohinoor (Malappuram). Karmaly, K.A., 1.iii.1995. [DZCU].

*Other materials examined:* 2W: INDIA: Kerala, Kohinoor, Karmaly. K.A., 1.iii.1995; IW: INDIA: Kerala, Aluva. Karmaly. K.A., 18.x.1995; 1W: INDIA: Kerala, Thrissur, Usha, 22.x.1998.

All specimens deposited in the Systematic Entomology Laboratory, Department of Zoology, Calicut University.

*Distribution:* INDIA: (Kerala: Malappuram), Tamil Nadu; Sri Lanka, Upper Mianmar, Singapore, Indonesia.

*Biology:* Unknown.

**Habitat:** Disturbed with shrubs and herbs.

**Discussion:** *Camponotus variegatus variegatus* Smith closely resembles *Camponotus variegatus infuscus* Forel. in the following features: 1. Antennae slender, filiform, 12 jointed; antennal scape cylindrical; 2. Thorax viewed from side forming a regular arch; 3. Tibiae of legs cylindrical; 4. Pedicel sessile and nodiform; 5. Hypopygium with circular anal orifice guarded by guard hairs. However *Camponotus variegatus variegatus* Smith differs from *Camponotus variegatus infuscus* Forel in having: 1. Head sub-triangular (in *Camponotus variegatus infuscus* head rectangular); 2. Median lobe of clypeus very short (in *Camponotus variegatus infuscus* Forel, median lobe of clypeus considerably longer); 3. Petiolar node thick, convex in front, flat posteriorly (in *Camponotus variegatus infuscus* Forel petiolar node narrowly oval and biconvex).

**Remarks:** Current subspecies: nominal plus *ambonensis* Karavaiev, *bacchus* Smith, *batta* Menozi, *clean* Forel, *comottoi* Emery, *crassinodis* Forel, *dulcis* Dalla Torre, *flavotestaceus* Donisthorpe, *fuscithora* Dalla Torre, *infuscus* Forel, *intrans* Forel, *kattensis* Bingham, *proles* Emery. Donisthorpe (1942) mentioned its locality as "Dohnavur, Tirunelvely Dist., South India."

***Componotus [Myrmoturba] variegatus infuscus* Forel**

(Figs. 70 - 71)

*Camponotus maculatus* r. *infuscus* Forel, 1892. *Jour. Bomb. N.H. Soc.* 242.  
SRI LANKA. [MS].

*Camponotus infuscus* Bingham, 1903. *Fauna. Brit. India Hymenoptera* 2: 354, raised to species.

Combination in *Camponotus (Myrmoturba)* Forel, 1913. *Zool. Jahrb. Abte. Fur. Syst. Geographie und Biol. der. Tiere.* 36: 126.

Combination in *Camponotus (Tanaemyrmex)* Emery 1925, *Genera Insect.* 183: 96.

Subspecies of *Variegatus* Emery, 1925. *Genera Insect.* 183: 96.

**Worker:** TL = 4.96 mm; HL = 1.38 mm; HW = 1.14 mm; CI = 82; SL = 1.07 mm; SI = 93 mm ; ED = 0.28 mm; PW = 1.42 mm; AL = 2.07 mm.

**Colour:** Light castaneous brown, mandibles, clypeus, antennae, and legs brown.

**Sculpture and Hair pattern:** Whole body minutely and closely reticulate, punctate; head and thorax above with large scattered punctures; pubescence spares, short, erect, a little more plentiful on the front of the head, cheeks and abdomen.

**Head:** Somewhat rectangular, rounded above, about the same width as the prothorax; clypeus medially, vertically carinate; median portion anteriorly rectangularly produced into a lobe, anterior margin with 3 long bristles followed by short bristles; mandibles with 6 teeth (an apical tooth followed by 5 acute teeth); antennae slender and filiform; antennal scape cylindrical; funicular segments longer than broad; club single segmented. Relative measurement of length of antennal segments: Scape = 1.07 mm; F<sub>1</sub> = 0.28 mm; F<sub>2</sub> = 0.25 mm; F<sub>3</sub> = 0.14 mm; F<sub>4</sub> = 0.21 mm; F<sub>5</sub> = 0.17 mm; F<sub>6</sub> = 0.17 mm; F<sub>7</sub> = 0.21 mm; F<sub>8</sub> = 0.17 mm; F<sub>9</sub> = 0.14 mm; F<sub>10</sub> = 0.17 mm; Club (F<sub>11</sub>) = 0.28. Eyes comparatively small, frontal rather than lateral.

**Thorax:** Pronotum nearly as broad as long, anteriorly narrowed, slightly constricted, not forming a distinct neck; pro-mesonotal suture distinct; meso-metanotal suture less distinct; legs longer than worker major.

**Abdomen:** Petiole sessile, nodiform, petiolar node narrowly oval, biconvex; 1st gastral segment longer than the 2nd gastral segment; posterior margin of gastral segment with light testaceous band, anal orifice on the last gastral segment guarded by guard hairs.

**Plesiotype: Worker:** INDIA: Kerala, Calicut University Campus, Karmaly. K.A., 26.v.1995. [DZCU].

**Other material examined:** 1W: INDIA: Kerala, Muthappanpuzha (Calicut) Karmaly. K.A., 25.iv.2000 [DZCU].

**Distribution:** INDIA: [Kerala : Malappuram, Calicut]; Sri Lanka, Upper Mianmar, Maymyo.

**Biology:** Unknown.

**Habitat:** Mixed crop area, disturbed by human interference.

**Variation :** Length ranging from 4.33 mm - 4.96 mm. But in the description by Bingham (1903) it is stated that length ranging from 6 mm - 7 mm.

**Discussion:** *Camponotus infuscus* Forel resembles *Camponotus taylora* Forel in the following features: 1. Head rectangular; 2. Antennae 12 segmented; 3. antennal scape cylindrical; 4. Anal orifice on last gastral segment guarded by guard hairs, 5. Clypeus medially vertically carinate, middle portion anteriorly rectangularly produced into lobe. However *Camponotus infuscus* Forel differs from *Camponotus taylora* Forel in having: 1. Median lobe of clypeus considerably short (in *Camponotus taylora* median lobe of clypeus considerably longer); 2. Legs

covered with short rather sparse recumbent hairs (in *Camponotus taylori* legs covered with short dense recumbent pubescence).

**Remarks:** This is the first report of this species from Kerala. Forel (1892) originally described it from Sri Lanka.

***Camponotus [Tanaemyrmex] variegatus somificus* Forel**

*Camponotus variegatus* subsp. *Somifica* Forel, 1902. *Ann. Soc. Ent. Belg.* 46: 287.

INDIA. [MS].

*Camponotus (Tanaemyrmex) variegatus* subsp. *somificus* Chapman and Capco, 1951.

*Monogr. Inst. Sci. Tech. Manila* 1. 252.

**Colour:** Black, abdomen, base of femora and funiculus reddish brown.

**Sculpture and Hair pattern:** Sculpture being more strong and more dense, more thick and coarse on vertex; pubescence erect, more plentiful on abdomen; pilosity on tibiae oblique and plentiful.

**Head:** Antennae long, slender, 12 jointed.

**Thorax:** Legs long.

**Abdomen:** Petiolar node very thin.

**Material examined:** Nil.

**Distribution:** INDIA : Kerala, Tamil Nadu, Sri Lanka.

**Biology:** Unknown.

**Habitat:** Unknown.

**Remarks:** No specimen of this subspecies could be available for this study. The above description is based on the paper of Forel (1902).

***Camponotus [Myrmepomis] velox* (Jerdon)**

*Formica velox* Jerdon, 1851. *Madras Jour. Lit. Sci.* 17: 124. INDIA. [BMNH].

Combination in *Camponotus* Roger, 1863. *Berl. Ent. Zeit.* 7: 3.

*Camponotus (Myrmepomis) velox* Chapman and Capco, 1951. *Monogr. Inst. Sci. Tech. Manila* 1: 236.

**Worker:** TL = 0.052 mm - 0.063 mm.

**Colour:** Dull blackish; pubescence greenish.

**Sculpture and Hair pattern:** Thorax smooth; pubescence restricted to abdomen.

**Head:** Long, oblong; mandibles strongly toothed; antennae long, slender, 12 jointed; eyes large, posterior rather than lateral.

**Thorax:** Smooth, legs long.

**Abdomen:** Petiolar node raised, somewhat rounded, wide above; gastral segments strongly divided.

**Material examined:** Nil.

**Distribution:** INDIA : Kerala (Malabar); Karnataka.

*Biology:* Unknown.

*Habitat:* Unknown.

*Remarks:* No material of this species could be available for this study. The above description is based on the paper of Jerdon (1851). He reported this species and mentioned its locality as Malabar, South India.

## Genus *LEPISIOTA* Santschi

*Lepisiota* Santschi, 1926. *Ann. de. la. Ento. de. France* 95: 15.

Type species: *Plagiolepis rothneyi* Forel, 1894. *Jour. Bomb. Nat. Hist. Soc.* 8: 415.

Synonyms by Bolton, 1995. *A New General Catalogue of the Ants of the world* : 33.

*Acantholepis* Mayr, 1861: 42 .

*Baroniurbania* Pagliano G. & Scaramozzino, P. 1990. *Mem. Soc. Ent. Italiana* 68: 4.

### Diagnostic features

**Worker:** Mandibles narrow elongate, masticatory margin with three acute teeth; maxillary palpi 6 jointed; labial palpi 4 jointed; clypeus broad; high, carinate down the middle, clypeal and antennal hollows confluent; frontal area distinct; antennal carinae very short, wide apart; antennae long, 11 jointed, filiform; scape long, slender, extending beyond the head; eyes large, oval, situated in the middle line of head; ocelli present. Thorax highly constricted in mesonotal region; propodeum swollen and bidentate (two tubercles on either side above); petiolar node biconvex, with two short, acute spines on either side above, bear a petiole posteriorly by which attached to the ventral surface of abdomen; abdomen broadly oval, gibbous in front, anal aperture provided with guard hairs.

**Distribution:** Palaearctic, Ethiopian, and Indo - Malayan regions. In INDIA: Karnataka, Goa, Kerala, Himalayas, Poona, Travancore, Malabar.

**Biology:** Medium sized small ants usually black in colour but some species are brown or yellowish. Nest are made in rotten wood either in standing trees or on the ground or are built directly into hard - packed earth. The foragers of larger species often ascend trees to tend aphids or coccids whilst of other species are found in the leaf-litter layer.

**Habitat:** Found in both disturbed and undisturbed habitat.

**Discussion:** This genus comes near to *Plagiolepis* Mayr in the following features: 1. Antennae 11 jointed. 2. Maxillary palpi 6 jointed; labial palpi 4 jointed. 3. Thorax constricted at mesonotum. However this genus *Lepisiota* Santschi differs from *Plagiolepis* Mayr in having: 1. Propodeum armed with a pair of spines, teeth or tubercles (in *Plagiolepis* propodeum unarmed); 2. Petiole a scale with dorsal margin bispinose (in *Plagiolepis* petiole a reduced scale, inclined forwards and may be overhung by the first gastral segment); 3. Abdomen broadly oval (in *Plagiolepis* abdomen massive).

**Remarks:** The genus *Lepisiota* was erected by Santschi (1926a) based on the type species *Plagiolepis rothneyi* Forel. The species *rothneyi* was originally described by Forel (1894 c) under the genus *Plagiolepis*. It was later shifted to the genus *Acantholepis* by Santschi (1926 a) which is a synonym of *Lepisiota*.

**Key to Oriental species of *LEPISIOTA* Region**  
(Based on workers)

[Modified from Bingham, 1903]

1. Scape of antennae long, extending for more than half its length beyond the top of the head [Fig.78] ..... 2
- Scape of antennae shorter, extending beyond the top of the head by not more than one-third of its length [Fig. 72] ..... 8
2. Pubescence present .....3
- Pubescence absent ..... 4
3. Head rounded behind [Philippines] ..... *L. chapmani* [Wheeler]
- Head not rounded behind [Kerala] ..... *L. munnarensis* sp. nov.
4. Petiole node pentagonal, not squamiform when viewed from side .....5
- Petiole node not pentagonal, but squamiform when viewed from side [India] ..... *L. annandelei* [Mukerjee]
5. Node of pedicel not armed with obtuse teeth [India] .....  
..... *L. frauenfeldi integra* [Forel]
- Node of pedicel armed with obtuse teeth ..... 6
6. Upper border of node of pedicel slightly emarginate .....7
- Upper border of node of pedicel slightly emarginate ..... 7
7. Abdomen smooth, not sculptured [India-Barackpore] .....  
..... *L. frauenfeldi frauenfeldi* [Mayr]
- Abdomen not smooth but sculptured [India] .....*L. sericea* [Forel]
8. Ocelli present .....9
- Ocelli absent [Mianmar] ..... *L. rothneyi watsonii* (Forel)
9. Clypeus carinate [Fig.83] ..... 10
- Clypeus not carinate [Fig.85] ..... 15

10. Abdomen shining .....11  
 - Abdomen not shining ..... 13
11. Petiole node low, flat, transverse above without spines [Fig.84] [India]  
 ..... *L. rothneyi* r. *wroughtonii* [Forel]  
 - Petiole node thick and high with spines or teeth [Fig.82] .....12
12. Head subtrapezoidal, slightly longer than broad, occiput slightly convex  
 [Philippines] ..... *Laurea punctaticeps* [Wheeler]  
 - Head nearly square, occiput slightly flattened and transverse [Kerala] .....  
 ..... *L. opaca opaca* [Forel]
13. Abdomen with a light reddish-yellow spot above at base covering the first  
 and anterior portion of second segment [Kerala] .... *L. opaca pulchella* [Forel]  
 - Abdomen without a light reddish-yellow spot above at base covering the  
 first and anterior portion of second segment .....14
14. Abdomen reddish brown [Kerala] ..... *L. fergusonii* [Forel]  
 - Abdomen fuscous brown [Kerala] ..... *L. malabarensis* sp. nov
15. Pubescence present ..... 16  
 - Pubescence absent [India] ..... *L. capensis simplex*. [Forel]
16. Petiole node bidentate [Fig.24] ..... 17  
 - Petiole node not dentate [Fig.84] [Kerala] ..... *L. rothneyi rothneyi* [Forel]
17. Mesonotum not strongly constricted [Kerala] .... *L. capensis capensis* [Forel]  
 - Mesonotum strongly constricted [India-Mussorie] ..... 18
18. Head broader than long ..... *L. anupama* sp. nov.  
 - Head longer than broad .....*L. modesta* [Forel]

Subspecies *lunaris* [Emery] and *splendida* [Viehmeyer] are excluded from this key since their descriptions are incomplete, and lack in details.

*Lepisiota anupama* sp. nov.

(Figs. 72 - 73)

**Worker.** TL = 3.1 mm; HL = 0.58 mm; HW = 0.74 mm; CI = 125 mm; SL = 0.84 mm; SI = 114 mm; ED = 0.09mm; PW = 0.53 mm; AL = 1.21 mm.

**Colour.** Mandibles antennae basal portion of tibiae and tarsi brownish red; head and legs dark brown; thorax and petiolar node reddish brown with brown markings on back; gaster dark brown, nearly black.

**Sculpture and Hair pattern:** Mandibles feebly reticulate punctate, shining; clypeus feebly reticulate-punctate; cheek, frontal, vertex, occiput finely reticulate-punctate, look like striating appearance; pubescence sparse; head, thorax and abdomen with erect hairs, more on abdomen; pilosity very fine acute and longer; antennae and legs with thick slanting hairs.

**Head:** Narrow, oval, slightly broader than long; mandibles triangular, 6-toothed [1 apical tooth followed by 1 acute tooth and 4 small teeth]; clypeus large, convex, anterior margin entire; median carinae clearly distinct; posterior margin concave; a small depression between posterior margin and frontal region; frontal lobe indistinct; frontal carinae short wide apart posteriorly; antennal carinae short and fused; antennal scrobe short, passing above the eyes, reaching up to middle of occipital region; antennae short, filiform, 11 jointed; antennal scape short reaching up to the vertex; all segments of funiculus longer than broad. Relative measurement of length of antennal segments: Scape = 0.84 mm; F<sub>1</sub> = 0.21 mm; F<sub>2</sub> = 0.11 mm; F<sub>3</sub> = 0.16 mm; F<sub>4</sub> = 0.8 mm; F<sub>5</sub> = 0.11 mm; F<sub>6</sub> = 0.11 mm; F<sub>7</sub> = 0.11 mm; F<sub>8</sub> = 0.13 mm; F<sub>9</sub> = 0.11 mm; Club (F<sub>10</sub>) = 0.18 mm. Eyes moderate, situated laterally in the mid line of head; ocelli present.

**Thorax:** Broad at middle, narrowed anteriorly and posteriorly; pronotum somewhat rectangular, broad posteriorly, pro-mesonotal suture clearly distinct; meso-metanotal suture above deep and distinct, two metanotal spiracles distinct; epinotal furrow superficial; epinotum more short; propodeal teeth thick and broad at base, strong and obtuse; legs short; tibiae with tibial spines, tarsi with tarsal spur; claws simple.

**Abdomen:** Petiolar node thick, bispinous, with angles laterally below the spines; pedicel with short peduncle posteriorly connected with 1st gastral segment; gaster with 4 visible segments, first segment larger, last gastral segment furnished with circular orifice guarded by guard hairs; gaster highly polished and shining.

**Holotype: Worker.** INDIA: Kerala, Aluva, Karmaly. K.A., 15.x.1995 [DZCU].

**Distribution:** INDIA: Kerala: Aluva.

**Biology:** Unknown.

**Habitat:** Disturbed.

**Etymology:** The species name *anupama* is taken from Sanskrit meaning unique (Feminine gender).

**Discussion:** *Lepisiota anupama* sp. nov. closely resembles *Lepisiota modesta* Forel in general appearance and in the following features: 1. antennae 11 jointed; 2. Propodeum with two strong obtuse teeth; 3. Pilosity very fine, acute and longer. However *Lepisiota anupama* sp. nov. differs from *Lepisiota modesta* Forel in having: 1. Head slightly broader than long (in *Lepisiota modesta* head much longer than broad); 2. Thorax and petiolar node reddish brown with brown markings on

back (in *Lepisiota modesta* thorax and petiolar node reddish yellow with brown markings on back).

*Lepisiota capensis capensis* [Mayr]

(Figs. 74 - 75)

*Acantholepis capensis* Mayr 1862. *Verh. Zool - Bot. Ges. Wien*: 699 SOUTH AFRICA.

**Worker.** TL = 2 mm; HL = 0.5 mm; HW = 0.51 mm; CI = 102 mm; SL = 0.6 mm; SI = 118 mm; ED = 0.2 mm; PW = 0.3 mm; AL = 0.7 mm.

**Colour.** Black, shining; mandibles, basal half of scape, tarsi brownish yellow; posterior half of scape, all segments of funiculus, and legs brown.

**Sculpture and Hair pattern:** Head and abdomen smooth and shining, highly polished; metanotum finely sculptured; yellowish erect hairs on head, thorax, more on abdomen; small adpressed hairs more on antennae and legs.

**Head:** Elongate, quadrangular without mandibles, more convex in front; occiput rounded, emarginate; mandibles narrow with 4 teeth (one acute teeth followed by three denticles); clypeus large, convex, anterior margin slightly arched; frontal lobe indistinct; frontal carinae and, frontal area not visible; antennal insertion immediately behind the posterior margin of clypeus; antennal scrobe distinct; torulus round, horizontal; antennal carinae short. Fused; antennae filiform, 11 jointed; antennal scape long extending beyond the top of head; all segments of funiculus longer than broad. Relative measurement of length of antennal segment: Scape = 0.6 mm; F<sub>1</sub> = 0.1 mm; F<sub>2</sub> = 0.07 mm; F<sub>3</sub> = 0.05 mm; F<sub>4</sub> = 1 mm; F<sub>5</sub> = 0.05 mm; F<sub>6</sub> = 0.05 mm; F<sub>7</sub> = 0.09 mm; F<sub>8</sub> = 0.08 mm; F<sub>9</sub> = 0.01

mm; Club ( $F_{10}$ ) = 0.17 mm. Eyes moderately large, oval, frontal, situated about the middle of head.

**Thorax:** pronotum circular from above, pro-mesonotal suture distinct; mesonotum slightly constricted in front forming a cylindrical neck, widening posteriorly; meso-metanotal suture deep and distinct above; metanotal teeth large, thick and broad at base, obtuse; legs somewhat long and slender, tibiae and tarsi with small hairs; claws simple.

**Abdomen:** Pedicel nodiform, single noded, petiolar node with the upper border strongly emarginate, bidentate, gaster oval, broad, rapidly narrowing anteriorly towards the apex.

**Plesiotype: Worker:** INDIA: Kerala, Calicut University Campus, Karmaly, K.A., 24.iii.1995. [DZCU].

**Other materials examined:** 1W: INDIA: Kerala, Kohinoor, Karmaly, K.A., 22.iii.1995; 1w: INDIA: Kerala, Thenjipalam, Karmaly, K.A., 22.v.1995.

All specimens deposited in the collections of Systematic Entomology Laboratory, Department of Zoology, Calicut University.

**Distribution:** India: [Kerala, The Himalayas, Central India, Poona]; Sri Lanka, Extending to Aden and North Eastern Africa.

**Biology:** Unknown.

**Habitat:** Disturbed.

**Discussion:** *Lepisiota capensis* Mayr closely resembles *Lepisiota fergusonii* Forel in the following features: 1. Head, thorax and abdomen abundantly pilose; 2. Antennae 11 segmented; 3. Clypeus convex; 4. Pronotum from above circular; 5. Petiolar node emarginate above. However *Lepisiota capensis* differs from

*Lepisiota fergusonii* in having: 1. Head and abdomen black (in *Lepisiota fergusonii* head and abdomen reddish brown); 2. Head polished, shining (in *Lepisiota fergusonii* head punctured, opaque); 3. Metanotum with obtuse teeth not curved (in *Lepisiota fergusonii* metanotum with two thick curved teeth).

**Remarks:** Current subspecies: nominal plus *acholli* [Weber], *anceps* [Forel], *guineensis* [Mayr], *issore* [Weber], *junodi* [Forel], *laevis* [Santschi], *lunaris* [Emery], *minuta* [Forel], *simplex* [Forel], *simplicoides* [Forel], *specularis* [Santschi], *subopaciceps* [Santschi], *thoth* [Weber], *validiuscula* [Emery] . This is the first report of this species from Kerala. Mayr (1862) originally described this species from South Africa under the genus *Acantholepis* Mayr.

### *Lepisiota fergusonii* [Forel]

*Acantholepis fergusonii* Forel, 1895. *Jour. Bomb. Nat. Hist. Soc.* 9: 459. INDIA.  
[MHNG].

*Acantholepis fergusonii* Bingham, 1903. *Fauna. Brit. India. Hymenoptera*, 2: 319.

*Acantholepis fergusonii* Chapman and Capco, 1951. *Monogr. Inst. Sci. Tech. Manila* 1:  
210.

**Worker.** TL = 3 mm - 3.5 mm.

**Colour.** Head and abdomen reddish brown; mandibles, clypeus, thorax, petiolar node, base of first abdominal segment broadly and a narrow transverse line at the base of third segment yellow; antennae and legs pale brown; yellowish pilose.

**Sculpture and Hair pattern:** Head densely and very finely punctured, opaque; head, thorax and abdomen abundantly pilose.

**Head:** Without the mandibles as broad as long; slightly convex in front; occiput transverse; mandibles narrow, curved, 4-toothed; clypeus convex; antennal carinae short, widely separated, slightly divergent posteriorly.

**Thorax:** Pronotum circular from above, rather flat, mesonotum depressed, thorax deeply emarginate behind the mesonotum; metanotum short, basal portion crescentic from above, two horns of the crescent formed by thick curved teeth or tubercles.

**Abdomen:** Pedicel nodiform, single noded; petiolar node emarginate above; gaster massive and broad.

**Material examined:** Nil.

**Distribution:** INDIA: Kerala (Travancore)

**Biology:** Unknown.

**Habitat:** Unknown.

**Discussion:** *Lepisiota fergusonii* (Forel) closely resembles *Lepisiota capensis* [Mayr] in the following features: 1. Head, thorax and abdomen abundantly pilose; 2. Antennae 11 segmented; 3. Clypeus convex; 4. Pronotum from above circular. 5. Petiolar node emarginate above. However *Lepisiota fergusonii* [Forel] differs from *Lepisiota capensis* [Mayr] in having: 1. Head and abdomen reddish brown (in *Lepisiota capensis* head and abdomen black); 2. Head punctured, opaque (in *Lepisiota capensis* head polished, shining); 3. Metanotum with two thick curved teeth or tubercle (in *Lepisiota capensis* metanotum with obtuse tubercles or teeth, not curved).

**Remarks:** No material of this species was available for this study. The above account of this species is based on the description of Bingham (1903). Bingham (1903) and Chapman and Capco (1951) reported this species from Travancore, South India [R.N. Tiwari, 1999].

*Lepisiota malabarensis* sp. nov.

[Figs. 76 – 77]

**Worker:** TL = 4.1 mm; HL = 0.9 mm; HW = 0.9 mm; CI = 100 mm; SL = 1.04 mm; SI = 114 mm; ED = 0.15 mm; PW = 0.4 mm; AL = 1.59 mm.

**Colour:** Mandibles, clypeus, antennal scape, thorax, petiolar node, tarsi yellowish brown; head, base of first abdominal segment reddish brown; abdomen fuscous brown; funicular segments, legs dark brown; pubescence copper brown.

**Sculpture and Hair pattern:** Head densely and very finely punctured opaque; pronotum densely and very finely punctured; mesonotum longitudinally striate; metanotum and petiolar node very minutely punctured; abdomen feebly reticulate-punctuate, shining, polished; legs feebly granulate, shining; pubescence sparse appressed, thickly present on antennae and legs; erect hairs on head, thorax and abdomen.

**Head:** Without mandibles as broad as long; mandibles narrow, curved with an acute teeth followed by three denticles; clypeus broad, convex, medially carinate, its anterior margin transverse, posterior margin laterally connected with antennal carinae; a triangular gap between posterior margin of clypeus and frontal lobe; frontal lobe indistinct; frontal carinae short, wide apart; antennal carinae short, widely separated, slightly divergent posteriorly; antennal scrobe

shallow, reaching up to the posterior margin of eyes; antennae long, filiform; antennal scape extending beyond the vertex of head; all segments of funiculus longer than broad; club single segmented. Relative measurement of length of antennal segments. Scape = 1.04 mm;  $F_1$  = 0.22 mm;  $F_2$  = 0.09 mm;  $F_3$  = 0.09 mm;  $F_4$  = 0.13 mm;  $F_5$  = 0.09 mm;  $F_6$  = 0.06 mm;  $F_7$  = 0.15 mm;  $F_8$  = 0.13 mm;  $F_9$  = 0.13 mm; Club ( $F_{10}$ ) = 0.27 mm. Eyes small, oval, frontal rather than lateral, medially situated.

**Thorax:** Deeply emarginate behind mesonotum; pronotum rhomboid from above, rather flat, wider at middle, narrowed anteriorly and posteriorly; mesonotum depressed, square; pro-mesonotal suture distinct; meso-metanotal suture feebly distinct; metanotum short, basal portion from above crescentic with thick curved tubercles; legs small tarsi with small slanting hairs.

**Abdomen:** Pedicel nodiform, single noded; petiolar node emarginate above, two short spines on either side, angle between them petiole with a short peduncle posteriorly by which it attached to gastral segments; gaster broad, massive, second gastral segment larger than remaining segments, apex of last gastral segment with circular anal orifice guarded by guard hairs.

**Holotype:** *Worker:* INDIA: Kerala, Anakampoyil, Pramod, 26.vi.1995. [DZCU].

**Paratype :** 2W: With the same data as that of holotype [DZCU].

**Distribution:** INDIA: Kerala: Calicut.

**Biology:** Unknown.

**Habitat:** Disturbed with shrubs herbs, and plants.

**Discussion:** This new species *Lepisiota malabarensis* sp. nov. closely resembles *Lepisiota fergusoni* [Forel] in the following features: 1. Head without mandibles as broad as long; 2. Antennae 11 segmented; 3. Clypeus convex; 4. antennal carinae short, widely separated; 5. Thorax deeply emarginate behind the mesonotum. However *Lepisiota malabarensis* sp. nov. differs from *Lepisiota fergusoni* [Forel] in having: 1. Abdomen fuscous brown (in *Lepisiota fergusoni* abdomen reddish brown); 2. Pronotum rhomboid (in *Lepisiota fergusoni* pronotum circular); 3. Mesonotum longitudinally striate (in *Lepisiota fergusoni* mesonotum smooth); 4. Abdomen without yellow spot at base (in *Lepisiota fergusoni* abdomen with yellow spot at base).

***Lepisiota munnarensis* sp. nov.**

(Figs. 78 - 79)

**Worker:** TL = 5 mm; HL = 1.07 mm; HW = 0.63 mm; CI = 59 mm; SL = 1 mm; SI = 159 mm; ED = 0.03 mm; PW = 1.3 mm; AL = 1.07 mm.

**Colour:** Dark reddish brown; mandibles and abdomen dark brown; eyes black with grey shade; basal portion of antennal scape, petiolar node, tarsi, claws brownish yellow; legs fuscous brown; first-abdominal segment anteriorly reddish brown; pubescence very pale; hairs brown.

**Sculpture and Hair pattern:** Head, thorax, abdomen, funicular segments, legs shining; petiolar node and metanotum very minutely rugulose; abdomen very minutely rugulose, and highly polished; mesonotum with long striations; sparse erect pilosity on head, thorax, abdomen and petiolar node; adpressed pubescence more on antennae and legs.

**Head:** When viewed from side front distinctly longer than broad not rounded, vertex slightly emarginate; mandibles not narrow, curved, with long and acute apical tooth followed by three small teeth; clypeus highly convex, anterior margin rounded with a faint transverse subapical furrow parallel to anterior margin; suture between posterior margin and frontal area feebly distinct; antennal insertion very close to posterior margin of clypeus; torulus rounded, vertical; antennal scrobe short, distinct; antennal carinae short, wide apart; antennae long, filiform, 11 jointed; antennal scape long, serrated laterally on both sides, extending beyond the top of head; all segments of funiculus longer than broad. Relative measurement of length of antennal segment : Scape = 1 mm; F<sub>1</sub> = 0.28 mm; F<sub>2</sub> = 0.35 mm; F<sub>3</sub> = 0.17 mm; F<sub>4</sub> = 0.14 mm; F<sub>5</sub> = 0.1 mm; F<sub>6</sub> = 0.21 mm; F<sub>7</sub> = 0.14 mm; F<sub>8</sub> = 0.15 mm; F<sub>9</sub> = 0.15 mm; Club (F<sub>10</sub>) = 0.25 mm. Eyes oval, lateral, situated about the middle of head.

**Thorax:** Pronotum broader than long, when viewed from side almost circular, nearly flat and concave above; pro-meso, meso-metanotal sutures distinct; mesonotum strongly constricted in front forming a cylindrical neck, widening posteriorly; metanotal groove distinct; metanotal spiracle present; metanotal teeth thick and broad at base, obtuse; legs moderate, tarsi with tarsal hairs; tibiae with tibial spines, claws very simple.

**Abdomen:** Pedicel nodiform, single noded; petiolar node pentagonal when seen from back, upper margin slightly emarginate with a small tooth at its lateral angles; gaster oval, massive with four visible segments, first gastral segment larger than the remaining segments; anal orifice at the apex of last gastral segment, guarded by guard hairs.

**Holotype:** Worker. INDIA: Kerala, Cheerambadi (Munnar), Blessy, 19.ix.1998. [DZCU].

**Paratypes** : 3W: With the same data as that of holotype [DZCU].

**Distribution**: INDIA: Kerala [Munnar].

**Biology**: Unknown.

**Habitat**: Disturbed with plants.

**Etymology**: Named after the Locality collection.

**Discussion**: This new species *Lepisiota munnarensis* sp. nov. closely resembles *Lepisiota frauenfeldi* [Mayr] in general appearance and in the following features: 1 Antennae 11 jointed; 2. Clypeus highly convex; 3. Mesonotum strongly constricted in front forming a cylindrical neck; 4. Metanotal teeth thick and broad at base. However this new species *Lepisiota munnarensis* sp. nov. differs from *Lepisiota frauenfeldi* [Mayr] in having: 1. Pubescence distinct on body especially on antennae and legs (in *Lepisiota frauenfeldi* pubescence entirely absent); 2. Head not rounded (in *Lepisiota frauenfeldi* head rounded); 3. Mandibles not narrow (in *Lepisiota frauenfeldi* mandibles narrow).

***Lepisiota opaca opaca* [Forel]**

(Figs. 80 - 81)

*Acantholepis opaca* Forel, 1892. *Ann. Soc. Ent. Bely.* 36: 43. INDIA. [MS].

*Acantholepis opaca* Bingham, 1903. *Fauna. Brit. India. Hymenoptera.* 2: 318.

*Acantholepis opaca* Chapman and Capco, 1951. *Monogr. Inst. Sci. Tech. Manila* 1: 210.

**Worker.** TL = 2.3 mm; HL = 0.58 mm; HW = 0.62 mm; CI = 106 mm; SL = 0.63 mm; SI = 102 mm; ED = 0.12 mm; PW = 0.4 mm; AL = 0.9 mm.

**Colour:** Head, thorax, coxae, femora of legs, thorax, petiolar node and abdomen brownish black; tibiae brownish black with a yellow tinge, antennal scape, apex of coxae, trochanter, bases and apices of femora reddish testaceous, funicular segments, maxillary and labial palpi brown; mandibles reddish brown; tarsal segments pale yellow with a reddish tinge; brown hairs; pubescence white.

**Sculpture and Hair pattern:** Head dorsally, feebly longitudinally striate; mandibles with some weak striations at base; cheeks smooth; clypeus somewhat smooth; pronotum with feeble longitudinal striations but more distinct than on head; meso and metanotum coarsely longitudinally striate, rugulose, petiolar node, abdomen and legs smooth, polished; pilosity a few on clypeus, dorsal surface of thorax, and ventral part of gaster. Abdomen clothed with few rows of strong brown, clavate long hairs; small white sparse pubescence seen on the whole body.

**Head:** A little broader than long, sides straight, posterolateral angles rounded, occiput transverse; mandibles narrow elongate, masticatory margin with three acute teeth; clypeus broad, high, carinate down the middle, anterior margin round, clypeal and antennal hollows confluent; frontal area distinct; antennal carinae very short, wide apart; torulus rounded; horizontal; antennal scrobe distinct; antennae long, filiform; antennal scape long, slender, extending beyond the head; all segments of funiculus except 2-5 longer than broad; segment 2-5 subequal in length and breadth. Relative measurement of length of antennal segments : Scape = 0.63 mm; F<sub>1</sub> = 0.12 mm; F<sub>2</sub> = 0.06 mm; F<sub>3</sub> = 0.06 mm; F<sub>4</sub> = 0.06 mm; F<sub>5</sub> = 0.08 mm; F<sub>6</sub> = 0.08 mm; F<sub>7</sub> = 0.08 mm; F<sub>8</sub> = 0.08 mm; F<sub>9</sub> = 0.1 mm; Club (F<sub>10</sub>) = 0.2 mm. Eyes large, oval, placed on the midline of head.

**Thorax:** Highly constricted at the mesonotum; pronotum broad and convex anteriorly, constricted posteriorly; pro-meso and meso-metanotal sutures distinct; mesonotum compressed, with two tubercles on either side above; basal portion of metanotum from above crescentic, the two horns of the crescent formed by thick straight teeth; legs elongate, mid and hind tibiae with spurs; claws simple.

**Abdomen:** Pedicel nodiform, single noded; petiolar node biconvex, with two short acute apices on either side above, bear a pedicel posteriorly by which attached to the ventral surface of gaster so that the gaster seems to be overhanging the petiole of pedicel; gaster broadly oval, gibbous in front slightly depressed and acutely pointed at apex, anal orifice guarded by guard hairs.

**Plesiotype: Worker.** INDIA: Kerala, Calicut University Campus, Karmaly. K.A., 24.vi. 1995. [DZCU].

**Other materials examined:** 1W: INDIA: Kerala, Kohinoor (near Calicut University), Karmaly. K.A., 26.iii.1995; 4W: INDIA: Kerala, Calicut University Campus, Sheela. S., 8.xii.1991. 1W: INDIA: Kerala, Aluva, Karmaly. K.A., 12.ii.1995; 5W: INDIA: Kerala, Calicut University Campus, Karmaly. K.A., 24.vi.1995; IW : INDIA: Kerala, Calicut University Campus, Karmaly. K.A., 28.vi.1995. 1W: INDIA: Kerala, Muthenga (Wyanad), Karmaly. K.A., 7.x.1995.

All specimens deposited in the collections of Systematic Entomology Laboratory, Department of Zoology, Calicut University.

**Distribution:** INDIA: [Kerala: Ernakulam, Malappuram, Wyanad]; Kanara, Goa.

**Biology:** Unknown.

**Habitat:** Disturbed with shrubs, herbs, grassy field etc.

**Discussion:** *Lepisiota opaca opaca* [Forel] closely resembles *Lepisiota opaca pulchella* (Forel) in general appearance and in the following features: 1. Head and thorax finely and very closely punctured, opaque; 2 Abdomen shining; 2 Clypeus large and very-convex, medially vertically carinate; 3. Antennae very short extending very little beyond the top of the head. However *Lepisiota opaca opaca* [Forel] differs from *Lepisiota opaca pulchella* (Forel) in having: 1. Pronotum broad; mesonotum moderately constricted (in *Lepisiota opaca pulchella* pronotum is narrower; mesonotum is not so strongly constricted); 2. Abdomen purplish black without a light reddish-yellow spot above at base covering the first and anterior portion of the second segment (in *Lepisiota opaca pulchella* abdomen purplish brown with a light reddish-yellow spot above at base covering the first and anterior portion of the second segment); 3. Head square, not convex in front, the occiput flattened and transverse (in *Lepisiota pulchella* head round, more convex in front, the occiput arched, not transverse).

**Remarks:** Current subspecies : nominal plus *pulchella* [Forel]. This is the first report of this subspecies from Kerala. Bingham (1903) reported this subspecies from Kanara and Goa. Later on Chapman and Capco (1951) also reported this subspecies from Kanara.

***Lepisiota opaca pulchella* [Forel]**

[Figs. 82 - 83]

*Acantholepis opaca*. r. *pulchella* Forel, 1892. *Ann Soc. Ent. Belg.* 36: 43. INDIA. [MS].

Bingham 1903 raised to species.

*Acantholepis pulchella* Bingham, 1903. *Fauna. Brit. India Hymenoptera*; 2: 318.

**Worker.** TL = 2.58 mm; HL = 0.75 mm; HW = 0.82 mm; CI = 109.33 mm; SL = 0.58 mm; SI = 70.73 mm; ED = 0.11 mm; PW = 0.62 mm; AL = 1.03 mm.

**Colour.** Head, thorax, legs dark purplish brown; anterior portion of thorax, mandibles, antennal scape lighter brown; funiculus dark brown; tarsi brownish white; abdomen dull black with a light reddish yellow spot above at base covering the first and anterior portion of second segment.

**Sculpture and Hair pattern.** Head and thorax finely and very closely punctured, opaque; abdomen shining; clypeus, vertex, anterior portion of pronotum, apex of abdomen with some scattered yellowish pilosity; funiculus with thick short pubescence.

**Head:** Round, more convex in front, occiput arched; mandibles narrow with an apical teeth followed by 3 denticles; clypeus large convex, medially vertically carinate, its anterior margin rounded, posterior margin. Somewhat transverse; frontal region distinct; frontal lobe indistinct; frontal carinae short, parallel; antennal carinae short, fused; toruli immediately connected with posterolateral margin of clypeus; antennal scrobe very short; antennae short, filiform, 11 segmented; antennal scape short, extending beyond the top of head. Relative measurement of length of antennal segments: Scape = 0.58 mm;  $F_1$  = 0.13 mm;  $F_2$  = 0.06 mm;  $F_3$  = 0.06 mm;  $F_4$  = 0.10 mm;  $F_5$  = 0.6 mm;  $F_6$  = 0.16 mm;  $F_7$  = 0.10 mm;  $F_8$  = 0.06 mm;  $F_9$  = 0.06 mm; Club ( $F_{10}$ ) = 0.17 mm. Eyes moderate, situated at the midline, frontal rather than lateral.

**Thorax:** Highly constricted at the mesonotum; pronotum anteriorly narrowed, broad at middle, rounded posteriorly, flat above pro-meso and meso-metanotal sutures distinct; mesonotum compressed with two tubercles on either side above; basal portion of metanotum from above crescentic, the two horns of

the crescent formed by thick straight teeth; legs elongated, mid and hind tibiae with spurs; claws simple.

**Abdomen:** Node of pedicel biconvex, with two short, acute spines on either side above, bear a petiolar node posteriorly by which attached to the ventral surface of abdomen so that the abdomen seems to be overhanging the petiolar node; gaster broadly oval, gibbous in front, slightly depressed and acutely pointed at apex, anal orifice provided with guard hairs.

**Plesiotype: Worker.** INDIA: Kerala, Calicut University Campus, Karmaly. K.A., 26.iv.1995. [DZCU].

**Other materials examined:** INDIA: Kerala, Thuruthipuram (Kodungalloor - Thrissur), Rani. K.A., 10.v.1995; 1W: INDIA: Kerala, Thenjipalam (near Calicut University Campus), Karmaly. K.A., 30.iv.1995; 2W: INDIA: Kerala, Calicut University Campus, Karmaly. K.A., 26.iv.1995; 5W: INDIA: Kerala, Calicut University Campus, Karmaly. K.A., 28.vi.1995.

All specimens deposited in the collections of Systematic Entomology Laboratory, Department of Zoology, Calicut University.

**Distribution:** INDIA: [Kerala: Thrissur, Malappuram].

**Biology:** Unknown.

**Habitat:** Disturbed by human interference.

**Variation:** Scattered yellowish pilosity is present on clypeus, vertex, anterior portion of pronotum and apex of abdomen all segments of funiculus clothed with thick short pubescence. In the description of Bingham (1903) it is stated that pilosity and pubescence entirely wanting.

**Discussion:** The affinities are discussed under *Lepiosiota opaca opaca* [Forel].

**Remarks:** This is the first report of this subspecies from Kerala. Forel (1892) originally reported this subspecies from Poona, Western India under the genus *Acantholepis* Forel.

***Lepisiota rothneyi rothneyi* [Forel]**

(Figs. 84 - 85)

*Plagiolepis rothneyi* Forel, 1894c. *Jour. Bomb. Nat. Hist. Soci.* 8: 415. INDIA. [MHNG].

Combination in *Acantholepis (Lepisiota)* Santschi, 1926a. *Ann. Soci. Ent. France.* 95: 15.

**Worker :** TL = 3.6 mm; HL = 0.73 mm; HW = 0.8 mm; CI = 110 mm; SL = 0.73 mm; SI = 91.3 mm; ED = 0.13 mm; PW = 0.8 mm; AL = 1.3 mm.

**Colour:** Dark brown; mandibles, antennae, legs reddish brown; eyes greyish brown; hairs dark brown.

**Sculpture and Hair pattern:** Minutely rugulose, smooth, shining, polished. Head, thorax and abdomen with sparse erect hairs and very fine thin pubescence, only to be seen in certain lights.

**Head:** Nearly square without mandibles, a little broader posteriorly than in front, occiput round, somewhat concave, slightly emarginate; mandibles triangular, masticatory margin broad, 5-toothed, apical tooth large and curved inward followed by 4 acute teeth; clypeus convex, tectiform, not carinate, medial angle on its anterior margin indistinct, not covering any portion of mandibles, posterior margin feebly distinct; frontal lobe fused, frontal carina short antennal

insertion immediately just behind the posterior margin of clypeus; antennal scrobe short, groove like; torulus short, rounded, vertical; antennal carinae distinct, short; antennae short, slender, 11 jointed; antennal scape short, its length equal to length of head, reaching up to top of head; all segments of funiculus longer than broad. Relative measurement of length of antennal segments: Scape = 0.73 mm; F<sub>1</sub> = 0.02 mm; F<sub>2</sub> = 0.06 mm; F<sub>3</sub> = 0.1 mm; F<sub>4</sub> = 0.13 mm; F<sub>5</sub> = 0.1 mm; F<sub>6</sub> = 0.1 mm; F<sub>7</sub> = 0.13 mm; F<sub>8</sub> = 0.13 mm; F<sub>9</sub> = 0.13 mm; Club (F<sub>10</sub>) = 0.33 mm. Eyes small, rounded, frontal rather than lateral, placed above the mandibles; ocelli present.

*Thorax:* Pronotum very convex and rounded in front, pro-mesonotal suture feebly distinct; mesonotum nearly as long as pronotum; meso-metanotal suture clearly distinct, deep and wide supported by two teeth like carinae; metanotum large, broad and flat, propodeum apically flat and obliquely sloping, its basal and apical portion about equal in size; legs small, tibiae smooth, compressed; tarsi with tarsal spines; claws simple.

*Abdomen:* Pedicel nodiform, single noded; petiolar node low, thick at base, slightly conical and rounded, broader than long at apex; gaster very broad, convex and massive, gibbous in front, five visible segments, last gastral segment with circular anal orifice at its apex guarded by guard hairs.

*Plesiotype: Worker.* INDIA: Kerala, Muthenga, Karmaly. K.A., 7.v.2000 [DZCU].

*Other materials examined:* 2 W: with the same date as that of plesiotype; 2W: INDIA: Kerala, Kasaragod (Cherkala), Sebastian. K.A., 8.x.2000; 2W: INDIA: Kerala, Manalikalad (Kodungallur), Karmaly. K.A., 23.ix.1995; 4W: INDIA: Kerala, Aralam forest, Karmaly. K.A., 16.xii.1995.

**Distribution:** INDIA: [Kerala: Wyanad, Kasaragod, Kannur, Thrissur), Bengal (Rothney), Western India (Wroughton).

**Biology:** Unknown.

**Habitat:** Collected from both disturbed and undisturbed habitat.

**Discussion:** *Lepisiota rothneyi* (Forel) closely resembles *Lepisiota watsoni* (Forel) in the following features: 1. Equal in size; 2. Antennae 11 jointed. However *Lepisiota rothneyi* [Forel] differs from *Lepisiota watsoni* [Forel] in having: 1. Clypeus not carinate (in *Lepisiota watsoni* clypeus carinate); 2. Masticatory margin broad (in *Lepisiota watsoni* masticatory margin oblique); 3. Pilosity and pubescence sparse (in *Lepisiota watsoni* pilosity and pubescence dense); 4. Ocelli present (in *Lepisiota watsoni* ocelli absent).

**Remarks:** Current subspecies: nominal plus *splendida* [Viehmeyer], *Sundaica* [Emery], *taivanae* [Forel], *watsonii* [Forel], *wroughtonii* [Forel].

## Genus *OECOPHYLLA* Smith

*Oecophylla* Smith, 1860. *Jour. Proc. Linn. Soc. Lond. Zool.* 5: 101.

Type species: *Formica virescens* Fabricius, 1775. AUSTRALIA. (Junior Synonym of *Oecophylla smaragdina*).

### Diagnostic features:

*Worker*: 7.5 mm - 11 mm. Head roundly quadrangular without the mandibles; posteriorly transverse, slightly broader than in front; mandibles long, triangular, apical teeth long, acute and crossing over at rest. Apical margin behind first tooth with seven to ten smaller teeth on denticles, of which the first and third are usually the largest. Masticatory margin very broad in proportion to length. Maxillary palpi 5 jointed; labial palpi 4 jointed; clypeus large, convex, anterior margin strongly arched, overhanging the basal borders of the mandibles, posterior margin little emarginate; frontal area small, triangular; antennal carinae short, wide apart, antennae situated remote from posterior margin of clypeus; antennae long, filiform, 12 jointed; first funicular segment longer than second and third together; antennal scape extends beyond head by more than half its length; eyes large, oval, prominent; ocelli absent but shallow pits may mark their location in the major workers. Alitrunk strongly constricted in mesonotal region; pronotum and propodeum considerably broader than the region separating them. Pronotum convex, anteriorly narrowed into a collar, mesonotum narrow, viewed from side forming a saddle-shaped; metanotum rounded above, gibbous; pro-meso and meso-metanotal sutures distinct; legs long and slender; petiole elongate

and narrow in dorsal view, forming a low, rounded node in profile. Gaster short, oval, with acidopore visible, not hidden by the pygidium.

**Distribution:** INDIA: [Throughout India]; Myanmar, Sri Lanka, extends through the Malayan subregion to Australia and New Guinea.

**Biology:** Arboreal ants, making nests by binding leaves together with larval silk. The major workers are generally carnivores and scavengers.

**Habitat:** Both disturbed and undisturbed areas.

**Discussion:** This genus comes near to *Opisthopsis* Emery in the following features: 1. Antennae 12 segmented; 2. Antennal sockets situated far behind posterior clypeal margin; 3. Mandibles elongate, triangular. However this genus *Oecophylla* Smith differs from *Opisthopsis* Emery in having: 1. Mandibles with 7-10 teeth (in *Opisthopsis* mandibles with 5-7 teeth); 2. Petiole reduced to an elongate low node (in *Opisthopsis* petiole an erect node or scale); 3. Maxillary palpi 5 segmented and labial palpi 4 segmented (in *Opisthopsis* maxillary palpi 6 segmented and labial palpi 4 segmented).

### *Oecophylla smaragdina* (Fabricius)

(Figs. 86 - 87)

*Formica smaragdina* Fabricius, 1775 *Syst. Ent.* : 828. INDIA. [BMNH].

**Worker major:** TL = 7.82 mm; HL = 1.29 mm; HW = 1.52 mm; CI = 117.82 mm; SL = 2.35 mm; SI = 154 mm; ED = 0.35 mm; PW = 1.29 mm; AL = 2.70 mm.

**Colour:** Rusty red on head, thorax and abdomen, mandibles yellow, masticatory margin brownish; antennae, legs and clypeus yellowish red; pubescence whitish in colour.

**Sculpture and Hair pattern:** Whole body feebly granulate pilosity wanting on head and thorax, a few erect hairs present beneath and along the margins of abdomen ventrally; pubescence very thin, fine and minute. Head, thorax, legs, node of pedicel and abdomen sub opaque.

**Head:** Somewhat quadrangular; little emarginate posteriorly; narrowing towards the front, broad posteriorly; mandibles long; masticatory margin very broad in proportion to its length; dentate, apical tooth acute, curved; maxillary palpi 5 jointed; labial palpi 4 jointed; clypeus broad, strongly convex, anterior margin arched, posterior margin shorter than anterior margin, little emarginate; frontal area small, triangular; frontal carinae short, parallel; antennal carinae short, wide apart; antennal scrobe short, groove like; torulus round, horizontal; antennae situated remote from the posterior margin of clypeus; antennae long, filiform, 12 jointed, 1st funicular segment longest, equal to the next two segments together; scape extends beyond the head by more than half its length. Relative measurement of length of antennal segments: Scape = 2.35 mm;  $F_1 = 0.82$  mm;  $F_2 = 0.35$  mm;  $F_3 = 0.35$  mm;  $F_4 = 0.23$  mm;  $F_5 = 0.29$  mm;  $F_6 = 0.17$  mm;  $F_7 = 0.17$  mm;  $F_8 = 0.23$  mm;  $F_9 = 0.29$  mm;  $F_{10} = 0.35$  mm; Club ( $F_{11}$ ) = 0.47 mm. Eyes large, oval, prominent, convex, frontal rather than lateral.

**Thorax:** Elongate; pronotum convex, possess a long neck in front, broader posteriorly; mesonotum constricted, narrow, concave dorsally, saddle shaped, highly emarginate in this portion, spiracles dorsally on either side, an incision just below the spiracles laterally; pro-mesonotal suture distinct, suture separating metanotum from the mesonotum can be seen only on the dorsal surface and it

continues a little laterally; metanotum rounded above, gibbous; legs long and slender; tarsi with tarsal spines.

**Abdomen:** pedicel elongate, incrassate in the middle, scarcely nodiform; gaster short, oval with 4 visible segments, 5th segment is hidden by the 4th gastral segment.

**Plesiotype: Worker:** INDIA: Kerala: Muthenga [Wyanad] Karmaly. K.A., 7.x.1995 [DZCU].

**Other materials examined:** 3W: INDIA: Kerala: Calicut University Campus, Sheela. S., 4. xii.1992; 5W: INDIA: Kerala: Aluva, Karmaly. K.A., 10.iii.1995; 2W: INDIA: Kerala: Manalikal, Karmaly. K.A., 23.ix.1995; 3W: INDIA: Kerala: Aralam Forest, Karmaly. K.A., 16.xii.1995; 6W: INDIA: Kerala: Kohinoor, Karmaly. K.A., 23.ii.1995; 4W: INDIA: Kerala, Muthappanpuha, Karmaly, K.A., 30.xi.1998.

All specimens deposited in the Systematic Entomology Laboratory, Department of Zoology, Calicut University.

**Distribution:** INDIA: ["Throughout"]; Mianmar; Sri Lanka; S. China; Malaya; New Guinea; Australia.

**Biology:** Nest usually seen on trees like *Mangifera indica*, coconut, Asoka trees, etc. The nests are made in the leaves which are bound together by fine whitish membranous tissue paper like synthetic substance. This is the notorious and vicious 'Red-Ant' of India; it inhabits in trees and makes nest in leaves. In Kanara and some other parts of the country, and Burma and Siam, a paste made of this species of ants pounded is eaten as a condiment with curry. The eggs of this species have been found to contain protein and fat. It is used as a medicine to

combat the condition of Avitaminosis, Particularly in case of Marasmus condition (R.N. Tiwari, 1999).

**Habitat:** Disturbed and undisturbed areas.

**Discussion:** *Oecophylla smaragdina* (Fabricius) closely resembles the African *Oecophylla longinoda* (Latreille) in the following features: 1. Antennae 12 jointed; 2. Whole body feebly granulate; 3. Thorax elongate, anteriorly, narrowed into a collar; 4 pedicel elongate, incrassate in the middle, scarcely nodiform. However *Oecophylla smaragdina* (Fabricius) differs from *Oecophylla longinoda* (Latreille) in having: 1. Head somewhat quadragular (in *Oecophylla longinoda* head trinagular); 2. Mandibles long (in *Oecophylla longinoda* mandibles short); 3. Pronotum convex (in *Oecophylla longinoda* pronotum less convex).

**Remarks:** Jerdon (1851) also reported this species under the genus *Formica* from S. India and noted "This ant is well known in Malabar, and the wooded parts of India." Subsequently, Bingham (1903) reported its distribution as "The whole of India, Mianmar and Sri Lanka within our limits, except the deserts and treeless tracts. The range of this species extends through the Malayan subregion to Australia and New Guinea."

## Genus *POLYRHACHIS* F. Smith

*Polyrhachis* Smith, F. 1857. *Jour. Proc. Linn. Soc.* 2: 58.

Type species : *Formica bihamata*; (Bolton), 1995. *A New General Catalogue of the Ants of the World*: 43.

The following synonymys by Bolton, 1995. *A New General Catalogue of the Ants of the world*.

*Anoplomyrma* Chapman, 1963: 258.

*Aulacomyrma* Emery, 1921 e: 17.

*Campomyrma* Wheeler, 1911 c: 860.

*Cephalomyrma* Karavaiev, 1935 a: 115.

*Chariomyrma* Forel, 1915 b: 107.

*Crystomyrma* Forel, 1915 b: 107.

*Dolichorhachis* Mann, 1919: 386.

*Erelyna* Donisthorpe, 1937 c: 273.

*Florencea* Donisthorpe, 1937 a: 624.

*Hagiomyrma* Wheeler, 1911 c: 860.

*Hedomyrma* Forel, 1915 b: 107.

*Hemioptica* Roger, 1862 a: 238.

*Hoplomyrma* Gerstaecker, 1859: 262.

*Irenea* Donisthorpe, 1938 e: 502.

*Johnia* Karavaiev, 1927 e: 43.

*Morleyidris* Donisthorpe, 1944 c: 64

*Myrma* Billberg, 1820: 104.

*Myrmatopa* Forel, 1915 b: 107.

*Myrmhopla* Forel, 1915 b: 107.

*Myrmothrinax* Forel, 1915 b: 107.

**Diagnostic features:**

Worker: Length 5.56 mm - 7.97 mm. Head oval, round orbicular, subtriangular, convex above, with very prominent, long and sinuate frontal carinae; mandibles 5-toothed; median portion of clypeus usually projecting as a lobe, broadly emarginate. Maxillary palpi 6 jointed; labial palpi 4 jointed; antennae long, 12 jointed; antennal scape inserted some distance behind posterior border of clypeus; funicular joints considerably longer than broad. Eyes well developed, strongly protuberant, situated on posterior half of head. Anterolateral frontal angles projecting as teeth or spines. Alitrunk emarginate laterally; propodeum usually bispinose. Petiole armed with from two to six teeth (spines). Gaster large, broadly subglobular, very convex above, first segment forming more than half of its surface and more or less truncated in front. Legs long and well developed; tibiae often constricted at the base.

***Distribution:*** Both hemispheres. In INDIA: Bengal, Bihar, Orissa, Assam. Karnataka, Western-ghats, Mangalore, Bangalore, Kerala, Malabar, Tamil Nadu.

***Biology:*** Arboreal ant, nesting in the wood or in rot holes in the branches. Some species built nests of silk mixed with vegetable fibres adherent to the undersides of leaves. A few species nest in the earth. Female is larger than the worker. Thorax is massive. Spines on the thorax and petiole are smaller. Wings are long. Gaster is massive. First gastral segment is proportionally shorter than in the worker. Male is small and slender. Thorax and petiole are unarmed. Petiole is with a low, thick scale. Frontal carinae are more approximated. Front is more convex. Pronotum is overarched by the mesonotum. Genital valves small and slender. Cerci distinct.

***Habitat:*** Found in both disturbed and undisturbed habitat.

**Discussion:** This genus comes near to *Camponotus* Mayr, in the following features: 1. Antennae 12 jointed; 2. Antennal sockets situated far behind posterior clypeal margin; 3. Maxillary palpi 6 jointed; labial palpi 4 jointed. However this genus *Polyrhachis* Smith differs from *Camponotus* Mayr in having: 1. Metapleural gland orifice absent from side of metapleuron (in *Camponotus* metapleural gland orifice present); 2. Tergite of first gastral segment large (in *Camponotus* tergite of first gastral segment shorter); 3. Spines present on pronotum, propodeum, petiole or on two or all of them (in *Camponotus* spines absent from pronotum, propodeum and petiole).

**Remarks:** The genus *Polyrhachis* comes under the subfamily Formicinae in India there are approximately 8 subgenera, 48 species and 13 subspecies. The following are the subgenera under the genus *Polyrhachis*. They are: *Anoplomyrma* Chapman, *Aulacomyrma* Emery, *Campomyrma* Wheeler, *Cephalomyrma* Karavaiev, *Crystomyrma* Forel, *Dolichorhachis* Mann, *Erelyna* Donisthorpe, *Florencea* Donisthorpe, *Hemioptica* Roger, *Hoplomyrma* Gerstaecker, *Irenea* Donisthorpe, *Johnia* Karavaiev, *Morleyidris* Donisthorpe, *Myrma* Billberg, *Myrmatopa* Forel, *Myrmhopla* Forel, *Myrmothrinax* Forel.

**Key to Indian species of *Polyrhachis* F. Smith**

[Based on Workers]

[Modified from Bingham 1903]

1. Thorax armed with spines or teeth [Fig.112] ..... 2
- Thorax unarmed [Fig. 110] ..... 60
2. Thorax rounded above, sides not margined along their whole length [Fig.116] ..... 3
- Thorax flat above, sides margined along their whole length [Fig.106] ..... 37
3. Mesonotum armed with spines ..... 4
- Mesonotum unarmed ..... 6
4. Petiole spines parallel, not divergent from base [Fig.6] ..... 5
- Petiole spines not parallel, but divergent from base [Fig.7] .....  
..... *P. ypsilon* Emery.
5. Pronotal spines pointing outwards and curved laterally backwards, forming hooks [Fig.10] ..... *P. bihamata* [Drury]
- Pronotal spines pointing outwards and downwards, not curved, not forming hooks [Fig.11] ..... *P. bellicosa* Smith
6. Metanotum armed with spines [Fig.12] ..... 7
- Metanotum unarmed [Fig.108] ..... 33
7. Pubescence soft erect and abundant ..... 8
- Pubescence silky, short and recumbent, or sparse and erect, or entirely wanting ..... 10
8. Spines on petiole forming hooks [Fig.12] [Kerala] ..... *P. furcata* Smith
- Spines on petiole not forming hooks [Fig.116] ..... 9
9. Head smooth, shining, not punctured .....  
..... *P. graciliori* Forel [= *weberi* Donisthorpe]

- Head not smooth, not shining, but coarsely punctured .....  
..... *P. rufipes* F. Smith [= *Phipsoni* Forel]
- 10. Spines on metanotum forming hooks [Fig.13] ..... 11
- Spines on metanotum not forming hooks [Fig.14] .....13
- 11. Abdomen clothed with golden hairs ..... *P. rupicapra*. Roger
- Abdomen not clothed with hairs ..... 12
- 12. Head and abdomen opaque; thorax finely punctured ..... *P. hodgsoni* Forel
- Head and abdomen not opaque, shining; thorax coarsely punctured .....  
..... *P. arachne* Emery
- 13. Basal portion of metanotum without margin laterally ..... 14
- Basal portion of metanotum with margin laterally ..... 27
- 14. Pubescence sparse or entirely wanting ..... 15
- Pubescence dense, silky and recumbent ..... 23
- 15. Spines on petiole wide-spreading shaped so as to encircle front of abdomen  
..... 16
- Spines on petiole not wide-spreading, not shaped so as to encircle the  
abdomen ..... 18
- 16. Head with a tubercle on either side behind the eyes [Fig.15] .....  
..... *P. tubericeps* Forel
- Head without a tubercle on either side behind the eyes [Fig.16] ..... 17
- 17. Propodeal spines slightly curved [Kerala] ..... *P. lacteipennis* Smith [in part]
- Propodeal spines not curved ..... *P. thompsoni* Bingham
- 18. Head, thorax and abdomen shining; metallic blue or purple .....  
..... *P. venus* Forel
- Head, thorax and abdomen not shining, black; abdomen sometimes red .....  
..... 19
- 19. Head, thorax and petiole node coarsely punctured ..... 20
- Head, thorax and petiole node finely punctured ..... 21

20. Abdomen black; petiole node cubical ..... *P. armata* Le Guillou  
 - Abdomen ferruginous; petiole node arcuate with acute spines .....  
 ..... *P. fortis* Emery
21. Petiolar node with two median vertical short acute spines between spines  
 on upper lateral angles of node [Fig.17] ..... *P. hauxwelli* Bingham  
 - Petiolar node without median spines between spines on upper lateral  
 angles of node [Fig. 100] ..... 22
22. Metanotal spines erect, slightly bent outwards [Kerala] .....  
 ..... *P. lacteipennis* F. Smith  
 [= *Simplex* Mayr]  
 - Metanotal spines not erect, strongly curved inwards ..... *P. menelas* Forel
23. Abdomen red ..... *P. bicolor* Smith  
 - Abdomen black ..... 24
24. Pubescence golden or bronzy yellow ..... 25  
 - Pubescence silvery [Kerala] ..... *P. tibialis tibialis* Smith
25. Two small teeth between spines on upper lateral angles of petiolar node ...  
 ..... 26  
 - Three small teeth between spines on upper lateral angles of petiolar node ..  
 ..... *P. vicina* Smith
26. Head short and broad ..... *P. dives dives* Smith  
 - Head long and broad ..... *P. dives belli* Forel
27. Spines on pronotum and metanotum subequal ..... 28  
 - Spines on pronotum and metanotum not subequal ..... 30
28. Petiolar node longer than wide ..... 29  
 - Petiolar node not longer, cubical ..... *P. chalybea* Smith

29. Abdomen red; length 7 mm - 9 mm ..... *P. hector* Smith  
 [= *abdominalis* Smith  
 = *mutatus* Smith  
 = *mutata* Smith. r. *ajax* Forel]
- Abdomen bronzen green; length 6 mm - 7 mm ..... *P. aedipus* Forel
30. Pronotal spines shorter, stouter and straight [Kerala] ..... *P. binghamii* Forel
- Pronotal spines long acute pointing divergently or straightly forward.... 31
31. Basal portion of metanotum posteriorly transversely margined .....  
 ..... *P. pubescens* Mayr
- Basal portion of metanotum posteriorly banded by a faint transverse carina  
 ..... 32
32. Thorax strongly arched ..... *P. aculeata aculeata* Mayr
- Thorax more gibbous ..... *P. aculeata gibbosa* Forel
33. Metanotum with spines; [Fig.121] ..... 35
- Metanotum without spines [Fig. 18] ..... 34
34. Abdomen, legs reddish yellow; antennae and front of head reddish .....  
 ..... *P. laevissima dichroa* Forel
- Abdomen, antennae and front of head black; legs blood red .....  
 ..... *P. laevissima laevissima* Smith
35. Abdomen very convex above; not depressed ..... 36
- Abdomen slightly convex above; strongly depressed .... *P. wroughtoni* Forel
36. Abdomen red; smooth and shining ..... *P. laevigata* Smith
- Abdomen black; feebly reticulate, punctate and slightly shining .....  
 ..... *P. hippomanes ceylonensis* Emery
37. Pronotum, mesonotum and metanotum with spines ... *P. craddocki* Bingham
- Pronotum with spine, mesonotum and metanotum with or without spines  
 or teeth or tubercles ..... 38

38. Pronotum always with a spine; mesonotum and metanotum with triangular lamina ..... *P. horni* Emery  
 - Pronotum with or without spines; mesonotum unarmed; metanotum with teeth or lamina or spine or tubercle ..... 39
39. Pronotum with long or short spine ..... 40  
 - Pronotum without spine ..... 57
40. Pronotum with long spines [Fig.106] ..... 41  
 - Pronotum with short spines or teeth [Fig.108] ..... 51
41. Petiole node with two long spines on upper angles, and two short lateral spines or teeth on sides ..... 42  
 - Petiole node with four short sub equal spines ..... 49
42. Lateral spines or teeth truncate or bimucronate at apex ..... 43  
 - Lateral spines or teeth pointed, not truncate nor bimucronate at apex .... 44
43. Very dense pubescence on body hiding the sculpture .....  
 ..... *P. proxima proxima* Roger  
 - Very sparse pubescence on body not hiding the sculpture .....  
 ..... *P. illaudata intermedia* Forel.
44. Pubescence on body very dense [Kerala] .....  
 ..... *P. illaudata illaudata* Walker [= *P. mayri mayri* Roger]  
 - Pubescence on body very sparse or wanting ..... 45
45. Basal portion of metanotum convex ..... *P. hemiopticoides* Mukerjee  
 - Basal portion of metanotum not convex, but transversely submargined .. 46
46. Antennal carinae long, divergent posteriorly ..... 47  
 - Antennal carinae short, not divergent posteriorly ..... 48
47. Abdomen finely punctured and the punctures seem to run into minutely fine striae ..... *P. striata striata* Mayr  
 - Abdomen simply reticulate punctuate without the trace of striae .....  
 ..... *P. striata assamensis* Forel

48. Meso-metanotal suture very distinct; legs densely covered with long erect hairs ..... *P. sumatrensis hamulata* Emery  
 - Meso-metanotal suture not very distinct; legs not covered with long erect hairs, smooth ..... *P. yerburyi* Forel
49. Recumbent and yellowish pubescence; length 9 mm - 10 mm .....  
 ..... *P. striatorugosa* Mayr  
 - Recumbent and glistening greyish pubescence; length 5 mm - 6 mm ..... 50
50. Pronotal spine short ..... *P. convexa* Roger  
 - Pronotal spine long ..... *P. travencoricus* sp. nov.
51. Petiole node with two long spines on upper lateral angles and two short obtuse teeth between them ..... *P. jerdoni* Forel  
 - Petiole node with three or four spines or teeth ..... 52
52. Petiole node quadridentate or quadrispinous ..... 53  
 - Petiole node trispinous ..... 55
53. Clypeus carinate ..... 54  
 - Clypeus not carinate [Kerala] ..... *P. punctillata fergusonii* Forel
54. Clypeus medially carinate [Kerala] ..... *P. punctillata punctillata* Roger  
 - Clypeus posteriorly carinate ..... *P. punctillata smythiesi* Forel
55. Antennal carinae divergent posteriorly ..... 56  
 - Antennal carinae not divergent posteriorly ..... *P. frauenfeldi* Mayr
56. Node of pedicel longer than wide [Kerala] ..... *P. thrinax thrinax* Roger  
 - Node of pedicel as long as wide ..... *P. thrinax* var. *lancearius* Forel
57. Metanotal spines vertical, very small [Fig.93] [Kerala] ..... *P. halidayi* Emery  
 - Metanotal spines broad, triangular, pointing backwards [Fig.90] ..... 58
58. Head and thorax punctured, not striate ..... 59  
 - Head and thorax not punctured, but striate [Kerala] .....  
 ..... *P. exercita rastrata* Emery

59. Petiolar node quadrispinous, equidistant from one another [Fig.90] [Kerala]  
 ..... *P. exercita exercita* [Walker] [= *P. clypeata clypeata* Mayr]
- Petiolar node quadrispinous, not equidistant from one another .....  
 ..... *P. exercita obtusisquama* Forel
60. Thorax very convex viewed from side, strongly arched and gibbous  
 anteriorly ..... 61
- Thorax nearly as convex viewed from side, rounded anteriorly.....  
 ..... *P. rastellata pagana* Santschi
61. Masticatory margin with five teeth [Fig. 61] [Kerala] .....  
 ..... *P. rastellata rastellata* [Latreille]
- Masticatory margin with four teeth [Fig. 104] [Kerala] .....  
 ..... *P. malabarensis* sp. nov

Species *indificans* [Jerdon], *Sylviola* [Jerdon], and subspecies *obsoleta* [Forel], *parsis* [Emery], are excluded from this key, for their descriptions are incomplete and want of details.

***Polyrhachis (Myrmhopla) binghamii* Forel**

*Polyrhachis binghamii* Forel, 1893. *Jour. Bomb. Nat. Hist. Soc.* 8: 25, 33. MIANMAR.  
 [MS].

*Polyrhachis binghamii* Bingham 1903. *Fauna.Brit. India, Hymenoptera* 2: 399.

*Polyrhachis (Myrmhopla) binghamii* Chapman and Capco, 1951. *Monogr. Inst. Sci. Tech. Manila* 1: 287.

**Worker:** TL. 5.5 mm.

**Colour:** Black

**Sculpture and Hair pattern:** Whole body slightly more coarsely granulate; pilosity extremely sparse; pubescence extremely thin and minute.

**Head:** Somewhat shorter and squarer; clypeus slightly more convex, very indistinctly subcarinate down the middle; mandibles broad and powerful, armed with 5 teeth; antennae long and slender, antennal scape extending more than half its own length beyond the top of the head; eyes prominent placed above the middle, rather forward.

**Thorax:** Pronotal spines shorter, stouter and straighter; mesonotum transversely convex; metanotum shorter, spines thick at base and short; legs long; tibiae slightly compressed without spines on the inner margin.

**Abdomen:** Pedicel short, thick, cylindrical, truncate posteriorly, armed with two short spines and embrace the abdomen somewhere about halfway up the anterior face of the first segment; gaster subglobose.

**Material examined:** Nil.

**Distribution:** INDIA: Kerala; Mianmar.

**Biology:** Unknown

**Habitat:** Unknown

**Discussion:** *Polyrhachis binghamii* Forel closely resembles *Polyrhachis hector* Smith in the following features: 1 Thorax and pedicel armed with spines or teeth; 2. Thorax more or less rounded above, the sides not margined along their whole length; 3. Metanotal spines nearly twice the length of the pronotal spine.

However *Polyrhachis binghamii* Forel differs from *Polyrhachis hector* Smith in having: 1. Clypeus slightly more convex (in *Polyrhachis hector* clypeus nearly flat); 2. Pronotal spines short, stout and straight (in *Polyrhachis hector* pronotal spines very long and slightly curved downwards).

**Remarks:** No material of this species was available for this study. The above description is based on Bingham (1903). Donisthorpe (1942) reported this species for the first time from Kerala ('Tenamalai' 500-800 ft, Travancore), South India which was further noted in the check list by Chapman and Capco (1951).

***Polyrhachis (Campomyrma) exercita exercita* [Walker]**

(Figs. 88 - 89)

*Formica exercita* Walker, 1859. *Ann. Mag. Nat. Hist.* 370. SRI LANKA. [BMNH].

Combination in (*Campomyrma*) Donisthorpe, 1932 *Ann. Mag. Nat. Dist.* 575.

*Polyrhachis clypeata* Mayr 1862: *Verh. Zool - Bot. Ges. Wien* 12: 683.

*Polyrhachis indica* Mayr. 1870b. *Verh. Zool - Bot. Ges. Wien* 20: 945.

Senior synonym of *clypeata* Donisthorpe 1932b: *Ann. Mag. Nat. Hist.* (10) 9: 575.

Senior synonym of *indica* Donisthorpe 1932b. *Ann. Mag. Nat. Hist.* (10) 9: 575.

**Worker:** TL 5.68 mm; HL = 2.23 mm; HW = 1.85 mm; CI = 8.3 mm; SL = 2.67 mm; SI = 11.7 mm; ED = 0.29 mm; PW = 1.41 mm; AL = 3.29 mm.

*Colour:* Black; mandibles except apex and legs red; antennae fuscous red; eyes blackish brown.

*Sculpture and Hair pattern:* Head, thorax and abdomen opaque, finely reticulate-punctate; pubescence very sparse, reduced to a few scattered erect hairs chiefly on apical abdominal segments, body covered with a very thin, fine silky pile visible only in certain light.

*Head:* Short, very broad, almost as broad posteriorly as in front; clypeus triangular with a well-marked medial vertical carina and a distinct anteriorly produced rectangular lobe, its anterior margin transverse with two long bristles followed by small bristles on either side and dentate; frontal area convex in the middle; frontal lobe fused; frontal carinae short wide apart posteriorly; antennal scrobe well marked; antennal carinae short wide apart; torulus rounded, vertical; antennae long, 12 jointed; antennal scape extending beyond the vertex, apex of scape wider; all segments of funiculus longer than broad. Relative measurement of length of antennal segments: Scape = 2.17 mm;  $F_1$  = 0.41 mm;  $F_2$  = 0.29 mm;  $F_3$  = 0.23 mm;  $F_4$  = 0.21 mm;  $F_5$  = 0.29 mm;  $F_6$  = 0.29 mm;  $F_7$  = 0.23 mm;  $F_8$  = 0.20 mm;  $F_9$  = 0.26 mm;  $F_{10}$  = 0.17 mm; Club ( $F_{11}$ ) = 0.44 mm. Eyes large, convex, posterolateral.

*Thorax:* Elongate; broad anteriorly gradually compressed and narrower towards metanotum, sides vertical; pro and mesonotum broader than long; pronotum arched anteriorly; pro-meso and meso-metanotal sutures very distinct and deeply impressed; basal portion of propodeum nearly square, posterolateral angles broadly turned upwards so as to form stout triangular projections, upper surface of propodeum concave from right to left; apical portion of propodeum nearly vertical, slightly concave; legs stout; tibiae with extremely minute distinct spines beneath.

**Abdomen:** Petiolar node slightly biconvex, armed with four short acute spines, nearly equidistant from one another, median spine nearly vertical, pointing a little backwards and slightly vertical, pointing a little backwards and slightly larger than lateral, which point obliquely outwards and backwards; gaster broadly oval, depressed, anterior portion of basal segment submargined, four visible segments, first segment larger, fifth segment hidden by the fourth segment; anal orifice at the apex of last gastral segment, guarded by guard hairs.

**Plesiotype:Worker:** INDIA: Kerala: Kottekkad, [Palakkad], Vidhu, 29.vii.2000. [DZCU].

**Other materials examined:** 1W: INDIA: Kerala, Thiruvananthapuram, Thanasingh, 10.xi.2000 [DZCU].

**Distribution:** INDIA: [Kerala: Thiruvananthapuram, Palakkad], Western India Bengal, Karnataka, Tamil Nadu; Sri Lanka.

**Biology:** Nests under leaf litters, foragers are often seen on plants; tending homopterans, [T.M. Musthak Ali, 1991].

**Habitat:** Disturbed with grassy field, plants, trees etc.

**Discussion:** *Polyrhachis exercita exercita* [Walker] closely resembles *Polyrhachis exercita rastrata* Emery in the following features: 1. Antennae 12 jointed; 2. Pronotum and mesonotum unarmed; metanotum with a triangular lamina; 3. Petiolar node biconvex, armed with four short acute spines, equidistant from each other. However *Polyrhachis exercita exercita* [Walker] differs from *Polyrhachis exercita rastrata* Emery in having: 1. Head and thorax punctured, not striate (in *Polyrhachis exercita rastrata* on head and thorax punctures run into regular longitudinal striate, close and fine on the head, sparser and deeper on the thorax).

**Remarks:** Current subspecies: nominal plus *lucidiventris* Forel, *obtusisquama* Forel, *rastrata* Emery.

*Polyrhachis (Campomyrma) exercita rastrata* Emery

(Figs. 90 - 92)

*Polyrhachis rastrata* Emery, 1889b *Ann. Mus. Civ. Stor. Nat. Gen.* (2) 7 (27): 517.  
MIANMAR. [MCSN].

*Polyrhachis clypeata* Mayr, 1862. *Verh. Zool - Bot. Ges. Wien* 683. SRI LANKA.

*Polyrhachis indica* Mayr, 1870: *Verh. Zool - Bot. Ges. Wien* 945. INDIA.

Combination in [*Campomyrma*] Emery, 1925. *Ann. Soc. Ent. Belgi.* 64: 179.

**Worker.** TL = 7.1 mm; HL = 2.2 mm; HW = 1.92 mm; CI = 87.3 mm; SL = 1.71 mm; SI = 89 mm; ED = 0.42 mm; PW = 1.71 mm; AL = 2.92 mm.

**Colour.** Black; apical two or three segments of antennae, apical tarsal segments with testaceous tint; tibial spurs, claws, tarsal spines brownish red; maxillary palpi brownish yellow; eyes blackish brown; pubescence white.

**Sculpture and Hair pattern:** Head, thorax, legs, petiolar node and gaster finely punctate, very feeble and minute on gaster and legs; punctures very feeble at anterior region on head, strong and becoming regularly striate posteriorly; punctures become five, regular striation on dorsal surface of pro and mesonotum; dorsum of propodeum granulate, with a few feeble superficial striae; striations strong on pronotum and diverging from anterior to posterior, reticulate on sides of thorax and base of forecoxae; mandibles smooth, polished and shining; pilosity

sparse, restricted to a few hairs at apex of gaster, coxae, trochanter and femur; mandibles with pubescence, short setae at apex; antennae, legs and gaster with appressed short pubescence, abundant on gaster and coxae of legs; minute on antennae widely spaces appressed short pubescence on head and dorsum of thorax, visible only on certain reflections of light.

*Head:* Short, a little broad posteriorly than in front, occipital margin normal; clypeus triangular; its anterior margin toothed, a well marked medial vertical carina and a distinct anteriorly produced rectangular lobe, extending portion slightly depressed, posterior portion medially convex; frontal area subtriangular depressed; frontal lobe fused; frontal carinae short, wide apart posteriorly, scarcely reaching up to level of mid line of eyes; torulus rounded, vertical; antennal scrobe well marked; antennae long, 12 jointed, antennal scape reaching beyond tope of head by half its own length; all segments of funiculus longer than broad. Relative measurement of length of antennal segment: Scape = 1.71 mm; F<sub>1</sub> = 0.35 mm; F<sub>2</sub> = 0.39 mm; F<sub>3</sub> = 0.35 mm; F<sub>4</sub> = 0.35 mm; F<sub>5</sub> = 0.32 mm; F<sub>6</sub> = 0.32 mm; F<sub>7</sub> = 0.28 mm; F<sub>8</sub> = 0.35 mm; F<sub>9</sub> = 0.35 mm; F<sub>10</sub> = 0.28 mm; Club [F<sub>11</sub>] = 0.39 mm. Eyes large, situated at posterolateral corners.

*Thorax:* Broad anteriorly, anterior margin of pronotum below neck carinate, anterolateral corners of pronotum formed into triangular lamina which project upwards, sides of thorax sharp by margined, pro and mesonotum broader than long, pronotum arched anteriorly; pro-mesonotal suture distinct, smooth; mesometanotal suture distinct and deeply impressed; propodeum in a lower level than mesonotum, dorsally concave, basal portion of propodeum nearly square, posterolateral angles broadly turned upwards so as to form a stout triangular laminae, their tips blunt indorsal view, but acute in profile, apex of propodeum slightly concave, propodeal spiracle distinct at margin of declivity; legs stout; tarsi, ventral portion of tibiae with short spines.

**Abdomen:** Petiolar node biconvex with four subequal, acute spines, median spines slender, base of lateral spines broad, erect, pointing backwards and slightly larger than lateral, which point obliquely outwards and backwards; gaster broadly oval, anterior face slightly concave, inclined to front, four visible segments, fifth segment hidden by the fourth segment; anal orifice at the apex of last gastral segment, guarded by guard hairs; sides of gaster compressed at anterior region.

**Plesiotype: Worker.** INDIA: Kerala: Muthenga, Karmaly, K.A., 7.v.2000. [DZCU].

**Other materials examined:** 1W: INDIA: Kerala, Aluva, Karmaly, K.A., 15.x.1995; 3W: INDIA: Kerala: Muthenga, Karmaly. K.A., 7.x.1995; 2W: INDIA: Kerala : Muthenga, Karmaly. K.A., 7.v.2000; 1W: INDIA: Kerala : Calicut Univerity Campus, Karmaly. K.A., 23.iii.1995; 1W: INDIA: Kerala : Muthenga, Lambert, 12.iv.2000; 2W: INDIA: Kerala : Kalpetta (Wyanad) Jobiraj, 10.iii.2001; 1W: INDIA: Karnataka: Sringeri, Sinu, 31.iii.2000.

All specimens deposited in the Systematic Entomology Laboratory, Department of Zoology, Calicut University.

**Distribution:** INDIA: [Kerala: Ernakulam, Malappuram, Wyanad], Karnataka; Tenasserim.

**Biology:** Unknown.

**Habitat:** Collected from both disturbed and undisturbed habitat.

**Discussion:** *Polyrhachis excercita rastrata* Emery closely resembles *Polyrhachis excercita obtusisquama* Forel in the following features: 1. Antennae 12 jointed; 2. Pronotum and mesonotum unarmed; 3. Metanotum with a triangular lamina. However *Polyrhachis excercita rastrata* Emery differs from *Polyrhachis excercita*

*obtusisquama* Forel in having: Petiolar node biconvex; armed with four short acute spines equidistant from each other (in *Polyrhachis exercita obtusisquama* petiolar node quadrispinous, not equidistant from one another).

***Polyrhachis (Myrmhopla) gracilior* Forel**

*Polyrhachis furcata gracilior* Forel, 1893. *Jour. Bomb. Nat. Hist. Soc.* 8: 25, 33. INDIA.

[MS].

*Polyrhachis gracilior* Bingham, 1903. *Fauna Brit. India. Hymenoptera*, 2: 388.

Bingham raised to species.

**Worker:** TL 4 mm - 4.5 mm

**Colour:** Rufous brown; head black; scape of antennae basally fuscous black.

**Sculpture and Hair pattern:** Head and abdomen highly polished, shining; thorax and node of pedicel coarsely punctured; pubescence soft, erect, dense.

**Thorax:** Rounded above, not marginate; pronotal spines short, pointing forward and outward, and curved slightly downward; metanotal spines longer than pronotal spines, erect and slightly curved backward.

**Abdomen:** Petiolar node not columnar, broader than long, with two slender long lateral spines, spines curved in a shape to embrace the gaster.

**Material examined:** Nil.

**Distribution:** INDIA: Kerala, Assam.

**Biology:** Unknown.

**Habitat:** Unknown

**Discussion:** *Polyrhachis gracilior* Forel closely resembles *Polyrhachis furcata* Smith in the following features: 1. Head and abdomen polished and shining; 2. Thorax and pedicel armed with spines; 3. Thorax rounded above, sides not margined; 4. Pubescence soft, erect and dense. However *Polyrhachis gracilior* Forel differs from *Polyrhachis furcata* Smith having: 1. Thorax and node of pedicel not so coarsely punctured (in *Polyrhachis furcata* thorax and node of pedicel very coarsely punctured); 2. Spines on petiolar node not forming hook (in *Polyrhachis furcata* spines on petiolar node forming hooks); 3. Pronotal spines short (in *Polyrhachis furcata* pronotal spines long); 4. Petiolar node not columnar (in *Polyrhachis furcata* petiolar node columnar).

**Remarks:** No material of this subspecies was available for this study. Bingham (1903) reported *gracilior* as a species from Travancore, South India but Chapman and Capco (1951) treated it as a subspecies from the same locality. The above description is taken from Bingham (1903).

***Polyrhachis (Campomyrma) halidayi* Emery**

(Figs. 93 - 94)

*Polyrhachis halidayi* Emery, 1889. *Ann. Mus. Civ. Stor. Nat. Genova.* 27: 517  
MIANMAR. [MCSN].

*Polyrhachis halidayi* Bingham, 1903. *Fauna Brit. India Hymenoptera* 2: 413.

Combination in *Polyrhachis (Campomyrma)* Emery, 1925. *Genera insect.* 183:  
180.

*Polyrhachis (Campomyrma) halidayi* Chapman and Capco, 1951. *Monogr. Inst. Sci. Tech. Manila* 1: 258.

**Worker.** TL = 06.64 mm; HL = 1.64 mm; HW = 1.64 mm; CI = 100 mm; SL = 1.85 mm; SI = 112.80 mm; ED = 0.35 mm; PW = 1.85 mm; AL = 2.28 mm.

**Colour.** Head, thorax, node of pedicel and abdomen black; all segments of funiculus, tarsi, base and apex of scape reddish brown; remaining portion of scape, legs except tarsi dark brown; pilosity pale yellow; eyes bronzen brown; mandibles reddish brown; teeth dark brown.

**Sculpture and Hair pattern:** Insect as a whole granulate, punctate; mandibles feebly granulate and polishing; longitudinal striations on head; towards scrobe striations somewhat slanting, converging to scrobe; thorax granulate, rugulose laterally, longitudinal striations above; node of pedicel feebly and regularly striate; abdomen feebly granulate, transversely striate, somewhat shining not opaque; pilosity sparse; whole insect, clothed with fine, thin, sericeous and shining recumbent pubescence.

**Head:** Shorter seen from in front, rounded, sides straight; clypeus convex, median lobe rectangularly produced, its posterior margin shorter than anterior margin; frontal lobe distinct; frontal carinae short, divergent posteriorly; antennal scrobe short, groove like, torulus rounded, horizontal; antennae short, slender, cylindrical, 12 jointed; antennal scape short extending beyond the occiput; all segments of funiculus longer than broad. Relative measurement of length of antennal segments: 1. Scape = 1.85 mm; F<sub>1</sub> = 0.35 mm; F<sub>2</sub> = 0.28 mm; F<sub>3</sub> = 0.21 mm; F<sub>4</sub> = 0.21 mm; F<sub>5</sub> = 0.21 mm; F<sub>6</sub> = 0.28 mm; F<sub>7</sub> = 0.21 mm; F<sub>8</sub> = 0.21 mm; F<sub>9</sub> = 0.21 mm; F<sub>10</sub> = 0.14 mm; Club (F<sub>11</sub>) = 0.18 mm. Eyes moderate rounded, convex, posterior rather than lateral.

**Thorax:** Pronotum broad in front, rounded anteriorly narrow posteriorly; pronotum angular laterally; pro-mesonotal suture very distinct, broad and deep; meso-metanotal suture marked by a transverse carina; basal portion of metanotum flat, spines at lateral angles minute; apical portion of metanotum concave; legs small, robust, tibiae compressed, with spines beneath; tarsi with tarsal spurs; claws simple.

**Abdomen:** Pedicel nodiform, single segmented, petiolar node biconvex, thick, quadrispinous, lateral spines broader, placed higher up on the node, two obtuse teeth medially placed much closer together; gaster broadly oval with 4 visible segments; first gastral segment larger than the remaining segments, last gastral segment furnished with circular anal orifice guarded by guard hairs.

**Plesiotype: Worker:** INDIA: Kerala, Devagiri Calicut, Girish, 21.xii.2000. [DZCU].

**Other materials examined:** 1W: INDIA: Kerala, Muthenga (Wyanad), Karmaly, K.A., 7.v.2000. [DZCU].

**Distribution:** INDIA: [Kerala: Calicut, Wyanad]; Myanmar.

**Biology:** This ant makes large nest among the leaves of trees [Bingham 1903].

**Habitat:** Disturbed.

**Variation:** Abdomen feebly granulate, transversely striate; tibiae with spines beneath. In the description of Bingham [1903] it is stated that abdomen smooth; tibiae smooth without spines

**Discussion:** *Polyrhachis halidayi* Emery closely resembles *Polyrhachis exercita* [Walker] in the following features: 1. Pilosity very sparse; whole insect clothed

with very thin, fine recumbent-pubesence; 2. Pronotum and mesonotum unarmed; metanotum with a spine on each side; 3. Thorax narrowed posteriorly, broad anteriorly. However *Polyrhachis halidayi* Emery differs from *Polyrhachis exercita* [Walker] in having: 1. Metanotal spines vertical, very small (in *Polyrhachis exercita* metanotal spines broad, triangular, pointing backward; 2. Head and thorax longitudinally striate (in *Polyrhachis exercita* head and thorax finely reticulate, punctate); 3. Abdomen somewhat shining, not opaque (in *Polyrhachis exercita* abdomen not shining but opaque); 4. Anterior margin of clypeus transverse not dentate (in *Polyrhachis exercita* anterior margin of clypeus transverse, dentate); 5. Basal portion of metanotum flat (in *Polyrhachis exercita* basal portion of metanotum square); 6. Petiolar node biconvex, thick, quadrispinous, lateral spines broader, placed higher up on the node, two obtuse teeth between them, much closer together (in *Polyrhachis exercita* petiolar node slightly biconvex, slightly thick, quadrispinous, short, acute, nearly equidistant).

*Polyrhachis (Myrma) illaudata illaudata* Walker

(Figs. 95 - 96)

*Polyrhachis illaudata* Walker, 1859. *Ann. Mag. Nat. Hist.* (3) 4: 373. SRI LANKA.  
[BMNH].

*Polyrhachis mayri* Roger, 1863b. *Berl. Ent. Zeit.* 7: 7 SRI LANKA.

Combination in (*Myrma*) Donisthorpe, 1932b *Ann. Mag. Nat. Hist.* (10) 9:576.

*Polyrhachis latispinosa* Donisthorpe, 1942 *Ann. Mag. Nat. Hist.* (11)9: 460. INDIA.

*Polyrhachis duodentata* Donisthorpe, 1942 *Ann. Mag. Nat. Hist.* (11)9: 461. INDIA.

**Worker.** TL = 7.5 mm; HL = 2.2 mm; HW = 2.13 mm; CI = 97 mm; SL = 2.8 mm; SI = 132 mm; ED = 0.32 mm; PW = 2.2 mm; AL = 3 mm.

**Colour.** Black; golden yellow in appearance due to the presence of a dense golden yellow pubescence all over the body; eyes yellowish grey; tarsal spine, tibial spurs, claws and apex of last flagellar segment brownish yellow.

**Sculpture and Hair pattern:** Body as a whole clothed with short suberect brownish grey hairs; body minutely punctate, but punctures hidden by dense pubescence; mandibles finely close striate; shining with short setae.

**Head:** Head in front view broadly oval, almost circular occipital margin medially a little depressed; clypeus convex, medially with an elevation, its anterior margin arched; margins of frontal area not distinct; frontal carinae extending beyond level of half length of eyes; antennal carinae short, wide apart; antennal scrobe distinct; torulus short, round, horizontal; antennae long, filiform 12 jointed; antennal scape extending beyond top of head, all segments of funiculus longer than broad. Relative measurement of length of antennal segment: Scape = 2.8 mm; F<sub>1</sub> = 0.36 mm; F<sub>2</sub> = 0.31 mm; F<sub>3</sub> = 0.36 mm; F<sub>4</sub> = 0.45 mm; F<sub>5</sub> = 0.36 mm; F<sub>6</sub> = 0.41 mm; F<sub>7</sub> = 0.27 mm; F<sub>8</sub> = 0.31 mm; F<sub>9</sub> = 0.31 mm; F<sub>10</sub> = 0.36 mm; Club (F<sub>11</sub>) 0.41. Eyes large, prominent, situated posterolateral corners in front view.

**Thorax:** Arched, compressed, wide anteriorly, narrowing posteriorly, laterally strongly margined, slightly convex between lateral margins, margins overhang sides; pronotum with two strong erect anterolateral spines, pointing forwards, broad at base; mesonotum broader than posterior portion of pronotum; pro-mesonotal suture very distinct; mesometanotal impression present, but suture indistinct; thorax deeply emarginate at pro-meso and meso-metanotal sutures; propodeum sloping from anterior to posterior margin, posterior face vertical with

median portion slightly depressed; propodeum posteriorly ends in two triangular short acute teeth, joined by a transverse carina; legs moderately long; tibiae cylindrical; tarsi with tarsal spines.

**Abdomen:** Pedicel nodiform, single noded, petiolar node broad, cuneiform, biconvex with two long spines on dorsolateral edges with two small spines on sides; long spines slightly curved backwards with its tips; gaster gibbous in front, concave anteriorly.

**Plesiotype: Worker.** INDIA: Kerala: Muthenga, Karmaly, K.A., 7.x.1995 [DZCU].

**Other materials examined:** 1W: INDIA: Kerala: Vythiri (Wyanad) Jobiraj, 2.x.2000 [DZCU].

**Distribution:** INDIA: [Kerala: Wyanad], Bengal, Sikkim, Karnataka, Tamil Nadu; Mianmar; Tenasserim; extending to Malayan subregion.

**Biology;** Unknown.

**Habitat:** Collected from both disturbed and undisturbed habitat.

**Variation:** Length 7.5 mm. In the description of Bingham (1903) length ranges 9.5 mm - 10.5 mm.

**Discussion:** *Polyrhachis illaudata* Walker closely resembles *Polyrhachis proxima* Roger in the following features: 1. Body covered with a dense golden recumbent pubescence, which hides the sculpture; 2. Antennae 12 jointed; 3. Pronotum with a long spine; 4. Petiolar node with two long spines on upper angles, and two short lateral spines on sides. However *Polyrhachis illaudata* differs from *Polyrhachis proxima* Roger in having: 1. Lateral spines of petiolar node not bimucronate at apex (in *Polyrhachis proxima* lateral spines of petiolar node

bimucronate at apex); 2. Thorax narrowing posteriorly (in *Polyrhachis proxima* thorax wider posteriorly); 3. Antennal carinae short, wide apart (in *Polyrhachis proxima* antennal carinae short and very much closer together).

**Remarks:** Current subspecies : nominal plus *intermedia*, Forel, *obesior* viehmeyer, *pauperata* Emery, *proximonayri* Emery.

***Polyrhachis (Myrma) illuadata intermedia* Forel**

(Figs. 97 - 99)

*Polyrhachis illuadata intermedia* Forel, 1886d *Jour. As. Soc. Beng.* IV. 242.

*Polyrhachis intermedia* Bingham, 1903. *Brit. India, Hymenoptera.* Vol.2: 405.

Combination in *Polyrhachis (Myrma)* Emery, 1925b *Genera Insect.* 201.

**Worker:** TL = 9 mm; HL = 2 mm; HW = 2.5 mm; CI = 125 mm; SL = 2.2 mm; SI = 88 mm; ED = 0.41 mm; PW = 1.64 mm; AL = 3.18 mm.

**Colour:** Black; eye copper brown; greyish pubescence; tarsal spurs brownish white.

**Sculpture and Hair pattern:** Head and thorax coarsely punctured, striated; abdomen very minutely punctured; pubescence sparse, not hiding the punctures.

**Head:** Broadly oval in front view, almost circular; occipital margin slightly medially depressed, rounded; mandibles narrow, triangular; clypeus convex, feebly marginate, anterior margin convex on sides, concave at middle, posterior margin concave; frontal carinae short, parallel, antennal carinae short, fused together; antennal scrobe distinct; torulus short, rounded, horizontal; antennae

long slender filiform, 12 jointed; antennal scape extending beyond the top of head; all segments of funiculus longer than broad. Relative measurement of length of antennal segments : Scape = 2.2 mm;  $F_1$  = 0.45 mm;  $F_2$  = 0.36 mm;  $F_3$  = 0.36 mm;  $F_4$  = 0.36 mm;  $F_5$  = 0.36 mm;  $F_6$  = 0.36 mm;  $F_7$  = 0.27 mm;  $F_8$  = 0.31 mm;  $F_9$  = 0.27 mm;  $F_{10}$  = 0.27 mm; Club ( $F_{11}$ ) = 0.5 mm. Eyes large, prominent, situated posterolateral in front view.

**Thorax:** Strongly arched, compressed, wide anteriorly, narrowing posteriorly, slightly convex between lateral margins, margins overhang sides; pronotum with two strong anterolateral spines pointing forwards, broad at base; mesonotum broader than posterior portion of pronotum; pro-mesonotal suture very distinct; meso-metanotal impression present, but suture indistinct; thorax deeply emarginate at pro-meso and meso-metanotal sutures; propodeum sloping from anterior to posterior margin, posterior face vertical with median portion slightly depressed; propodeum posteriorly ends in two triangular short acute teeth; legs moderately long; tibiae cylindrical; tarsi with tarsal spines.

**Abdomen:** Pedicel nodiform single noded; petiolar node broad, with two long spines on upper angles, and two short spines on lateral sides bimucronate at apex, long spines slightly curved backwards with its tips; gaster massive, broad, oval; first gastral segment larger, covering half of its total length; anal aperture on the apex of last gastral segment, guarded by guard hairs.

**Plesiotype: Worker.** INDIA : Kerala: Eravikulam [Idukki] Sureshan, 1.iii.1995 [DZCU].

**Other materials examined:** 1W: INDIA: Kerala. Ambalavayal (Wyanad), Razak, 24.1.2001 [DZCU].

**Distribution:** INDIA: [Kerala: Idukki, Wyanad, Assam]; Myanmar: Myitkyina, Bhamo, Ruby Mines.

**Biology:** Unknown.

**Habitat:** Undisturbed.

**Discussion:** *Polyrhachis intermedia* Forel closely resembles *Polyrhachis proxima* Roger in the following features: 1. Antennae 12 jointed; 2. Pronotum with long spine; 3. Petiolar node with two long spines on upper angles, two short lateral spines, bimucronate at apex. However *Polyrhachis intermedia* Forel differs from *Polyrhachis proxima* Roger in having: 1. Body clothed with sparse greyish pubescence, not hiding the sculpture (in *Polyrhachis proxima* body clothed with dense golden pubescence, hiding the sculpture); 2. Thorax narrower posteriorly than in front (in *Polyrhachis proxima* thorax wider posteriorly than in front).

***Polyrhachis (Myrmhopla) indificans* (Jerdon)**

*Formica indificans* Jerdon, 1851. *Madras Jour. Lit. Sci.* 17: 125. INDIA. [BMNH].

*Polyrhachis (Myrmhopla) indificans* Chapman and Capco, 1951 *Monogr. Inst. Sci. Tech. Manila* 1: 293.

**Worker:** TL 1.04 mm to 5 mm.

**Colour:** Head and abdomen rufous, thorax dark glossy brown.

**Head:** Triangularly ovate, elevated; mandibles strongly 3-toothed; eyes moderate.

**Thorax:** Wide anteriorly, narrowed posteriorly, pronotum with two small spines, anteriorly pointing forwards; metanotum with two large spines apically

pointing upwards and backwards, two rudimentary spines behind and beneath these large spines.

**Abdomen:** Pedicel nodiform, single noded; petiole node square, raised with two large upright spines, and similar one on each side, gaster short.

**Material examined:** Nil.

**Distribution:** INDIA: Kerala (Malabar).

**Biology:** This ant makes a small nest of some papyraceous material, which fixes on a leaf. Each nests contains one female and 8 or 10 workers. It is very rare species (R.N. Tiwari, 1999).

**Discussion:** *Polyrhachis indificans* (Jerdon) closely resembles *Polyrhachis sylvicola* (Jerdon) in the following features: 1. Thorax wide anteriorly, narrowed posteriorly; 2. Pronotum and metanotum armed with spines; 3. Pedicel nodiform, single noded. However *Polyrhachis indificans* [Jerdon] differ from *Polyrhachis sylvicola* [Jerdon] in having: Mandibles strongly 3-toothed (in *Polyrhachis sylvicola* mandibles strongly 5-toothed).

**Remarks:** The specimens of this species could not be available for this study. Jerdon (1851) described this species under the genus *Formica* from Malabar South India. The above description based on the literature of Jerdon (1851).

***Polyrhachis (Myrmhopla) lacteipennis* F. Smith**

(Figs. 100 - 102)

*Polyrhachis lacteipennis* Smith, F. 1858b. *Catalogue of Hymenopterous insects in the collection of the British Museum 6 Formicidae* : 60. INDIA. [OXUM].

*Polyrhachis simplex* Mayr, 1862 *Verh. Zool - Bot. Ges. Wien* 12: 682. INDIA.

*Polyrhachis spiniger* Mayr, 1879 *Verh. Zool - Bot. Ges. Wien* 28: 653. INDIA.

*Polyrhachis simplex* Bingham, 1903. *Fauna Brit. India. Hymenoptera* 2: 394.

*Polyrhachis (Myrmhopla) simplex* Chapman and Capco. 1951. *Monogr. Inst. Sci. Tech. Manila* 1: 297.

Combination in (*Myrmhopla*) Emery, 1925 *Genera Insect.* 195.

Current subspecies nominal plus *grisescens* Emery, *obsoleta* Forel.

**Worker.** TL = 4 mm; HL = 1.4 mm; HW = 1.7 mm; CI = 121 mm; SL = 1.7 mm; SI = 100 mm; ED = 0.3 mm; PW = 2 mm; AL = 1.4 mm.

**Colour.** Black; eyes copper brown; coxa, femora, tibiae reddish brown; funicular segments brown; basal portion of tibiae, and tarsal segment fuscous; maxillary palp and claws yellowish brown; silky pilosity.

**Sculpture and Hair pattern:** Head thorax and petiolar node finely punctured, granulate; abdomen finely, minutely rugulose, opaque, scattered erect pilosity on front of head and on apical segments of abdomen; short adpressed pubescence sparse more on funiculus and on legs.

**Head:** Head broadly oval, occiput round, sides concave; mandibles short, 4-toothed; clypeus with a distinct medial vertical carina, briefly lobed, its anterior margin medially incised; frontal lobe not distinct; frontal area short, frontal carinae short; antennal scrobe short and groove like; torulus round, horizontal; antennal carinae short, wide apart, not divergent; antennae short, slender, 12 jointed; antennal scape extending up to top of head; all segments of funiculus longer than broad. Relative measurement of length of antennal segments: Scape = 1.7 mm;  $F_1 = 0.43$  mm;  $F_2 = 0.21$  mm;  $F_3 = 0.21$  mm;  $F_4 = 0.14$  mm;  $F_5 = 0.18$  mm;  $F_6 = 0.21$  mm;  $F_7 = 0.18$  mm;  $F_8 = 0.21$  mm;  $F_9 = 0.21$  mm;  $F_{10} = 0.21$ ; Club ( $F_{11}$ ) = 0.35 mm. Eyes short, rounded, situated towards posterior end.

**Thorax:** Short, convex, narrower than head, compressed posteriorly; pronotum and mesonotum longer than broad; pro-mesonotal suture well marked; meso-metanotal suture impressed, not visible; anterolateral angles of pronotum with very short spines, thick at base, apex narrow, directed obliquely outwards; metanotal species much longer erect, thick at base, slightly divergent, its apex slightly bent outwards; propodeum with small teeth like lamina at base, slopered, slightly convex with concave cavity at apex; legs short, stout, tibiae without spines, except towards the apex where there are three or four spines on underneath.

**Abdomen:** Pedicel nodiform, single noded, petiolar node broader, biconvex, with two long spines, thick at base, curved to shape of abdomen, two obtuse points in between spines. Gaster short, convex above, globose.

**Plesiotype: Worker:** INDIA: Kerala: Calicut University Campus, Karmaly. K.A., 3.viii.2000. [DZCU].

**Distribution:** INDIA: [Kerala: Malappuram], found throughout our limits.

**Biology:** Unknown.

**Habitat:** Disturbed

**Discussion:** *Polyrhachis lacteipennis* Smith. F Closely resembles *Polyrhachis hauxwelli* Bingham in the following features : 1 Head, thorax and petiolar node finely punctured; 2. Pubescence confined to a few short erect hairs on the front of the head and apical segments of the abdomen; 3. Antennae 12 jointed. However *Polyrhachis lacteipennis* Smith differs from *Polyrhachis hauxwelli* Bingham in having: petiolar node without median spines (in *Polyrhachis hauxwelli* petiolar node with median spines).

**Remarks:** Identification at subspecies level could not be made for want of details.

***Polyrhachis (Cyrtomyrma) malabarensis* sp. nov.**

(Figs. 103 - 105)

**Worker.** TL = 5 mm; HL = 1.1 mm; HW = 1.6 mm; CI = SL = 1.57 mm; SI = 98 mm; ED = 0.89 mm; PW = 1.15 mm; AL = 2.05 mm.

**Colour:** Black; eyes silvery white; maxillary palp, posterior end of trochanter blood red; white pubescence; hairs silky white; tibial spines, tarsal spurs and claws yellowish brown.

**Sculpture and Hair pattern:** Head, thorax and abdomen shining, polished, rugulose, reticulous; pubescence sparse restricted to segments of funiculus; pilosity present on mandibles frontal region, ventral and posterior part of abdomen.

**Head:** Triangular, posteriorly very broad, vertex and occiput rounded, posterior corners rounded, cheek almost concave; mandibles triangular, linear,

thick, masticatory margin 4-toothed; clypeus broad, convex, emarginate anteriorly, broadly carinate in the middle; frontal lobe parallel, close together; frontal area distinct; torulus rounded, vertical; antennal scrobe distinct; antennal hollows placed remote from the posterior margin of clypeus, antennal carinae widely divergent posteriorly; antennae slender, filiform, 12 jointed; antennal scape extending back to the head by about half its length; all segments of funiculus thick and almost similar in size. Relative measurement of length of antennae: Scape = 1.57 mm;  $F_1$  = 0.47 mm;  $F_2$  = 0.21 mm;  $F_3$  = 0.18 mm;  $F_4$  = 0.23 mm;  $F_5$  = 0.21 mm;  $F_6$  = 0.18 mm;  $F_7$  = 0.23 mm;  $F_8$  = 0.15 mm;  $F_9$  = 0.23 mm;  $F_{10}$  = 0.15 mm; Club [ $F_{11}$ ] = 0.28 mm. Eyes large, rounded, situated at the posterolateral angles.

*Thorax:* Very convex and rounded above, viewed from side strongly arched and gibbous anteriorly; pro-mesonotal suture distinct; meso-metanotal suture obsolete; pro-mesonotum in same level with metanotum; metanotum submargined in dorsal view; metanotal groove indistinct; propodeum submarginate, unarmed, the dorsum very oblique and sloping into the vertical and weakly concave declivity and ends with semicircular ring; legs moderately long, posterior ends of femur and tibia possess spines, tarsi also possess small spines; claws simple; first leg pectinate.

*Abdomen:* Pedicel nodiform. Single noded; petiolar node thick at base, sloping posteriorly to a sharp margin above, node armed with four subequal small acute spines, the median two spines close together and vertical, other two lateral in position and very small in size, the ends of each slightly curved inwards, the ventral part of pedicel possess a keel like structure, which anteriorly possess two long hairs; gaster globose, very convex above, first gastral segment covers more than half its length, anteroventral part of abdomen possess a tooth which directed forward.

**Holotype: Worker :** INDIA: Kerala: Calicut, Girish, 5.i.2001. [DZCU].

**Distribution:** INDIA: [Kerala: Calicut]

**Biology:** Unknown.

**Habitat:** Disturbed area with plants.

**Etymology:** Named after the region of collection viz. Malabar.

**Discussion:** This species *Polyrhachis malabarensis* sp. nov. closely resembles *Polyrhachis rastellata* [Latreille] in general appearance and in the following features: 1. Antennae 12 jointed; 2. Clypeus broad and convex, carinate in the middle; 3. Thorax unarmed; 4. Petiolar node with four subequal small acute spines. However *Polyrhachis malabarensis* sp. nov. differs from *Polyrhachis rastellata* in having: Mandibles with 4 teeth (in *Polyrhachis rastellata* mandibles with 5 teeth).

***Polyrhachis (Myrma) proxima proxima* Roger**

(Fig. 106 - 107)

*Polyrhachis proxima* Roger 1863a *Berl. Ent. Zeit.* 7: 155, INDONESIA. [MNHU].

*Polyrhachis proxima* Bingham, 1903. *Fauna. Brit. India. Hymenoptera.* Vol.2 : 405.

Combination in *Polyrhachis (Myrma)* Viehmeyer, 1916a *Arch. fur. Natur.* 81: 166.

**Worker.** TL = 6.54 mm; HL = 2.57 mm; HW = 1.57 mm; CI = 61 mm; SL = 2.21 mm; SI = 141 mm; ED = 0.42 mm; PW = 3 mm; AL = 2.52 mm.

**Colour.** Black; due to the presence of golden yellow shining pubescence all over the body, golden yellow in appearance; maxillary palp pale yellow; tibial

spines, tarsal spurs and claws brownish red; apex of last flagellar segment testaceous; pilosity brownish grey.

*Sculpture and Hair pattern:* Body finely minutely punctate, but punctures hidden by pubescence; mandibles finely close striate, shining with short setae.

*Head:* Head in front view broadly oval, almost circular, occipital margin rounded; clypeus convex, medially with an elevation, its anterior margin arched; margins of frontal area indistinct; frontal carinae extending beyond level of half length of eyes; antennal carinae very much closer together; torulus rounded, horizontal; antennal scrobe distinct; antennae slender, 12 jointed; antennal scape extending beyond the top of head, all segments of funiculus unequal in size. Relative measurement of length of antennal segment: Scape = 2.21 mm;  $F_1$  = 0.28 mm;  $F_2$  = 0.21 mm;  $F_3$  = 0.32 mm;  $F_4$  = 0.39 mm;  $F_5$  = 0.39 mm;  $F_6$  = 0.39 mm;  $F_7$  = 0.32 mm;  $F_8$  = 0.35 mm;  $F_9$  = 0.35 mm;  $F_{10}$  = 0.28 mm; Club ( $F_{11}$ ) = 0.28 mm. Eyes large prominent, situated towards posterolateral corners in front view.

*Thorax:* Strongly arched, compressed proportionately wider posteriorly, laterally margined, margins deep, overhanging the vertical sides with two strong erect anterolateral spines on pronotum, broad at base, slender and acute at apex, pointing forwards; pro-mesonotal and meso-metanotal scitures distinct; metanotum broader than posterior portion of pronotum; thorax deeply emarginate at pro-meso and meso-metanotal sutures; propodeum anteriorly sharply margined and anterior corners projecting upwards; posteriorly ends in two triangular small acute teeth, which are joined by a carina; propodeum sloping from anterior to posterior, median portion slightly depressed; legs moderately long, pubescent, tibiae cylindrical, tarsi with spines beneath.

*Abdomen:* Pedicel nodiform, single jointed; petiolar node biconvex with bimucronate lateral spined slightly curved backwards with its tips, two small

spines on sides; gaster gibbous in front, concave anteriorly; with four visible segments, 1st gastral segment larger than the remaining segment and covering almost more than half of its length; anal orifice small rounded, at the apex of last gastral segment, guarded by guard hairs.

**Plesiotype: Worker.** INDIA: Kerala: Peechi (KFRI) Binoy, 30.ii.2000 [DZCU].

**Other materials examined:** INDIA: Kerala: 1W: With the same data as that of plesiotype [DZCU].

**Distribution:** INDIA: [Kerala]; Myanmar; Sri Lanka; Malacca extending to Java.

**Biology:** Unknown.

**Habitat:** Undisturbed.

**Discussion:** *Polyrhachis proxima* Roger closely resembles *Polyrhachis illaudata* Walker in the following features: 1. Body covered with a dense golden recumbent pubescence, which hides the sculpture; 2. Antennae 12 jointed; 3. Pronotum with a long spine; 4. Petiolar node with two long spines one upper angles, and two short lateral spines on sides. However *Polyrhachis proxima* Roger differs from *Polyrhachis illaudata* Walker in having: 1. lateral spines of petiolar node bimucronate at apex (in *Polyrhachis illaudata* petiolar node not binucronate at apex); 2. Thorax wider posteriorly (in *Polyrhachis illaudata* thorax narrowing posteriorly); 3. Antennal carinae short and very much closer together in *Polyrhachis illaudata* antennal carinae short, wide apart).

**Remarks:** Current subspecies: nominal plus *semirufipes* Donisthorpe.

***Polyrhachis (Myrma) punctillata punctillata* Roger**

(Figs. 108 - 109)

*Polyrhachis punctillata* Roger, 1863. *Berl. Ent. Zeit.* 7: 152. SRI LANKA. [MNHU].*Polyrhachis punctillata* Roger, 1894. var. *smythiesi* Forel, *Jour. Bomb. Nat. Hist. Soc.* 9: 456*Polyrhachis subpilosa* Emery, 1894. *Ann. Mus. Civ. Stor. Nat. Genova.* 34: 480.*Polyrhachis punctillata* Bingham, 1903. *Fauna Brit. India. Hymenoptera.* 2: 400.*Polyrhachis (Myrma) punctillata* Chapman and Capco, 1951. *Monogr. Inst. Sci. Tech. Manila* 1: 275.**Worker:** TL = 6.37 mm; HL = 2mm; HW = 2.25 mm; CI = 112.5 mm; SL = 2.37 mm; SI = 105.3 mm; ED = 0.37 mm; PW = 3 mm; AL = 2.87 mm.**Colour:** Black; tibial spurs, tarsal spines and claws reddish brown.**Sculpture and Hair pattern:** Body opaque; head and thorax finely granulate; mandibles finely striate; scape of antennae, legs, petiole and gaster finely punctate, punctures on petiole and gaster more strong; head, thorax and petiole with grey pubescence not seen clearly; pilosity restricted to a few hairs on head, coxae; a row of pilosity on frontal carinae; one or two on trochanters and base of femora, few on apex and ventral side of gaster; all segments of funiculus with short, white, thick pubescence; legs and gaster also with thick grey pubescence, clearly seen in certain reflections of light.**Head:** Oval, vertex rounded in front face view, very little broader posteriorly than in front, sides almost convex; mandibles linear with a large apical

tooth followed by 4 small teeth; clypeus broader than high, indistinctly medially carinate; frontal area triangular, frontal lobe depressed anteriorly, broader and high posteriorly with emargination medially; frontal carinae reaching up to middle line of eyes; antennal scrobe shallow; antennal carinae wide apart posteriorly; antennae slender cylindrical, 12 jointed; antennal scape short not reaching up to occiput; all segments of funiculus longer than broad; club thickened and pointed at the tip. Relative measurement of length of antennal segments: Scape = 2.37 mm;  $F_1$  = 0.5 mm;  $F_2$  = 0.25 mm;  $F_3$  = 0.37 mm;  $F_4$  = 0.43 mm;  $F_5$  = 0.37 mm;  $F_6$  = 0.43 mm;  $F_7$  = 0.25 mm;  $F_8$  = 0.31 mm;  $F_9$  = 0.37 mm;  $F_{10}$  = 0.25 mm; Club ( $F_{11}$ ) = 0.37 mm. Eyes moderate in size lateral, prominent situated towards posteriolateral corners in front view.

*Thorax:* Broad, narrowed posteriorly, laterally incised at the pro-meso, and meso-metanotal sutures; pro-mesonotal suture very distinct; meso-metanotal suture nearly obsolete; anterior margin of pronotum undulate, lateral angles armed with a strong triangular tooth pointing outwards; metanotal groove indistinct; basal portion of metanotum trapezoidal, lateral posterior angles each with a very short erect tooth, bases joined by a slight carina; apical portion of metanotum concave; propodeal spiracles prominent but not much projecting; legs short, slender; tibial smooth, aspinous.

*Abdomen:* Pedicel with a blocky massive petiole. Petiole biconvex with four small spines. Spines acute at apex, median spines longer than lateral ones, distance between spines subequal; gaster highly convex above; gastral segments distinct.

*Plesiotype:* *Worker.* INDIA: Kerala, Muthenga [Wyanad], Karmaly, K.A., 7.v.2000. [DZCU].

**Other materials examined:** 5W: With same data as that of plesiotype; 1W: INDIA: Kerala; Vithura [Trivandrum], Karmaly. K.A., 8-iii.2000.

All specimens deposited in the Systematic Entomology Laboratory, Department of Zoology, Calicut University.

**Distribution:** INDIA: [Kerala: Trivandrum, Wyanad], Tamil Nadu, Karnataka and North-West Provinces. Elsewhere: Sri Lanka, Mianmar, Java.

**Biology:** Unknown.

**Habitat:** Disturbed with grassy field, shrubs, herbs, trees, vegetation etc.

**Discussion:** *Polyrhachis punctillata punctillata* Roger resembles *Polyrhachis punctillata fergusonii* Forel in the following features: 1. Head broader posteriorly than in front; 2. Antennae 12 jointed; 3. Clypeus indistinctly medially carinate; 4. Antennal carinae wide apart; 5. Tibiae smooth without spines. However *Polyrhachis punctillata punctillata* Roger differs from *Polyrhachis punctillata fergusonii* Forel in having: petiolar node quadridentate, teeth equidistant one from the other (in *Polyrhachis punctillata fergusonii*. Petiolar node quadrispinous with the spines are more longer, more narrow and more pointed above all the median spines are fairly more away and rather more longer than the half of its length).

**Remarks:** Current subspecies: nominal plus *fergusonii* Forel, *smythiesii* Forel. This is the first report of this subspecies from Kerala. Roger [1863] originally reported this subspecies from Sri Lanka. Bingham (1903) recorded this subspecies from Kanara of South India. Donisthorpe [1943] mentioned its locality as "Muthikalam, 300 ft; Coimbatore Dist."

*Polyrhachis (Myrma) punctillata fergusonii* Forel

*Polyrhachis punctillata* r. *fergusoni* Forel, 1902 *Ann. Soc. Ent. Bel.* 46: 289. INDIA.  
[MS].

*Polyrhachis (Myrma) punctillata* subsp. *fergusoni* Chapman and Capco, 1951 *Monogr. Inst. Sci. Tech. Manila* 1: 275.

**Worker:** TL = 5-6 mm

**Colour:** Black; pale hairs; pubescence silky.

**Sculpture and Hair pattern:** Body minutely rugulose, opaque; hairs sparse and erect; pubescence very thin.

**Head:** Oval, elongate, very little broader posteriorly than in front, vertex rounded; clypeus broader than high, not at all notched without the trace of carinae; antennal carinae wide apart.

**Thorax:** Broad anteriorly, narrowed posteriorly, incised laterally at pro-meso and meso-metanotal sutures; pro-mesonotal suture distinct; meso-metanotal suture nearly obsolete; anterior margin of pronotum undulate, its lateral angles armed with a strong triangular tooth pointing outwards; basal portion of metanotum trapezoidal, lateral posterior angles with very short erect teeth, bases joined by a slight carina; apical portion of metanotum concave; legs slender; tibiae smooth; without spines.

**Abdomen:** Pedicel nodiform, single noded; petiole node quadrispinous with the spines are more longer more narrow and more pointed above all the

median spines are fairly more away and rather more longer than the half of its length; gaster oval very convex above.

*Material examined* : Nil

*Distribution* : INDIA: Kerala.

*Biology* : Unknown

*Habitat* : Unknown

*Discussion:* The affinities are discussed under *Polyrhachis punctillata punctillata* Roger.

*Remarks:* No specimen of this species could be collected in this work. Bingham (1903) considered *Polyrhachis punctillata* race *fergusoni* Forel (1902) considered as a synonym of *Polyrhachis punctillata* Roger. (1803). Chapman and Capco (1951) treated *fergusoni* as separate subspecies under *Polyrhachis punctillata* and mentioned its locality as "India: Travancore." The above description based on Bingham [1903].

*Polyrhachis (Cyrtomyrma) rastellata rastellata* [Latreille]

(Figs. 110 - 111)

*Polyrhachis rastellata* Latreille, 1802 *Hist. Nat. F ourmis*, 130. INDONESIA ("Indes orientalis"). [MNHN].

Combination in *Polyrhachis* Smith, F. 1858. *Catalogue of hymenopterous insects in the collection of the British Museum* 6. *Formicidae*: 59.

*Polyrhachis busiris* Smith, 1861. *Jour. Proc. Linn. Soc.* 5: 98.

*Polyrhachis euryalus* Smith, 1863. *Jour. Proc. Linn. soc.* 7: 16.

*Polyrhachis rastellata* Bingham, 1903 *Fauna Brit. India Hymenoptera* 2: 414.

*Polyrhachis (Crytomyrma) rastellata* Chapman and Capco, 1951 *Monogr. Inst. Sic. Tech.* Manila 1: 265.

**Worker.** TL = 5.18 mm; HL = 1.61 mm; HW = 1.28 mm; CI = 79.5 mm; SL = 1.67 mm; SI = 130.46 mm; ED = 0.36 mm; PW = 1.88 mm; AL = 2 mm.

**Colour:** Black; trochanter, femora, and tibiae of legs blood red, the joints of which also black; anterior coxae shaded with fuscous; tarsi of legs black with red blood spur; scape of antennae dark brown; segments of funiculus black.

**Sculpture and Hair Pattern:** Head, thorax and abdomen shining, polished, and regulose, reticulous (resembling network); pubescence entirely absent, pilosity present on mandibles ventral and posterior part of abdomen.

**Head:** Triangular, posteriorly very broad, vertex and occiput rounded, posterior corners rounded, cheek almost concave; mandibles triangular, linear, thick, masticatory margin 5-toothed (2 small apical teeth followed by 3 very short teeth); clypeus broad, convex, emarginate anteriorly, broadly carinate in the middle; frontal lobe parallel, close together, frontal area present; torulus rounded, vertical; antennal scrobe distinct; antennal hollows placed remote from the posterior margin of clypeus; antennal carinae widely divergent posteriorly; antennae 12 jointed, filiform, slender; antennal scape extending back to the head by about half its length, all segments of funiculus thick and almost similar in size. Relative measurement of length of antennae : Scape = 1.67 mm; F<sub>1</sub> = 0.38 mm; F<sub>2</sub> = 0.22 mm; F<sub>3</sub> = 0.22 mm; F<sub>4</sub> = 0.27 mm; F<sub>5</sub> = 0.22 mm; F<sub>6</sub> = 0.19 mm; F<sub>7</sub> = 0.19 mm; F<sub>8</sub>

= 0.16 mm;  $F_9$  = 0.16 mm;  $F_{10}$  = 0.19 mm; Club. ( $F_{11}$ ) = 0.42 mm. Eyes large, rounded, situated at the posterolateral angles.

**Thorax:** Very convex and rounded above, viewed from side strongly arched and gibbous anteriorly; pro-mesonotal suture distinct; meso-metanotal suture obsolete; pro-mesonotum in same level with metanotum, metanotum submargined in dorsal view; metanotal groove indistinct; propodeum submarginate unarmed, the dorsum very oblique and sloping into the vertical and weakly concave declivity and ends with a semicircular ring; legs moderately long posterior ends of femur and tibia possess, spines, tarsi also possess small spines; claws simple, first leg pectinate.

**Abdomen:** Pedicel nodiform, single noded; petiolar node thick at base, sloping posteriorly to a sharp margin above, armed with four subequal small acute spines, the median two spines close together and vertical, other two lateral in position and very small in size, the ends of each slightly curved inwards, the ventral part of pedicel possess a keel like structure, which anteriorly possess two long hairs; gaster globose, very convex above, first gastral segment covers more than half its length, anteroventral part of abdomen possess a tooth which directed forward.

**Plesiotype: Worker:** INDIA: Kerala, Calicut University Campus, Karmaly, K.A., 19.v.1999. [DZCU].

**Other materials examined:** 2W: INDIA: Kerala, Calicut University Campus, Sheela. S., 7.1.1992; 1W: INDIA: Kerala, Calicut University Campus, Sheela. S., 3.ii.1993; 1W: INDIA: Kerala, Anakampoil, Pramod, 24.vi.1992; 1W: INDIA: Kerala, Kohinoor, Karmaly. K.A., 25.iii.1995; 1W: INDIA: Kerala: Aluva, Karmaly. K.A., 3.iii.1995; 1W: INDIA: Kerala: Calicut University Campus, Karmaly. K.A., 30.1.2001.

All specimens deposited in the Systematic Entomology Laboratory, Department of Zoology, Calicut University.

**Distribution:** INDIA: (Kerala: Ernakulam, Malappuram, Calicut), Karnataka; Sri Lanka; Mianmar; Thailand; Philippines; Indonesia (Java, Sumatra, Borneo); Lang Is, New Guinea, Australia (Queensland).

**Biology:** Unknown.

**Habitat:** Collected from disturbed habitat.

**Discussion:** The affinities are discussed under *Polyrhachis malabarensis* sp. nov.

**Remarks:** Current subspecies *nominal plus baduri* Donisthorpe *celebensis* Vieheneyer *ceylonensis* Donisthorpe (Junior homonymn), *congener* Santschi, *corporali* Santschi, *fulakora* Mann, *nomo* Donisthorpe, *pagana* Santschi, *semiinermis* Forel. This is the first report of this subspecies from Kerala. Latreille (1802) originally described from Indonesia. Bingham (1903) recorded this species from South India (South Konkan, Kanara) along with other localities.

***Polyrhachis (Myrmhopla) sylvicola* [Jerdon]**

*Formica sylvicola* Jerdon, 1851. *Madras. Jour. Lit. Sci.* 17: 120 INDIA. [BMNH].

*Polyrhachis (Myrmhopla) sylvicola* Chapman and Capco, 1951. *Monogr. Inst. Sci. Tech. Manila.* 1: 298.

**Worker.** 2.08 mm to 8.3 mm.

**Colour:** Dull black, shining glaucous green.

**Head:** Narrowed in front, occiput rounded; mandibles short, 5-toothed, apical teeth longest and bent; antennae inserted in front of the eyes with a strong crest bordering their insertion internally; eyes posterior rather than lateral.

**Thorax:** Wide anteriorly, narrowed posteriorly; pronotum on its antero lateral angles with two spines; metanotum with two stronger spines, posteriorly pointing backwards and upwards.

**Abdomen:** Pedicel nodiform, single noded; petiolar node large, square, ending behind the two large curved spines pointing backwards and outwards, two tubercles or points behind and between them; gaster short and oval.

**Materials examined:** Nil.

**Distribution:** INDIA: Kerala [Malabar]

**Biology:** This ant makes a small nest of some papyraceous material, which it fixes on a leaf. Each nest contain one female and 8 or 10 workers, found only in jungles [R.N. Tiwari, 1999].

**Discussion:** *Polyrhachis sylvicola* (Jerdon) closely resembles *Polyrhachis indificans* (Jerdon) in the following features: 1. Thorax wide anteriorly, narrowed posteriorly; 2. Pronotum and metanotum armed with spines; 3. Pedicel nodiform, single noded. However *Polyrhachis sylvicola* [Jerdon] differs from *Polyrhachis indificans* [Jerdon] in having: Mandibles strongly 5-toothed (in *Polyrhachis indificans* mandibles strongly 3-toothed).

**Remarks:** No material of this species could be available for this study. Jerdon (1851) described this species under the genus *Formica* from Malabar.

*Polyrhachis (Myrmothrinax) thrinax thrinax* Roger

(Figs. 112 - 115)

*Polyrhachis thrinax* Roger, 1863. *Berl. Ent. Zeit.* 7: 152. SRI LANKA.*Polyrhachis thrinax* Bingham, 1903. *Fauna. Brit. India Hymenoptera* 2: 410.Combination in (*Myrmothrinax*) Forel. 1915. *Arkiv for zoologi* 9: 117.*Polyrhachis mucronis* Donisthorpe, 1942. *Ann. Mag. Nat. Hist.* (11)9: 460. S. INDIA.*Polyrhachis (Myrmothrinax) thrinax* Chapman and Capco, 1951. *Monogr. Inst. Sci. Tech. Manila* 1: 302.*Polyrhachis (Myrmothrinax) thrinax* var. *mucronis* Brown, 1959. *Ent. News Lancaster*, 70: 164.*Polyrhachis thrinax* Tiwari et al., 1994. *State fauna series 3: Fauna of West Bengal* 8: 277.**Worker.** TL : 4.85 mm; HL = 1.19 mm; HW = 1.33 mm; CI = 111.76 mm; SL = 1.80 mm ; SI = 135.33 mm; ED = 0.23 mm; PW = 1.14 mm; AL = 1.85 mm.**Colour.** Ferrugino testaceous, scape dorsobasally and tarsal segments brownish black, base of funiculus 1-5 brownish black, apex of them yellow, remaining funicular segments yellow; frontal carinae and anterior margin of clypeus brown; body shows a black tint in some reflections of light.**Sulpture and Hair pattern:** Head, thorax and petiole finely minutely reticulate, punctate, reticulations on head especially on clypeus, gena and surrounding areas of eyes arranged into longitudinal rows; antennal scape and

legs finely punctate, longitudinal pattern of reticulations on dorsum of pronotum diverging posteriorly; sculpture on head and thorax above smaller than sides of head and thorax, gaster feebly shagreened, coxae of legs sculptured as on sides of thorax. Pubescence restricted to funicular segments of antennae and tarsi of legs, not very thick, a few scattered pubescence on scape of antennae, tibia of legs and on gaster seen in certain reflections of light, mandibles with minute pubescence, apically with short setae; pilosity restricted to three long hairs at apex of scape, two rows on frontal carina, two on coxae and femora and a few on apex of gaster.

*Head:* Oval in front view posterior margin of head convex, occipital margin normal, without any wavy appearance; mandibles 5-toothed; clypeus broad, convex, medially carinate, anterior margin transverse with a very slight median incision, sides of mid lobe toothed; posterior margin shorter than anterior margin; frontal lobe distinct and raised; frontal area small, depressed, triangular; frontal carinae long, extending beyond level of mid line of eyes, diverging posteriorly; antennal carinae short; torulus rounded, vertical; antennal scrobe short, shallow; antennae short, filiform, 12 segmented, club thickened, pointed posteriorly; antennal scape extending beyond top of head by more than half its own length; all segments of funiculus longer than broad. Relative measurement of length of antennal segment: Scape = 1.80 mm;  $F_1 = 3.33$  mm;  $F_2 = 0.19$  mm;  $F_3 = 0.19$  mm;  $F_4 = 0.19$  mm;  $F_5 = 0.23$  mm;  $F_6 = 0.23$  mm;  $F_7 = 0.19$  mm;  $F_8 = 0.23$  mm;  $F_9 = 0.19$  mm;  $F_{10} = 0.19$  mm; Club ( $F_{11}$ ) = 0.19 mm. Eyes large, oval, elongate, situated above transverse midline of head.

*Thorax:* Elongate convex above, margined throughout its length; sides compressed, broad anteriorly, narrowed posteriorly; pronotum constricted anteriorly with two short teeth at anterolateral corners; pro-meso and meso-metanotal sutures clearly distinct; episternal spiracle visible; apical portion of

metanotum with two strong spines, pointed vertically; propodeum very narrow, apex slightly concave two weak median longitudinal carinae on dorsal surface of propodeum, propodeal spiracle distinct; legs long, moderately stout; tibiae cylindrical, smooth, anteriorly narrow, tarsi with scattered tarsal spines.

**Abdomen:** Pedicel nodiform longer than thick; petiolar node somewhat rectangular, its anterior and posterior faces vertical, in profile higher than long, and provided with one long median spine, two short, acute, lateral teeth; median spine cylindrical and bimucronate at apex, slightly curved with back side; length of spine subequal to length of node; sub-petiolar process distinct short, nearly conical; gaster gibbous in front, with four visible segments. First gastral segment larger, last gastral segment furnished with circular anal orifice guarded by guard hairs.

**Plesiotype: Worker:** INDIA: Kerala, Parasala Jose, 26.xii.1991. [DZCU].

**Other materials examined:** 4W: With the same data as that of plesiotype. [DZCU].

**Distribution:** INDIA: [Kerala: Malabar, Travancore, Thiruvananthapuram]; Tamil Nadu; Karnataka; West-Bengal; Elsewhere: Sri Lanka, Mianmar, Java.

**Biology:** Unknown.

**Habitat:** Disturbed; with grass, shrubs, herbs, trees etc.

**Discussion:** *Polyrhachis thrinax* Roger closely resembles *Polyrhachis frauenfeldi* Mayr in the following features: 1. Pedicel nodiform, petiolar node trispinous; 2. Abdomen shining. However *Polyrhachis thrinax* Roger differs from *Polyrhachis frauenfeldi* Mayr in having: 1. Head thorax and petiolar node rugulose and granulate (in *Polyrhachis frauenfeldi* head thorax and petiolar node

finely and closely punctured, cribrate and opaque); 2. Antennal carinae distinctly divergent posteriorly (in *Polyrhachis frauenfeldi* antenal carinae not divergent posteriorly); 3. Pronotum with two short teeth at anterolateral corners (in *Polyrhachis frauenfeldi* pronotum with two obtuse teeth at anterolateral corners). 4. Metanotum armed posteriorly with two stout erect short spines (in *Polyrhachis frauenfeldi* metanotum with two teeth pointing outwards). 5. Petiolar node with one long median spine, vertical, bimucronate at apex and two short acute lateral teeth (in *Polyrhachis frauenfeldi* petiolar node with a medial upwards and posteriorly directed straight spine not bimucronate at apex and two lateral teeth).

*Remarks:* Current subspecies: nominal plus *castanea* Stitz, *inconstans* Veihmeyer, *javonica* Mayr, *lancearia* Forel, *lucida* Emery, *nigripes* Emery (Jounior homonym). Bingham (1903) reported this species *Polyrhachis thrinax* Roger (1863) and mentioned its distribution as "India: Bengal, Kanara, Travancore; Sri Lanka, Mianmar, Java," which was again reported by Donisthorpe (1942) from Nadungayam (200 ft.), Malab<sup>a</sup>r, South India. Donisthorpe, in the same year, also described another new variety *mucronis* under the same species from Malab<sup>a</sup>r, which was later considered as a new synonym of *Polyrhachis (Myrmothrinax) thrinax thrinax* Roger, (1863) by Brown (1959).

***Polyrhachis (Myrmhopla) tibialis tibialis* Smith**

(Figs. 116 - 118)

*Polyrhachis tibialis* Smith, 1858. *Cat. Hym. Brit. Mus.* 6: 63. MIANMAR. [OXUM].

*Polyrhachis tibialis* Bingham, 1903. *Fauna, Brit. India Hymenoptera*, 2: 396.

*Polyrhachis (Myrmhopla) tibialis* Chapman and Capco, 1951, *Monogr. Inst. Sci. Tech. Manila*, 1: 298.

*Polyrhachis tibialis* Tiwari et al. 1994. *State Fauna Series 3: Fauna of West Bengal*. 8: 277.

**Worker.** TL = 5 mm; HL = 1.23 mm; HW = 1 mm; CI = 81.3 mm; SL 1 mm; SI = 180 mm; ED = 0.3 mm; PW = 1.9 mm; AL = 1.76 mm.

**Colour.** Black; the legs more or less castaneous red; hairs silky silvery, very brilliant and glittering.

**Sculpture and Hair pattern.** Whole insect covered with a fine dense, recumbent, hairs entirely hiding the sculpture.

**Head:** Very convex in front and at the sides; mandibles subtriangular, thick, 5-toothed; clypeus tectiform, broad, with a median carina, the sides not extending to the cheeks, the anterior margin more or less rounded, the anterior mid point slightly incised, clypeal teeth distinct; posterior margin emarginate; antennal carinae; 'S' shaped; antennal hollows situated remote from the posterior margin of clypeus; antennae 12 jointed, filiform; antennal scape extending beyond the top of head by more than half its length. Relative measurement of length of antennal segments: Scape = 1.8 mm; F<sub>1</sub> = 0.35 mm; F<sub>2</sub> = 0.23 mm; F<sub>3</sub> = 0.17 mm; F<sub>4</sub> = 0.23 mm; F<sub>5</sub> = 0.20 mm; F<sub>6</sub> = 0.17 mm; F<sub>7</sub> = 0.17 mm; F<sub>8</sub> = 0.17 mm; F<sub>9</sub> = 0.17 mm; F<sub>10</sub> = 0.17 mm; Club [F<sub>11</sub>] = 0.35 mm. Eyes large, round, prominent, situated immediately above the middle line of head.

**Thorax:** The sides not margined along its whole length; pro and mesonotum gibbous; pronotal spines smaller than metanotal spines, acute, straight and pointing forwards; pro-mesonotal suture well marked; though meso-metanotal suture not distinct the pubescence in that region separates both clearly; metanotal spines long, acute and pointing backwards; legs long and slender; 1st tibiae with pectinate and middle and hind tibiae with simple spurs; claws simple.

**Abdomen:** Pedicel nodiform, single noded, petiolar node high, biconvex middle slightly arched with two short teeth and on either side of it present two large spines curved to the shape of the abdomen; sub petiolar process present; gaster broadly oval, the first segment covering more than half its length.

**Plesiotype:** *Worker*. INDIA: Kerala, Peerumadu (Idukki), Karmaly. K.A., 19.v.1999 [DZCU].

**Other materials examined:** 2W. INDIA: Kerala, Kohinoor, Karmaly. K.A., 17.ii.1995; 5W. INDIA: Kerala, Aluva, Karmaly. K.A., 3.iii.1995; 1W: INDIA : Kerala, Kodungaloor (Thrissur) Rani. K.A., 10.iv.1995.

**Distribution:** INDIA: (Kerala: Malappuram, Ernakulam); Karnataka, West Bengal; Burma, Indonesia (Borneo, Celebes).

All specimens deposited in the Systematic Entomology Laboratory, Department of Zoology, Calicut University.

**Biology:** Nests under leaf litter, sometimes workers are seen in leaf folds on plant (T.M. Musthak Ali, 1991).

**Habitat:** Collected from disturbed habitat.

**Discussion:** *Polyrhachis tibialis* Smith closely resembles *Polyrhachis dives* Smith in the following features: 1. Pubescence dense and recumbent on thorax and abdomen; 2. Thorax and pedicel armed with spines; 3. Pro-and metanotum with a spine; mesonotum unarmed. However *Polyrhachis tibialis* Smith differs from *Polyrhachis dives* Smith in having : 1. Metanotal spines straight, pointing backward (in *Polyrhachis dives* metanotal spines erect, slightly bent downward; 2. Silky silvery hairs dense on head, hiding the sculpture (in *Polyrhachis dives* bronzy golden recumbent hairs sparse on head, not hiding the sculpture); 3. Petiolar node high, biconvex, middle slightly arched with two short teeth, lateral angles

spined, the spines wide spreading, curved to the shape of the abdomen (in *Polyrhachis dives* petiolar node high, flat and truncate in front, convex posteriorly, lateral angles spined, the spines wide spreading, curved to the shape of the abdomen).

**Remarks:** Current subspecies: nominal plus *addax* Santschi, *caligata* Emery, *completa* Santschi, *crassiquamis* Forel, *nigricornis*, *orientalis* Karavaiev, *parsis* Emery, *pectita* Santschi, *robustior* Karavaiev. Bingham (1903) reported this species from "India: Kanara, Bengal; Sri Lanka, Mianmar and extending to the Malayan Subregion." Subsequently Donisthorpe (1942) reported this species from Tenamalai (500-800 ft), Travancore and Nadungayam (200 ft), Malabar of South India.

***Polyrhachis (Myrma) travencorius* sp. nov.**

(Figs. 119 - 120)

**Worker:** TL = 6.2 mm; HL = 1.8 mm; HW = 1.4 mm; CI = 77 mm; SL = 1.6 mm; SI = 114.28 mm; ED = 0.2 mm; PW = 2.4 mm; AL = 2.2 mm.

**Colour:** Head, thorax, node of pedicel, gaster black; legs more or less castaneous red; silky silvery hairs; pubescence white; tibial spines reddish yellow; tarsal spur reddish brown.

**Sculpture and Hair pattern:** Head, thorax and abdomen shining; head and thorax minutely regulose; abdomen more minutely regulose than the head and thorax; pubescence adpressed, sparse on body, dense on antennae and on thorax laterally; silky silvery erect hairs scattered on head, thorax and gaster, more abundant on apex of gaster underneath.

*Head:* Very convex in front and at the sides, tending to be more convergent in front of the eyes, rounded posteriorly; mandibles sublinear, 5-toothed; clypeus carinate, tectiform, its anterior margin arcuate with a shallow median lobe; frontal lobes small, subparallel; frontal carinae prominent; parallel; antennal carinae distinct; scrobe indistinct, torulus rounded, horizontal; antennal insertion separated from posterior clypeal margin by a distinct gap, antennae short, slender, 12 jointed; antennal scape extending little beyond the top of head; all segments of funiculus longer than broad, 1st funicular segment longer than remaining segments, last segment thickened and forming club. Relative measurements of length of antennal segments: Scape = 1.6 mm;  $F_1$  = 0.9 mm;  $F_2$  = 0.35 mm;  $F_3$  = 0.2 mm;  $F_4$  = 0.2 mm;  $F_5$  = 0.2 mm;  $F_6$  = 0.2 mm;  $F_7$  = 0.2 mm;  $F_8$  = 0.15 mm;  $F_9$  = 0.2 mm;  $F_{10}$  = 0.2 mm; Club ( $F_{11}$ ) = 0.3 mm; Eyes moderately large, more towards the posterior end, slightly above the lateral sides.

*Thorax:* More or less flat above; sides margined along their whole length; pronotum broad posteriorly, narrower anteriorly, two strong long erect spines on anterolateral angles of pronotum, pointing forwards; pro-mesonotal suture very distinct; meso-metanotal impressions present, but no distinct suture; metanotal groove indistinct; metanotum unarmed; propodeum anteriorly margined and anterior corners projecting upwards, thorax deeply emarginate at pro-meso and meso-metanotal sutures; propodeum situated in a level below the pro-mesonotum, emarginate, the dorsum very oblique and sloping into the vertical and weakly concave declivity ends with a carina; legs slender, elongate; tibiae cylindrical with a spine beneath; tarsi with tarsal spurs.

*Abdomen:* In front view the sides of petiole diverge from the base, pass through the rounded angle and then converge dorsally to the base of a pair of curved spines; petiole node rhomboidal, biconvex slightly arched at middle bearing two long spines on dorsolateral edges guarded by two small teeth on

sides; long spines slightly curved backwards with its tips. Gaster globose, with four visible segments, first gastral segment larger, covering more than half of its length, apex of last gastral segment with circular anal orifice guarded by guard hairs.

**Holotype:** *Worker*. INDIA: Kerala, Palode, Karmaly. K.A., 10.iii-2000. [DSCU].

**Etymology:** Named after the locaty of collection.

**Distribution :** INDIA : [Kerala: Thiruvananthapuram].

**Bioogy:** Unknown.

**Habitat:** Disturbed with small plants and trees.

**Discussion:** This new species resembles *Polyrhachis convexa* Roger in the following features: 1. Antennae 12 jointed; 2 Clypeus tectiform; 2. Thorax flat above, sides margined along their whole length. However this new species differs from *Polyrhachis convexa* Roger in having: 1. Pronotal spine long (in *Polyrhachis convexa* pronotal spine short); 2. Legs with spines and erect hairs (in *Polyrhachis convexa* legs devoid of spines and erect hairs); 3. Petiolar node rhomboidal, biconvex with two long spines on dorsolateral edges guarded by two small teeth on sides (in *Polyrhachis convexa* petiolar node broad biconvex with four short subequal spines, equidistant from each other).

*Polyrhachis (Myrmhopla) wroughtonii* Forel

(Figs. 121 – 122)

*Polyrhachis wroughtonii* Forel, 1894. *Jour. Bomb. Nat. Hist. Soc.* 8: 398. INDIA.  
[MHNG].

*Polyrhachis wroughtoni* Bingham, 1903. *Fauna Brit. India Hymenoptera* 2: 401.

Combination in *Polyrhachis (Myrmhopla)* Emery, 1925. *Genera. Insect.* 183:  
191.

**Worker.** TL = 4.5 mm; HL = 0.88 mm; HW = 1.33 mm; CI = 151.13 mm;  
SL = 1.5 mm; SI = 113 mm; ED = 0.27 mm; PW = 1.22 mm; AL = 1.94.

**Colour:** Black; antennae except basal region, tibiae and tarsi of anterior, femora, tibiae and tarsi of intermediate and posterior legs ochraceous, shaded with fuscous, femora of anterior legs castaneous, eye reddish yellow mixed with fuscous; pubescence pale, greyish.

**Sculpture and Hair pattern:** Head, thorax, petiolar node coarsely punctured, cribrate (pierced with closely set, small holes); mandibles somewhat shining; abdomen finely granulate, opaque; legs finely granulate; a few short erect pale greyish hairs on head anteriorly, and on the apex of abdomen beneath; a very thin recumbent pilosity on head, sides of thorax and abdomen.

**Head:** More or less broader posteriorly; sides convex, occiput concave, constricted; clypeus very convex, its anterior margin arched with two short divergent teeth in the middle; frontal lobe indistinct, frontal carinae short, wide apart posteriorly; antennal scrobe short, groove like, passing above the eye, reaching up to frontal region; torulus short, rounded, horizontal; antennal carinae

short, widely separated, divergent posteriorly; antennae short, filiform 12 segmented; antennal scape extending beyond the occiput, apical portion of scape wider; all the segments of funiculus longer than broad, last segment thickened, pointed, forming club. Relative measurement of length of antennal segments: Scape = 1.5 mm; F<sub>1</sub> = 0.27 mm; F<sub>2</sub> = 0.16 mm; F<sub>3</sub> = 0.13 mm; F<sub>4</sub> = 0.11 mm; F<sub>5</sub> = 0.11 mm; F<sub>6</sub> = 0.13 mm; F<sub>7</sub> = 0.16 mm; F<sub>8</sub> = 0.11 mm; F<sub>9</sub> = 0.16 mm; F<sub>10</sub> = 0.16 mm; Club (F<sub>11</sub>) = 0.27 mm. Eyes rounded, convex, prominent, posterolateral.

*Thorax:* Short, massive; pronotum much broader than long, its anterior margin transverse, undulate, the lateral angles armed with a short acute tooth, bent downward, directed obliquely outwards; pro-mesonotal suture clearly distinct; meso-metanotal suture obsolete; metanotal spines acute, very strong, erect, very divergent, directed outwards; apical portion of metanotum flat, slightly concave; legs short, stout, tibiae smooth.

*Abdomen:* Pedicel nodiform; petiolar node biconvex, broad, with two stout laterally spreading spines, curved to the shape of abdomen; upper margin of node arched with two minute erect teeth between laterally spreading spines; gaster depressed, very slightly convex above, first gastral segment larger, covering the major portion (nearly 3/4) of gaster; remaining segments smaller; last gastral segment ends with circular anal orifice guarded by guard hairs.

*Plesiotype: Worker.* INDIA: Kerala, Karmaly. K.A., Vithura, 9.iii.2000. [DZCU].

*Other materials examined:* 1W. INDIA: Karnataka, Sringeri (Bangalore) Sinu, 31.iii.2001. [DZCU].

*Distribution:* INDIA: [Kerala], Karnataka.

*Biology:* Unknown.

**Habitat:** Disturbed; collected from Acacia plant.

**Variation:** Front of the abdomen not reddish but black. In the description of Bingham (1903) it is stated that front of the abdomen reddish.

**Discussion:** *Polyrhachis wroughtonii* Forel closely resembles *Polyrhachis ceylonensis* Emery in the following features: 1. pronotum with a short tooth; 2. metanotum with a spine on each side; 3. mesonotum unarmed; 4. Abdomen black; 5. Head broader posteriorly than in front; 6. Antennal carinae slightly divergent posteriorly. However *Polyrhachis wroughtonii* Forel differs from *Polyrhachis ceylonensis* Emery in having: 1. Head and thorax coarsely punctured (in *Polyrhachis ceylonensis* head and thorax finely reticulate, punctate). 2. Anterior margin of clypeus arched with two short divergent teeth in the middle (in *Polyrhachis ceylonensis* anterior margin of clypeus arched without teeth in the middle); 3. Petiolar node armed with two stout laterally spreading spines and two minute erect teeth between them in (*Polyrhachis ceylonensis* petiolar node armed with two strong laterally wide spreading spines without minute erect teeth between them); 4. Abdomen strongly depressed, only very slightly convex above (in *Polyrhachis ceylonensis* abdomen not depressed, very convex above).

## Subfamily 2. *CERAPACHYINAE*

### Diagnostic features of worker:

Antennae 9-12 jointed. Antennal sockets horizontal, in the plane of the transverse axis of the head. Mandibles denticulate. Clypeus, from front to back, moderately broad to reduced. Frontal lobes usually vestigial or absent, rarely weakly present. Frontal carinae distinct, narrow, vertical and are present in between the antennal sockets. Eyes usually present but frequently reduced or absent in some groups. Pro-mesonotal suture usually absent; if present (in one species) it is fused and inflexible, alitrunk fusiform and box-like; Petiole sessile to subsessile, the tergite and sternite not fused; sternite of petiole with simple posterior margin and simple articulation to the third abdominal segment. Propodeal spiracle low on side and usually behind mid length of sclerite, spiracular orifice not subtended by a longitudinal impression. Propodeal lobes present. Armament of pygidium consisting of an apical row or marginal rows of short peg-like teeth or spines. Pro-mesonotal suture usually completely absent, only extremely rarely visible. Pygidium transversely flattened or impressed and armed laterally, posteriorly or both, with a row of short spines or peg-like teeth that usually project vertically.

## Genus *CERAPACHYS* F. Smith

*Creaphachys* F. Smith, 1857. *Jour. Proc. Linn. Soc.* 2: 74.

Type species *Ceraphachys antennatus* F. Smith, 1857. loc. cit, by monotypy.

### Diagnostic features:

**Worker.** Palp formula 2, 2; mandibles triangular edentate or denticulate; clypeus very narrow and transverse; frontal carinae raised; antennal carinae elongate, curving round the base of the antennae, but not broadened into a lamina over the base of the antennae; antennal hollow very wide, bounded exteriorly by a strong carina; antennae 11-12 jointed, the basal joints of the flagellum very short, the apical funicular segment greatly swollen, pointed at apex and forming a single segmented club. Eyes small, lateral, placed posteriorly rather than anterior margin of head. Dorsum of alitrunk devoid of sutures; and legs moderately long and stout, tibiae with a single pectinate calcar at apex, middle and hind tibiae with two spurs; claws simple; petiole is a distinct and massive node, never marginate laterally; petiolar node separate, both from the metanotum and abdomen, more or less roundly cubical. Gaster elongate, gastral constriction between the first and second segments deep and well marked; pygidium impressed, armed laterally or posteriorly with a row of spines or denticulate.

**Distribution:** Ethiopian and Indo-Malayan regions.

**Biology:** Arboreal ants; black in colour, more rarely depigmented and yellowish. Nests are made in hollow twigs or rotten branches of trees, often a considerable distance above ground. The species are rare and appear to be mainly nocturnal in behaviour [Bolton 1973].

**Habitat:** Unknown.

**Discussion:** This genus *Cerapachys* F. Smith closely resembles *Phyracaces* Emery in the following features: 1. Clypeus very narrow and transverse; 2. Frontal carinae raised; 3. Antennal hollow very wide, bounded exteriorly by a strong carina; 4. Dorsum of alitrunk devoid of sutures; 5. Legs moderately long and stout. However *Cerapachys* F. Smith differs from *Phyracaces* Emery in having: 1. Antennae 11 - 12 jointed (in *Phyracaces* antennae 12 jointed); 2. Single segmented club (in *Phyracaces* three segmented club); 3. Petiolar node never marginate laterally (in *Phyracaces* petiolar node distinctly marginate laterally).

**Remarks:** So far three species have been reported from India.

#### *Cerapachys longitarsus* (Mayr)

*Liponera longitarsus* Mayr, 1879. *Verh. Zool - Bot. Ges. Wien* 27: 667 INDIA.  
[NHMW].

Combination in *Cerapachys*; Brown, 1975. *Search. Agri. Sc. 5. Entomology* (Ithaca) 15: 23.

*Liponera longitarsus* var. *australis* Forel 1895f. *Ann. Soc. Ent. Belg.* 39: 422.  
AUSTRALIA.

*Liponera bicolor* Wheeler, W.M. & Chapman, 1925. *Phil. Jour. Sci.* 28: 54.  
PHILIPPINES.

*Liponera longitarsus* r. *parava* Forel 1900d. *Jour. Bomb. Nat. Hist. Soci.* 13: 330.  
INDIA.

*Phyracaus pygmeus* Clark, 1934b *Mem. Nat. Mus. Victoria* 8: 26 AUSTRALIA.

*Cerapachys aegyptiacus* Brown, 1975. *Search Agri. 5. Entomology.* [Ithaca] 15: 22.

*Lipoponera alferii* Donisthorpe, 1939a. *Ann. Mag. Nat. Hist.* (11)3: 256.

**Worker:** TL = 4 mm.

**Colour:** Head and abdomen black, shining; mandibles, antennae, thorax, legs and pedicel red.

**Sculpture and Hair pattern:** Head, thorax and abdomen, above with minute scattered punctures; pilosity sparse, very short, erect and black.

**Head:** Ovato-rectangular; mandibles triangular, masticatory margin broad, obsoletely dentate; clypeus narrow, transverse; antennal carinae short, prominent, close together; antennae 12 jointed, subapical joint of the flagellum longer than broad, apical joint more than twice as long as broad; eyes round, very large, placed forward on sides of head close to base of mandibles.

**Thorax:** Short, rectangular, transverse in front, truncate posteriorly, sides flat; pro-meso and meso-metanotal sutures indistinct; legs elongate; femora and tibiae cylindrical.

**Abdomen:** Pedicel nodiform, one-jointed, petiolar node nearly square, slightly convex above, broader than long, truncate, slightly concave in front, transverse posteriorly, gaster comparatively long, longer than thorax, constriction between the basal two segments very deep.

**Material examined:** Nil.

**Distribution:** India: Kerala, Maharashtra, West-Bengal; Indonesia (Sumatra), Formosa.

**Biology:** Unknown.

**Habitat:** Unknown.

**Discussion:** *Cerapachys longitarsus* (Mayr) closely resembles *Cerapachys aitkenii* Forel in the following features: 1. Antennae 12 jointed; 2. Femora and tibiae of legs cylindrical; 3. Pedicel nodiform, one-jointed. However *Cerapachys longitarsus* (Mayr) differs from *Cerapachys aitkenii* Forel in having : 1. Pilosity sparse, and black (in *Cerapachys aitkenii* pilosity dense, and yellowish); 2. Petiolar node nearly square, slightly convex above, truncate (in *Cerapachys aitkenii* petiolar node nearly cubical, rounded above, not truncate).

**Remarks:** No material of this species was available for this study. Bingham (1903) mentioned its localities as "Bengal and Western India, Poona to Travancore." The above description is taken from Bingham [1903].

### Subfamily 3. *DOLICHODERINAE*

#### Diagnostic features of worker:

Median portion of clypeus broad from front to back so that antennal sockets are well behind anterior margin of head. Median portion of clypeus usually extended backward between the antennal sockets, sometimes not. Often a post clypeal frontal triangle present. Antennal sockets inclined; the portion of the sockets margin and torulus closest to the dorsal midline of the head on a higher level than the portion of margin most distant from midline. Frontal carine usually present, rarely absent; eyes usually present, very rarely absent or vestigial; ocelli rarely present; antennae usually with 12 segments except in *Semonius* Forel. Pro-mesonotal suture present, situated in lower posterior corner of metapleuron, opening laterally or posterolaterally; metanotum and its spiracle present on dorsal surface of alitrunk. Petiole present (single segmented). Pygidium small, simple. Hypopygium not modified into an acidopore apically. Sting absent or vestigial.

## KEY TO THE GENERA OF SUBFAMILY DOLICHODERINAE OF INDIA

[Based on workers]

(Modified from Bolton, 1994)

1. Antennae with 12 segmented [Fig.123]; petiole in profile usually a simple transversely flattened strip, sometimes slightly swollen anterodorsally but never equipped with a standing scale; petiole overhung by first gastral segment and usually not visible in dorsal view when alitrunk and gaster are in the same plane ..... 2
- Antennae with 12 segments; petiole in profile surrounded by a node or scale which may be high and erect or lower and somewhat inclined forward, but scale or node always present and conspicuous. Petiole not or only weakly overhung by first gastral segment, usually visible in dorsal view when alitrunk and gaster are in the same plane ..... 3
2. In dorsal view 5 gastral tergites visible [Fig. 131], the fifth small but continuing the line of the gaster and not bent forward below the fourth; anal and associated orifices are then situated apically .....  
 ..... *TECHNOMYRMEX* Mayr  
 In dorsal view only 4 gastral tergites visible [Fig. 127], fifth tergite bent forward below the fourth, visible in ventral view where it forms a transverse plate abutting the fifth sternite; the anal and associated orifices are thus situated ventrally, monomorphic species, maximum diameter of eye usually distinctly greater than maximum width of antennal scape [Fig. 127] ..... *TAPINOMA* Förster
3. Palp formula 4, 2, or 2, 3 ..... *BOTHRIOMYRMEX* Emery
- Palp formula 6, 4 ..... 4

4. Integument thick, hard and armour-like, the surface varying from smooth (Very rare) to strongly and coarsely sculptured; propodeum not bearing a long, horn-like protuberance, although in some species it is angulate in side view ..... *DOLICHODERUS* Lund
- Integument thin and flexible, not armour-like, the surface usually very finely and densely sculptured, only extremely rarely more or less smooth; other characters may or may not be as in alternate ..... 5
5. With alitrunk viewed in profile, metanotal groove impressed and metathoracic spiracles dorsal, anterior face of first gastral tergite without a deep concavity in the area immediately behind the petiolar scale .....  
..... *IRIDOMYRMEX* Mayr
- With alitrunk in profile, metanotal groove not impressed and metathoracic spiracles lateral. Anterior face of first gastral tergite with a deep concavity in the area immediately behind petiolar scale ..... *LIOMETOPUM* Mayr

## Genus 1. *DOLICHODERUS* Lund

*Dolichoderus* Lund, 1831a *Ann. Sci. Nat.* 23: 130.

Type species: *Formica attelaboides*, by monotypy.

### Diagnostic features:

**Worker.** Length 2.44 mm - 2.78 mm. Integument stiff, somewhat brittle and often rather strongly sculptured, especially on head and thorax. Head uniformly reddish brown, rectangular with short appressed pubescence. Cheeks and front slightly convex; mandibles triangular, masticatory margin broad slightly transverse; eyes moderately large placed on midline of head; ocelli absent. Antennae 12 jointed; antennal fossa touching posterior border of clypeus; antennal scape long; flagellum of antennae and mandibles pale; maxillary palpi 6 jointed; labial palpi 4 jointed; thorax elongate, very minutely coarsely reticulate; pronotum more or less flat, sloping posteriorly; pro-mesonotal suture distinct. Mesoepinotal constriction strongly pronounced; metanotum truncate. Apex of metanotum concave, side of metanotum flat; petiolar node smooth and shining, thicker than above base, somewhat inclined forward, dorsal part broad. Gaster subglobose, broad at base, inclined anteriorly, not extended above petiole. Cloacal orifice inferior.

**Distribution:** Both hemispheres. In India: Kerala, Malabar.

**Biology:** Unknown.

**Habitat :** Disturbed with grass, shrubs, herbs, plants etc.

**Discussion:** This genus comes near to *Turneria* Forel in the following features: 1. Antennae 12 jointed; 2. Maxillary palpi 6 jointed; labial palpi 4

jointed. However this genus *Dolichoderus* Lund differs from *Turneria* Forel in having: 1. Integument thick, hard and armour-like, the surface varying from smooth to strongly and coarsely sculptured (in *Turneria* integument thin and flexible, not armour-like, the surface usually very finely and densely sculptured, only extremely rarely more or less smooth).

**Remarks:** So far one sub genus, seven species and five subspecies have been reported from India [Bolton, 1995].

### KEY TO THE INDIAN SPECIES OF *DOLICHODERUS* Lund

[BASED ON WORKERS]

[MODIFIED FROM BINGHAM 1903]

1. Mesonotum not longitudinally sulcate above [Fig. 125] ..... 2
- Mesonotum longitudinally sulcate above [Fig. 123] ..... 3
2. Length over 5 mm; head, thorax and petiolar node black .....  
..... *D. sulcaticeps* [Mayr]
- Length under 3 mm; head, thorax and petiolar node, reddish brown .....  
..... *D. burmanicus* Bingham
3. Head, thorax and abdomen without erect hairs ..... 4
- Head, thorax and abdomen with erect hairs ..... 5
4. Thorax irregularly and coarsely punctured, not wrinkled .....  
..... *D. feae feae* Emery

- Thorax irregularly and less coarsely punctured, but wrinkled.....  
..... *D. feae fuscus* Emery
- 5. Head densely punctured, pubescent and opaque; thorax coarsely rugose ..  
..... *D. bituberculatus* [Mayr]
- Head smooth, shining, slightly pubescent, not opaque; thorax less coarsely  
rugose ..... 6
- 6. Head and thorax reddish yellow ..... 7
- Head and thorax concolorous ..... 8
- 7. Abdomen black; legs shorter ..... *D. taprobanae taprobanae* [Smith]
- Abdomen reddish brown; legs longer ... *D. taprobanae var. gracilipes* [Mayr]
- 8. Length over 3 mm; basal portion of metanotum clearly longer than the  
apical truncate portion ..... 9
- Length under 3 mm; basal portion of metanotum clearly shorter than the  
apical truncate portion ..... *D. moggridgei moggridgei* Forel
- 9. Legs light brown; with pilosity ..... *D. affinis affinis* Emery
- Legs light yellowish red, with pilosity ..... *D. affinis. glabripes* Forel

Subspecies *bicolor* Santschi and *lugubris* Santschi are excluded from this.  
For want of details.

***Dolichoderus (Hypoclinea) bituberculatus* [Mayr]**

(Figs. 123 - 124)

*Hypoclinea bituberculata* Mayr, 1862. *Verh. Zool - Bot. Ges. Wien* 12: 705.  
PHILIPPINES. [NHMW].

Combination in *Dolichoderus* : Emery, 1887a *Ann. Mus. Civ. Stor. Nat. Genova*(2) 4: 254.

Combination in *Dolichoderus (Hypoclinea)*: Emery, 1894c. *Bull. Soc. Ent. Italiana* 26: 229.

*Hypoclinea sellaris* Roger, 1863a. *Berl. Ent. Zeit.* 7: 213. SRI LANKA.

**Worker.** TL = 3.2 mm; HL = 0.68 mm; HW = 0.69 mm; CI = 101.5 mm; SL 0.45 mm; SI = 65.22 mm; ED = 0.16 mm; PW = 0.5 mm; AL = 1.34 mm.

**Colour.** Head and thorax black, legs dark reddish brown; petiolar node dark brown; abdomen dark brown, posteriorly nearly black; silky pale pubescence; black hairs.

**Sculpture and Hair pattern:** Whole body densely punctured and opaque; thorax very coarsely cribrately punctured and wrinkled, mesonotum longitudinally sulcate, metanotum smooth; petiolar node smooth and shining; abdomen shining; head, thorax and abdomen clothed with sparsely scattered erect hairs and abundant silky pale pubescence, dense on head, thorax and legs.

**Head:** Broadly oval without mandibles, cheeks and front strongly convex; mandibles triangular, masticatory margin broad, with minute teeth; clypeus broad, slightly convex, its anterior margin very slightly and widely emarginate; frontal area indistinct; antennal carinae short, wide apart; antennal scrobe short

and shallow; torulus rounded, horizontal; antenna 12-jointed, stout; antennal scape long; all segments of funiculus (except apical three segments) longer than broad, apical three segments slightly thickening. Relative measurement of length of antennal segment : Scpe = 0.45 mm; F<sub>1</sub> = 0.23 mm; F<sub>2</sub> = 0.1 mm; F<sub>3</sub> = 0.07 mm; F<sub>4</sub> = 0.07 mm; F<sub>5</sub> = 0.07 mm; F<sub>6</sub> = 0.07 mm; F<sub>7</sub> = 0.1 mm; F<sub>8</sub> = 0.07 mm; F<sub>9</sub> = 0.1 mm; F<sub>10</sub> = 0.1 mm; Club (F<sub>11</sub>) = 0.23 mm. Eyes very flat, not prominent, placed slightly above the middle transverse line of head.

*Thorax:* Short, laterally compressed and slightly constricted about the middle; pronotum more or less flat, margined anteriorly; pro-mesonotal and meso-metanotal sutures very distinct; mesonotum short and raised above the level of the pronotum; metanotum laterally compressed, basal, portion slightly inclined towards anteriorly, truncate apical portion concave and curved inwards, sides flat, smooth, margined above and posteriorly; legs long; tibiae with tibial hairs; claws simple.

*Abdomen:* Pedicel nodiform, single jointed; petiolar node scale like, low and inclined forwards, thicker above than at base, a little broader than thick; gaster broad at base, slightly convex above, somewhat pointed at apex.

*Plesiotype: Worker.* INDIA: Kerala, Calicut University Campus, Karmaly. K.A., 27.v.1999 [DZCU].

*Other materials examined:* 6W: INDIA: Kerala, Calicut University Campus, Sheela, S., 24.1.1992.

*Distribution:* INDIA: [Kerala: Malappuram], Sikkim (Möller), Western India (Wroughton); Burma, Tenasserim; extending into the Malayan subregion.

*Biology:* Unknown.

*Habitat:* Disturbed.

**Discussion:** *Dolichoderus bituberculatus* [Mayr] closely resembles *Dolichoderus burmanicus* Bingham in the following features: 1. Antennae 12 jointed, 2. Clypeus broad and slightly convex; 3. Pro-mesonotal and meso-metanotal sutures distinct. However *Dolichoderus bituberculatus* [Mayr] differs from *Dolichoderus burmanicus* Bingham in having: 1. Head broadly oval without mandibles (in *Dolichoderus burmanicus* head with the mandibles from the front elongately triangular); 2. Mesonotum distinctly longitudinally sulcate above (in *Dolichoderus burmanicus* mesonotum not longitudinally sulcate above); 3. Pronotum flat above (in *Dolichoderus burmanicus* pronotum rounded above).

***Dolichoderus (Hypoelinea) burmanicus* Bingham**

(Figs. 125 - 126)

*Dolichoderus burmanicus* Bingham, 1903. *Fauna Brit. India, Hymenoptera*. Vol. 2: 293  
BURMA.

Combination in *Dolichoderus (Hypoelinea)* Emery, 1912g. In Wytsman, P.  
*Genera Insect.* Fasc. 137: 13.

**Worker:** TL = 2.1 mm; HL = 0.86 mm; HW = 0.94 mm; CI = 109 mm;  
SL = 0.92 mm; SI = 98 mm; ED = 0.19 mm; PW = 0.41 mm; AL = 1.2 mm.

**Colour:** Head, thorax, petiolar node reddish brown, mandibles, antennae  
yelliwish brown; legs, abdomen yellow in striking contrast.

**Sculpture and Hair pattern:** Thorax coarsely punctured, rugose; mandibles  
punctured; whole body densely pilose and minutely and sparsely pubescent.

**Head:** With the mandibles from the front elongately triangular, convex, occiput emarginate, concave; mandibles very broad and straight at masticatory margin, with 12 small acute teeth; clypeus broad, slightly convex, its anterior margin transverse, fringed with longish hairs; frontal area small, distinct, triangular; torulus round, horizontal, antennal scrobe short shallow; antennal carinae short wide apart, parallel, antennae stout, 12-jointed; antennal scape long, extending beyond the top of head; all segments of funicular (except apical one) longer than broad. Relative measurement of length of antennal segment : Scape = 0.92 mm; F<sub>1</sub> = 0.16 mm; F<sub>2</sub> = 0.11 mm; F<sub>3</sub> = 0.09 mm; F<sub>4</sub> = 0.09mm; F<sub>5</sub>= 0.11 mm; F<sub>6</sub> = 0.09 mm; F<sub>7</sub> = 0.09 mm; F<sub>8</sub> = 0.11 mm; F<sub>9</sub> = 0.11 m; F<sub>10</sub> = 0.13 mm; Club (F<sub>11</sub>) = 0.28 mm. Eyes moderate in size, posterior to the transverse midline of head.

**Thorax:** Short, coarsely cribrately punctured, rugose; pronotum rounded above, slightly convex; pro-mesonotal suture distinct; meso-metanotal suture very distinct, emargination very deep; mesonotum circular from above, slightly raised above the pronotum, slightly convex not sulcate; metanotum triangular, basal portion of metanotum longer than the truncate apical portion, convex, not flat, apical portion vertical, flat, not concave; legs long, tibiae cylindrical with tibial hairs; tarsi with tarsal spurs; claws simple.

**Abdomen:** Pedicel nodiform, single noded; petiolar node flat, broader than long; gaster short, broad, globose, convex above.

**Plesiotype: Worker.** INDIA: Kerala, Calicut University Campus, Karmaly. K.A., 27.v.1999. [DZCU].

**Other materials examined:** 3W: With the same data as that of plesiotype; 4W: INDIA: Kerala, Calicut University Campus, Sheela, S., 24.1.1992; 1W: INDIA: Kerala, Muthukulam, Sheela. S., 16.xi.1995.

All specimens deposited in the Systematic Entomology Laboratory, Department of Zoology, Calicut University.

**Distribution:** India: [Kerala: Malappuram]; Myanmar.

**Biology:** Unknown.

**Habitat:** Disturbed.

**Discussion:** *Dolichoderus burmanicus* Bingham closely resembles *Dolichoderus bituberculatus* Mayr in the following features: 1. Antennae 12 jointed; 2. Clypeus broad and slightly convex; 3. Pro-mesonotal and meso-metanotal sutures distinct. However *Dolichoderus burmanicus* Bingham differs from *Dolichoderus bituberculatus* Mayr in having: 1. Head with the mandibles from the front elongately triangular (in *Dolichoderus bituberculatus* head broadly oval without mandibles); 2. Mesonotum not longitudinally sulcate above (in *Dolichoderus bituberculatus* mesonotum distinctly longitudinally sulcate above); 3. Pronotum rounded above (in *Dolichoderus bituberculatus* pronotum flat above).

## Genus 2. TAPINOMA Förster

*Tapinoma* Förster, 1850a. *Hym. stud.* 1: 43. Type species: *Tapinoma collina*, by monotypy.

Synonyms: = *Micromyrma* Mayr, 1963: 455.

=*Neoclystopsenella* Borwn, 1888a : 337

=*Semonius* Forel, *Tapinoptera* Santschi, *Zatapinoma* Wheeler: Shattuck 1992 c. 146.

### Diagnostic features:

**Worker:** Length 0.83 mm - 2 mm. Mandibles with apical two or three large teeth, followed by a row of denticles; maxillary palpi 6 jointed; labial palpi 4 jointed; antennae 12 jointed; clypeus with or without median anterior border emarginate. Eyes placed in front of midlength of sides of head on dorsal view; propodeum unarmed or rarely with a pair of blunt tubercles. The petiolar node reduced to an anterior thickening of the depressed or flattened petiole which is overlaid by first gastral segment. Gaster in dorsal view with four visible tergites; anal and associated orifice ventral.

**Distribution:** Both hemispheres. In India: Western India (Bingham, 1903), Kerala: Malabar.

**Biology:** Unknown.

**Habitat:** Found in both disturbed and undisturbed habitat.

**Discussion:** This genus comes near to *Technomyrmex* Mayr in the following features: 1. Antennae 12 jointed; 2. Maxillary palpi 6 jointed; labial palpi 4

jointed; 3 propodeum unarmed or rarely with a pair of blunt tubercles. However this genus *Tapinoma* Förster differs from *Technomyrmex* Mayr in having: 1. Eyes placed in front of midlength of sides of head on dorsal surface. (in *Technomyrmex* eyes placed at or in front of midlength of sides of head); 2. Gaster in dorsal view with four visible tergites (in *Technomyrmex* gaster in dorsal view five visible tergites); 3. Anal and associated orifice situated ventrally (in *Technomyrmex* anal and associated orifice situated apically).

**Remarks:** So far four species have been reported from India (Bolton 1993).

### Key to species of *Tapinoma* Förster of Kerala

(Based on Workers)

1. Antennal scape long extending beyond the top of the head [Fig.129] .....  
..... *T. melanocephalum melanocephalum* [Fabricius]
- Antennal scape short not extending beyond the top of the head [Fig.127] ...  
..... *T. indicum indicum* Forel

### *Tapinoma (Micromyrma) indicum indicum* Forel

(Figs. 127 - 128)

*Tapinoma indicum* Forel, 1895e. *Jour. Bomb. Nat. Hist. Soc.* 9: 472. INDIA. [MS]

Combination in *Tapinoma (Micromyrma)*. Santschi 1928e. *Bull. Soc. Vaud. Sci. Natur.* 56: 473.

**Worker.** Brownish yellow; not shining; mandibles, antennae and legs pale yellow; pubescence silky white; eyes black.

*Sculpture and Hair pattern:* Head, thorax and abdomen somewhat smooth subopaque, not shining; pilosity very sparse; pubescence very thin.

*Head:* Short, broader posteriorly, oval, not emarginate posteriorly; mandibles triangular, broad, with the masticatory margin equal to the outer margin, armed with numerous minute teeth; clypeus evenly but highly convex, broader than high, its anterior margin transverse, raised, fused with short hairs to posterior margin well defined; antennal insertion very close to posterior margin of clypeus; frontal area not distinct; antennal carinae short, wide apart; torulus rounded, horizontal; antennal scrobe short, groove like antennae short, filiform, 12 jointed, antennal scape short extending beyond the top of head, segments of funiculus (except 3-8) longer than broad. Relative measurement of length of antennal segment: Scape = 0.3 mm;  $F_1$  = 0.06 mm;  $F_2$  = 0.04 mm;  $F_3$  = 0.03 mm;  $F_4$  = 0.04 mm;  $F_5$  = 0.04 mm;  $F_6$  = 0.02 mm;  $F_7$  = 0.03 mm;  $F_8$  = 0.04 mm;  $F_9$  = 0.04 mm;  $F_{10}$  = 0.03 mm; Club ( $F_{11}$ ) = 0.13 mm. Eyes comparatively large, lateral, placed a little to the front.

*Thorax:* Much broader in front, when viewed from side not emarginate, pro-meso and meso-metanotal sutures distinct; thorax slightly constricted at meso-metanotal sutures; basal portion of metanotum very short, passing into the much longer obliquely slopping portion by an obtuse angle; legs stout, tibiae with spine; tarsi with tarsal hairs; claws simple.

*Abdomen:* Pedicel nodiform, single noded; petiolar node flat, strongly inclined towards anteriorly; gaster short, oval, basal segment gibbous, overhanging the petiolar node, with an almost obsolete fovea on the anterior face for the reception of the petiolar node.

*Plesiotype: Worker.* INDIA: Kerala, Muthenga, Karmaly. K.A., 7.x.1995. [DZCU].

**Other materials examined:** 6W: INDIA, Kerala, Muthukulam, Sheela. S., 29.x.1995; 3W: INDIA: Kerala, Calicut University Campus, Sheela. S., 21.v.1993; 3W. INDIA - Kerala, Aralam farm, Karmaly. K.A., 16.xii.1995.

All specimens deposited in the Systematic Entomology Laboratory, Department of Zoology, Calicut University.

**Distribution:** India: [Kerala: Alapuzha, Malappuram, Kannur], Western India.

**Biology:** Unknown.

**Habitat:** Disturbed.

**Discussion:** *Tapinoma indicum* Forel closely resembles *Tapinoma melanocephalum* [Fabricius] in the following features: 1. Masticatory margin armed with numerous minute teeth; 2. Antennae 12 jointed; 3. Antennal insertion very close to posterior margin of clypeus. However *Tapinoma indicum* Forel differs from *Tapinoma melanocephalum* [Fabricius] in having: 1. Head, thorax and abdomen subopaque smooth not-shining (in *Tapinoma melanocephalum* head, thorax and abdomen smooth, shining); 2. Posterior margin of clypeus well defined (in *Tapinoma melanocephalum* posterior margin of clypeus not well defined); 3. Antennae short, scape not extending beyond the top of head (in *Tapinoma melanocephalum* antennae long, scape extending beyond the top of head).

**Remarks:** Current subspecies nominal plus *timidum*. This is the first report of this subspecies from Kerala. Forel (1895) originally reported this species from Western India.

***Tapinoma (Micromyrma) melanocephalum melanocephalum* [Fabricius]**

(Figs. - 129 - 130)

*Formica melanocephala* Fabricius, 1793 *Ent. Syst.* 2: 353.*Formica nana* Jerdon, 1851 *Madras Jour. Lit. Sci.* 17: 125.*Myrmica pellucida* Smith, 1858 *Cat. Hym. Brit. Mus.* 6: 124.*Tapinoma melanocephalum* Bingham, 1903. *Fauna. Brit. India Hymenoptera* 2: 304.*Tapinoma melanocephalam* Negi. et al. 1930. *Jour. Bomb. Nat. History Soc.* 34(1): 186.*Tapinoma (Micromyrma) melanocephalum* Chapman and Capco, 1951 *Monogr. Inst. Sci. Tech. Mamila* 1: 192.*Tapinoma melanocephalum* Taylor. 1987. *CSIRO Aust. Div. Entomol.* 41: 71.

**Worker:** TL = 2 mm; HL = 0.4 mm; HW = 0.7 mm; CI = 175 mm; SL = 0.4 mm; SI = 57 mm; ED = 0.06 mm; PW = 0.22 mm; AL = 0.7 mm.

**Colour:** Head and thorax fuscous; abdomen pale brownish; mandibles, antennae, legs, yellow; eyes blackish brown; pubescence whitish, distinctly seen when viewed in certain light.

**Sculpture and Hair pattern:** Head thorax and abdomen somewhat smooth shining pilosity scattered and erect; pubescence very sparse.

**Head:** Longer than broad, oval, rounded posteriorly not emarginate; mandibles triangular, broad, with the masticatory margin equal to the outer margin, armed with numerous minute teeth; clypeus evenly but highly convex, broader than high, its anterior margin slightly arched; antennal insertion very

close to posterior margin of clypeus; frontal area not distinct; antennal carinae short, wide apart; torulus round, horizontal; antennal scrobe short, groove like; antennae somewhat thick, short, 12 jointed; antennal scape long, extending beyond the top of head, all segments of funiculus longer than broad. Relative measurement of length of antennal segments: Scape = 0.4 mm; F<sub>1</sub> = 0.07 mm; F<sub>2</sub> = 0.06 mm; F<sub>3</sub> = 0.05 mm; F<sub>4</sub> = 0.06 mm; F<sub>5</sub> = 0.05 mm; F<sub>6</sub> = 0.04 mm; F<sub>7</sub> = 0.03 mm; F<sub>8</sub> = 0.03 mm; F<sub>9</sub> = 0.04 mm; F<sub>10</sub> = 0.04 mm; Club (F<sub>11</sub>) = 0.06 mm. Eyes comparatively large, lateral, placed a little to the front.

*Thorax:* When viewed from side not emarginate, pro-meso and meso-metanotal sutures distinct, thorax slightly constricted at meso-metanotal suture; basal portion of metanotum very short, passing into the much longer obliquely sloping portion by an obtuse angle, legs stout, tarsi with hairs;

*Abdomen:* Pedicel nodiform, single noded; petiolar node flat, strongly inclined towards anteriorly; gaster elongate, oval, basal segment gibbous, overhanging the petiolar node, with an almost obsolete fovea on the anterior face for the reception of the petiolar node.

*Plesiotype: Worker:* INDIA: Kerala, Muthenga, Karmaly. K.A., 10.x.1995. [DZCU].

*Other materials examined:* 1W. INDIA: Kerala, Calicut University Campus, Sheela. S., 4.xii.1991; 1W: INDIA: Kerala, Calicut University Campus, Sheela. S., 26.viii. 1992; 1W: INDIA: Kerala, Calicut University, Sheela. S., 8.iv.1993; 1W: INDIA: Kerala, Aluva, Karmaly. K.A., 25.x.1995; 4W: INDIA, Kerala, Muthukulam, Sheela. S., 29.x.1995.

All specimens deposited in the Systematic Entomology Laboratory, Department of Zoology, Calicut University.

**Distribution** : India: [Kerala: Alapuzha, Ernakulam, Malappuram, Wyanad], Tamil Nadu, Karnataka and mostly throughout the country. Elsewhere: Oceania, South America (Cayenne) and spread through the tropics of both hemispheres.

**Biology**: Unknown.

**Habitat**: Disturbed.

**Discussion**: The affinities are discussed under *Tapinoma indicum indicum* Forel.

**Remarks**: Current subspecies nominal plus *Coronatum* Forel, *malesianum* Forel. This is the first report of this subspecies from Kerala. Jerdon (1851) originally described this species *Formica nana* from Mysore, South India, which was later considered as a synonym of *Tapinoma melanocephalum* (Fabr., 1793) by Bingham (1903). Subsequently, Negi *et al* (1930) also recorded this species from Salem Dist. Tamil Nadu, South India.

### Genus 3. TECHNOMYRMEX Mayr

*Technomyrmex* Mayr, 1872. *Ann. Mus. Civ. Stor. Nat. Genova.* 2: 147.

Type species: *Technomyrmex strenuus*, by monotypy.

Synonyms = *Aphantolepis* Brown, 1953h: 5. = *Engramma* Shattuck, 1992c : 153.

#### Diagnostic features:

**Worker.** Length 1.6 mm - 5.1 mm. Mandibles with apical two or three teeth, large followed by a row of denticles, maxillary palpi 6 jointed, labial palpi 4 jointed. Clypeus with or without median anterior border emarginate. Antennae 12 jointed. Eyes placed at or in front of midlength of side of head on dorsal surface; propodeum unarmed rarely with a pair of blunt tubercles; petiole reduced over hung by the first gastral segment and not visible in dorsal view. Gaster with five visible tergites; anal and associated orifice apical.

**Distribution:** Ethiopian, Indo-Malayan and Australian regions. In India: Sikkim, Western India, Assam, Kerala, Bangalore, Malabar.

**Biology:** Unknown.

**Habitat:** Found in both disturbed and undisturbed habitat.

**Discussion:** This genus comes near to *Tapinoma* Förster in the following features: 1 Antennae 12 jointed; 2. Maxillary palpi 6 jointed, labial palpi 4 jointed; 3. Propodeum unarmed or rarely with a pair of blunt tubercles. However this genus *Technomyrmex* Mayr differs from *Tapinoma* Förster in having : 1. Eyes placed at or in front of midlength of side of head on dorsal surface (in *Tapinoma*

eyes placed in front of midlength of side of head on dorsal surface); 2. Gaster in dorsal view with five visible tergites (in *Tapinoma* gaster in dorsal view with four visible tergites); 3. Anal and associated orifice situated apically (in *Tapinoma* and associated orifice situated ventrally).

**Remarks:** So far four species and two subspecies have been reported from India [Bolton 1995].

### Key to Indian species of *TECHNOMYRMEX* Mayr

[Based on workers]

[Modified from Bingham 1903]

1. Anterior margin of clypeus with a deep crescentic emargination [Fig. 132] ..  
..... 2
- Anterior margin of clypeus medially very slightly and widely emarginate  
[Fig.138] [Kerala] ..... *T. elatior* Forel
2. Antennal scape scarcely extending beyond top of head [Fig.131] ..... 3
- Antennal scape extending beyond top of head by one fourth of its length  
[Fig.135] [Kerala] ..... *T. bicolor bicolor* Emery
3. Head, thorax and abdomen very finely and closely reticulate-punctate .. 4
- Head, thorax and abdomen smooth ..... *T. albipes brunneus* Forel
4. Black, the tarsi white [Kerala] ..... *T. albipes albipes* [Smith]
- Black, the tarsi brown ..... *T. albipes brunncipes* Forel

Species *incisus* [Mukerjee] is excluded from this key since its description is incomplete, and want of details.

***Technomyrmex albipes albipes* [Smith]**

(Figs. 131 - 132)

*Formica (Tapinoma) albipes* Smith. F., 1861b. *Jour. Proc. Linn. Soc. Zool.* 6: 38.  
SULAWESI.

Combination in *Tapinoma*: Mayr, 1863. *Verh. Zool/- Bot. Ges. Wien.* 12: 455.

Combination in *Technomyrmex* Emery, 1888d. *Zeit. Wisse. Zool.* 46: 392.

*Tapinoma nigrum* Mayr, 1862. *Verh. Zool - Bot. Ges. Wien* 12: 703. SRILANKA.

*Tapinoma albitrase* Motschoulsky, 1863. *Bull. Imp. Natur. Moscow* 32 (11): 14.  
SRILANKA.

*Technomyrmex albipes* **st.** *rufescens* Santschi, 1928c: *Rev. Sui Zool.* 35: 70.

*Technomyrmex albipes* var. *vitiensis* Mann, 1921. *Bull. Mus. Comp. Zool. Harvard college* 64: 473.

**Worker:** TL = 2 mm; HL = 0.4 mm; HW = 0.4 mm; CI = 100 mm; SL = 0.4 mm; SI = 100 mm; ED = 0.08 mm; PW = 0.25 mm; AL = 0.53 mm.

**Colour:** Mandibles yellowish brown; head, thorax and abdomen fuscous brown, tarsi white, eyes brownish black; pubescence silky-white; hairs very pale.

**Sculpture and Hair pattern:** Head, thorax and abdomen very finely and closely reticulate-punctate; body covered with a thin, very short silky white pubescence; a few scattered erect pale hairs in front of head and apex of abdomen.

**Head:** Longer than broad, cordate; emarginate, posteriorly; mandibles broad, triangular, masticatory margin equal in length to the outer margin, denticulate; the anterior margin of clypeus with a deep crescentic emarginating; its position or margin not clearly defined; frontal area indistinct; antennal carinae short, wide apart; antennal scrobe distinct, groove like; torulus rounded, horizontal; antennal insertion immediately behind the posterior region of clypeus; antennae short, slender, 12 jointed antennal scape moderately long; all segments funiculus (except apical segments) as broad as long, apical segment slightly thickening. Relative measurement of length of antennal segment: Scape = 0.4 mm; F<sub>1</sub> = 0.05 mm; F<sub>2</sub> = 0.06 mm; F<sub>3</sub> = 0.05 mm; F<sub>4</sub> = 0.05 mm; F<sub>5</sub> = 0.03 mm; F<sub>6</sub> = 0.06 mm; F<sub>7</sub> = 0.06 mm; F<sub>8</sub> = 0.06 mm; F<sub>9</sub> = 0.05 mm; F<sub>10</sub> = 0.08 mm; Club (F<sub>11</sub>) 0.15 mm. Eyes comparatively large, placed in front of transverse middle line of head.

**Thorax:** Moderately broad, when viewed in profile emargination at meso-metanotal suture wide but not very deep; pronotum broad, slightly narrow anteriorly; pro-mesonotal suture distinct but not incised; mesonotum convex, slightly raised above the pronotum; pronotum and mesonotum together forming a convex gibbosity; metanotum convex, its basal portion slightly sloping forward, apical portion much longer and sloping backwards; legs short, stout, tibiae with calcaria pectinate; tibiae and tarsi with tarsal spurs.

**Abdomen:** Pedicel nodiform, single noded; petiolar node not elevated simply with an oval flat thickening in the middle; gaster very much produced at base, raised and gibbous, overhanging the pedicel conical posteriorly with an apical cloacal aperture.

**Plesiotype: Worker:** INDIA: Kerala, Muthenga, Karmaly. K.A., 7.x.1995. [DZCU].

**Other materials examined:** INDIA: Kerala, Aluva, Karmaly. K.A., 15.x.1995; 1W: INDIA: Kerala, Calicut University Campus, Karmaly. K.A., 6.iv.1995; 1W: INDIA: Kerala, Muthukulam, Sheela. S., 29.x.1995.

All specimens deposited in the Systematic Entomology Laboratory, Department of Zoology, Calicut University.

**Distribution:** India. [Kerala: Alapuzha, Ernakulam, Malappuram]; spread over the whole tropics of the Old World.

**Biology:** Unknown.

**Habitat:** Disturbed.

**Discussion:** *Technomyrmex albipes* [Smith] closely resembles *Technomyrmex bicolor* Emery in the following features : 1. Antennae 12 jointed; 2. The anterior margin of clypeus with a deep crescentic emargination; 3. Pedicel nodiform, single noded, petiolar node flat, oval. However *Technomyrmex albipes* [Smith] differs from *Technomyrmex bicolor* Emery in having: 1. Head cordate (in *Technomyrmex bicolor* head subcordate); 2. Thorax broad (in *Technomyrmex bicolor* thorax slender); 3. Pronotum and mesonotum together forming a convex gibbosity (in *Technomyrmex bicolor* pronotum and mesonotum together not forming a convex gibbosity).

**Remarks:** Current subspecies: nominal plus *bruncipes* Forel, *brunneus* Forel, *cedarensis* Forel, *cordiformis* Viehmeyer, *rotundiceps* Karavaiev, *turnicola* Weber, *wedda* Forel.

*Technomyrmex bicolor bicolor* Emery

(Figs. 133 - 135)

*Technomyrmex bicolor* Emery, 1893f *Ann. Soc. Ent. France.* 62: 249. SRI LANKA.

**Worker.** TL = 3.4 mm; HL = 0.81 mm; HW = 0.74 mm; CI = 91.35 mm; SL = 0.78 mm; SI = 105 mm; ED = 0.02 mm; PW = 0.43 mm; AL = 1.17 mm.

**Colour.** Mandibles, antennae, head, thorax, legs and pedicel pale brownish yellow, tarsi and trochanter of legs pale yellow, abdomen black; pubescence silky white; hairs very pale.

**Sculpture and Hair pattern:** Head, thorax and abdomen very closely, minutely reticulate punctate; a few scattered erect pale hairs on mandibles, anterior margin of head, coxa of legs and posterior region of abdominal segments.

**Head:** Subcordate, posteriorly broader than anteriorly, cheeks convex, occiput emarginate; mandibles triangular, smooth, masticatory margin almost equal to the outer margin, with a long apical tooth followed by numerous small acute teeth; clypeus broad, its anterior margin with a deep crescentic emargination, and provided with a number of long setae, posterior margin arched; frontal area short distinct; antennal carinae short, wide apart; antennae long, slender, 12 jointed; antennal scape extending beyond the head by 1/4 its length; all segments of funiculus longer than broad. Relative measurement of length of antennal segment : Scape = 0.78 mm; F<sub>1</sub> = 0.13 mm; F<sub>2</sub> = 0.12 mm; F<sub>3</sub> = 0.13 mm; F<sub>4</sub> = 0.1 mm; F<sub>5</sub> = 0.12 mm; F<sub>6</sub> = 0.1 mm; F<sub>7</sub> = 0.12 mm; F<sub>8</sub> = 0.1 mm; F<sub>9</sub> = 0.12 mm; F<sub>10</sub> = 0.1 mm; Club (F<sub>11</sub>) = 0.23 mm. Eyes proportionately large, round, lateral, placed in front of midline of head.

**Thorax:** Elongate, narrow; pronotum broad, a little convex; mesonotum convex but very narrow; metanotum truncate, pro-mesonotal suture distinct; meso-metanotal suture very deep; mesonotum obliquely sloping backwards; basal portion of metanotum short, sloping forwards, apex of metanotum much longer and sloping backwards; legs long; first and last tibial spurs pectinate, middle spur simple, tarsi spinose beneath, claws simple.

**Abdomen:** Pedicel nodiform, single noded, without a distinct elevated node; petiolar node flat, oval; gaster large, massive with four visible segments, first gastral segment larger than others, overhanging the pedicel, apical portion with a slit like opening.

**Plesiotype: Worker:** INDIA: Kerala, Aluva, Karmaly. K.A., 15.x.1995. [DZCU].

**Other materials examined:** 1W: With same data as that of plesiotype; 3W: INDIA: Kerala, Calicut University Campus, Sheela. S., 11.xiii.1991; 3W: INDIA: Kerala, Calicut University Campus, Sheela. S., 20.xii.1992; 3W: INDIA: Kerala, Anakampoyil, Pramod, 24.vi.1995; 1W: INDIA: Kerala, Muthukulam, Sheela. S., 29.x.1995.

All specimens deposited in the Systematic Entomology Laboratory, Department of Zoology, Calicut University

**Distribution:** India: [Kerala: Alapuzha, Malappuram, Calicut]; Sri Lanka.

**Biology:** Unknown.

**Habitat:** Disturbed.

**Discussion:** *Technomyrmex bicolor* Emery closely resembles *Technomyrmex elatior* Forel in the following features: 1. Head posteriorly broader than anteriorly;

2. Antennae 12 jointed; 3. First and last tibiae with pectinate spurs; 4. Pedicel nodiform without a proper elevated node. However *Technomyrmex bicolor* Emery differs from *Technomyrmex elatior* Forel in having : 1. The anterior margin of the clypeus with a deep crescentic emargination (in *Technomyrmex elatior* the anterior margin of the clypeus very slightly and widely emarginate).

**Remarks:** Current subspecies : nominal plus *antonii* Forel, *textor* Forel.

### *Technomyrmex elatior* Forel

(Figs. 136 - 138)

*Technomyrmex modiglianii* ♂. *elatior* Forel, 1902d *Ann. Soc. Ent. Belg.* 46: 293, INDIA.

*Technomyrmex elatior* Bingham, 1903 *Fauna. Brit. India, Hymenoptera* 2: 302.

**Worker:** TL = 2.3 mm; HL = 0.59 mm; HW = 0.62 mm; CI = 105 mm; SL = 0.62 mm; SI = 100 mm; ED = 0.2 mm; PW = 0.29 mm; AL = 0.94 mm.

**Colour:** Black; mandibles reddish brown; antennae dark brown; trochanter and tarsi of legs yellow; pubescence silky white, hairs very pale.

**Sculpture and Hair pattern:** Body smooth, but minutely closely reticulate, dull and subopaque, pedicel smooth, polished; pubescence dense on abdomen longer than that on head and thorax; pilosity very scarcely on head, thorax and abdomen.

**Head:** More or less cordate, posteriorly broader than anteriorly, cheeks convex, occiput emarginate, mandibles triangular, proportionately rather large, shining, masticatory margin very broad equal in length to outer margin, with a

large apical tooth followed by a number of small acute teeth; maxillary palpi six jointed; labial palpi three jointed; clypeus broad, convex, incised medially, its anterior margin slightly and widely emarginate with a row of long setae, posterior margin feebly distinct; frontal area indistinct; antennal carinae parallel, wide apart; torulus rounded, horizontal; antennal scrobe distinct, shallow; antennae slender, filiform, 12 jointed; antennal scape extending a little beyond the top of head; all segments of funiculus longer than broad. Relative measurement of length of antennal segment : Scape = 0.62 mm; F<sub>1</sub> = 0.11 mm; F<sub>2</sub> = 0.08 mm; F<sub>3</sub> = 0.06 mm; F<sub>4</sub> = 0.06 mm; F<sub>5</sub> = 0.07 mm; F<sub>6</sub> = 0.08 mm; F<sub>7</sub> = 0.08 mm; F<sub>8</sub> = 0.1 mm; F<sub>9</sub> = 0.08 mm; F<sub>10</sub> = 0.08 mm; Club (F<sub>11</sub>) = 0.2 mm. Eyes comparatively large, round, lateral, placed in front of midline of head.

**Thorax:** Elongate; pro and mesonotum convex, mesonotum obliquely sloping backwards; thorax emarginate at meso-metanotal suture; pro-meso and meso-metanotal sutures distinct; basal portion of metanotum short, horizontal, much shorter than the obliquely truncate apical portion; legs of moderate size, first and last tibiae with pectinate spurs, midtibiae with long simple spur; tarsi spinose beneath; claws simple.

**Abdomen:** Pedicel nodiform, single noded, without a proper elevated node, simply with an oval flat thickening in the middle; gaster massive with base very much produced, raised and gibbous, overhanging the pedicel, conical posteriorly with an apical transverse slit like anal orifice.

**Plesiotype: Worker.** INDIA: Kerala, Muthenga, Karmaly. K.A., 7.x.1995. [DZCU].

**Other materials examined:** 6W: with same data as that of plesiotype; 1W: INDIA: Kerala, Idukki, Sureshan. 17.i.1992; 1W: INDIA: Kerala, Muthukulam, Sheela. S., 12.iv.1992; 3W: INDIA: Kerala, Anakampoyil, Pramod, 24.iv.1995; 1W:

INDIA: Kerala, Manalikkad, Karmaly. K.A., 23.ix.1995; 1W: INDIA, Kerala, Aralam forest, Karmaly. K.A. 16.xii.1995.

All specimens deposited in the Systematic Entomology Laboratory, Department of Zoology, Calicut University

**Distribution:** INDIA: [Kerala: Alapuzha, Idukki, Thrissur, Calicut, Kannur], Assam; Upper Mianmar, Bhamo; Southern Shan States.

**Biology:** Unknown.

**Habitat:** Found in both disturbed and undisturbed area.

**Discussion:** *Technomyrmex elatior* Forel closely resembles *Technomyrmex bicolor* Emery in the following features: 1. Head posteriorly broader than anteriorly; 2. Antennae 12 jointed; 3. First and last tibiae with pectinate spurs; 4. Pedicel nodiform without a proper elevated node. However *Technomyrmex elatior* Forel differs from *Technomyrmex bicolor* Emery in having: 1. The anterior margin of the clypeus very slightly and widely emarginate (in *Technomyrmex bicolor* the anterior margin of the clypeus with a deep crescentic emargination).

**CHECKLIST OF THE SPECIES AND SUBSPECIES OF  
SOME GENERA OF FORMICIDAE OF INDIA**

**Subfamily FORMICINAE**

**Genus 1. ACROPYGA Roger, 1862**

1. *Acropyga acutiventris* Roger, 1862 - India, Kerala, Western India, Sri Lanka, Myanmar, Nicobars.

**Genus 2. ANOPLOLEPIS Santschi, 1914**

1. *Anoplolepis gracilipes* [Smith], 1857 - Throughout India, Lakshadweep  
[= *Anoplolepis longipes* [Jerdon] ], Islands, Port Blair, Andaman Islands  
1851

**Genus 3. CAMPONOTUS Mayr, 1861**

1. *Camponotus (Tanaemyrmex) aethiops cachmiriensis* Emery, 1925 - India, Kashmir.
2. *Camponotus (Tanaemyrmex) albosparsus* Bingham, 1903 - India; Singapore, Sumatra, Borneo.
3. *Camponotus (Dinomyrmex) angusticollis angusticollis* (Jerdon), 1851 - India, Kerala, Tamil Nadu, Western and Central India, Assam, West Bengal, Darjeeling, Himalaya, Nepal; Myanmar.
4. *Camponotus (Dinomyrmex) angusticollis sanguinolentus* Forel, 1895 - India.
5. *Camponotus (Myrmentoma) apoorvus* sp. nov. - India, Kerala.
6. *Camponotus (myrmoturba) arrogans* [Smith], 1858 - India, Bengal; Myanmar, Tenasserim, the Malay Peninsula.
7. *Camponotus [Dinomyrmex] ashokai* sp. nov. - India, Kerala.
8. *Camponotus (Myrmosphincta) auriventris* Emery, 1889 - India.

9. *Camponotus (Colobopsis) badius* [Smith] - India, Kerala, Karnataka, Mianmar, Sri Lanka, Malaca, Borneo, Singapore, Sumatra.
10. *Camponotus (Myrmoturba) barbatus barbatus* Roger, 1863 - India, Kerala; Philippines.
11. *Camponotus (Myrmoturba) barbatus taylori* Forel, 1892 - Throughout India, Kerala, N.W. Himalayas, Sikkim, Orissa, Poona, Nilgiris; Sri Lanka, Mianmar, the Shan States.
12. *Camponotus (Myrmotemnus) bighamii* Forel, 1894 - India, Kerala; Upper Mianmar, Mandalay, Tenasserim.
13. *Camponotus (Myrmoturba) buddhae* Forel, 1892 - India.
14. *Camponotus (Myrmosphincta) camelinus camelinus* Smith, 1857 - India, Sikkim; Mianmar, Tenasserim, Singapore, Sumatra, Malacca.
15. *Camponotus (Myrmosphincta) camelinus singularis* [Smith], 1858 - India; Mianmar.
16. *Camponotus (Dinomyrmex) carin carin* [Emery], 1889 - India, Kerala; Mianmar.
17. *Camponotus (Myrmosphincta) cinerascens* [Fabricius], 1787 - India; Philippines, Java.
18. *Camponotus (Tanaemyrmex) compressus* (Fabricius), 1787 - India, Kerala, Tamil Nadu, Assam, West Bengal, Nepal; Srilanka, Mianmar, Philippines, Borneo, Russia, Arabia, Africa.
19. *Camponotus (Myrmosphincta) confucii* Forel, 1894 - India, Western India, Kanara; Upper Mianmar, Tenasserim.
20. *Camponotus (Colobopsis) cotesii* Forel, 1893 - India, Assam.
21. *Camponotus (Myrmoturba) crassiquamis* Forel, 1902 - India, Assam; Upper Mianmar.
22. *Camponotus [Myrmoturba] dichrous* Andre, Forel, 1882 - India, Himalaya; Algeria.

23. *Camponotus (Myrmoscericus) dolendus* Forel, 1892 - India, Kerala, Karnataka, Tamil Nadu, Sikkim, N.W. Himalayas, West Bengal.
24. *Camponotus (Tanaemyrmex) exiguoguttatus* Forel, 1886 - India.
25. *Camponotus (Myrmoturba) festinus* [Smith], 1857 - India; Borneo, Java, China, Myanmar.
26. *Camponotus (Dinomyrmex) gigas* [Latreille], 1802 - India; The Malaya Peninsula, Borneo, Sumatra, South Tenasserim, Philippines.
27. *Camponotus (Myrmablys) gretae* Forel, 1902 - India; Singapore.
28. *Camponotus (Myrmosphincta) holosericeus* Emery, 1889 - India; Upper Myanmar, the Chin Hills, Tenasserim.
29. *Camponotus (Myrmoturba) invidus* Forel, 1892 - India, Kerala, Orissa.
30. *Camponotus (Myrmoturba) irritans irritans* [Smith], 1857 - India; Sri Lanka, West Malaysia.
31. *Camponotus (Myrmoturba) irritans pallidus* Smith, 1857 - India; Borneo.
32. *Camponotus (Camponotus) japonicus* Mayr, 1866 - India; Japan, Philippines, China.
33. *Camponotus (Tanaemyrmex) keralensis* sp. nov. - India, Kerala.
34. *Camponotus (Myrmoturba) lamarckii* Forel, 1892 - India, Kerala.
35. *Camponotus (Colobopsis) longi* Forel, 1892 - Northern India, Sikkim.
36. *Camponotus (Tanaemyrmex) luteus* [Smith], 1858 - Northern India; Myanmar, Java.
37. *Camponotus (Myrmoturba) marginata marginata* [Latreille], 1798 - India, N.W. Himalayas; Europe, North America, France.
38. *Camponotus (Myrmoturba) marginata himalayanus* Forel, 1893 - India.
39. *Camponotus (Myrmosphincta) megalonyx* Wheeler, 1895 - India, Borneo.
40. *Camponotus (Orthanotomyrmex) mendax mendax* Forel - India, Kerala.
41. *Camponotus (Myrmotarsus) misturus misturus* [Smith], 1857 - India; Tenasserim, Borneo.

42. *Camponotus (Myrmotarsus) misturus fornaronis* Forel, 1892 - India, Kerala.
43. *Camponotus (Myrmoturba) mitis* [Smith], 1858 - India, Kerala, Indo-Malaya region, New Guinea.
44. *Camponotus (Myrmothrix) nicobarensis nicobarensis* Mayr, 1865 - India, Kerala, Assam, Mianmar, Nicobaris, Cochin-China.
45. *Camponotus (Myrmamblys) nirvanae* Forel, 1893 - India.
46. *Camponotus (Myrmoturba) oblongus* [Smith], 1858 - India; Mianmar.
47. *Camponotus (Myrmosericus) parius* Emery, 1889 - Throughout India, Kerala, Assam; Mianmar, Sri Lanka.
48. *Camponotus (Colobopsis) phragmaticola* Donisthorpe, 1943 - India, Kerala, Travancore.
49. *Camponotus (Orthonotomyrmex) puniceps* Donisthorpe, 1942 - India.
50. *Camponotus (Myrmotrema) radiatus* Forel, 1892 - Western India, Kanara.
51. *Camponotus (Myrmotemnus) reticulatus reticulatus* Roger, 1863 - India, Sri Lanka.
52. *Camponotus (Myrmablys) reticulatus latitans* Forel, 1893 - India.
53. *Camponotus (Myrmablys) reticulatus yerburyi* Forel, 1893 - India, Sri Lanka.
54. *Camponotus (Colobopsis) rothneyi* Forel, 1893 - India, Hindustan; Japan, Singapore.
55. *Camponotus (Myrmosericus) rufoglaucus rufoglaucus* [Jerdon], 1851 - India, Kerala, Travancore, Delhi, Hyderabad, Assam; Sri Lanka, Upper Mianmar.
56. *Camponotus (Myrmosericus) rufoglaucus tenius* Forel, 1889 - India.
57. *Camponotus (Orthanotomyrmex) selene* (Emery), 1889 - India.
58. *Camponotus (Myrmentoma) sericeus sericeus* [Fabricius], 1798 - India, Kerala, Karnataka; Senegal.
59. *Camponotus (Orthanotomyrmex) sericeus opaciventris* Mayr, 1879 - India.
60. *Camponotus (Myrmoturba) siemsseni* Forel, 1901 - India, Kerala; Sumatra.

61. *Camponotus (Tanaemyrmex) sklarus* Donisthorpe, 1933 - India.
62. *Camponotus (Myrmophyma) socrates* Forel, 1904 - India.
63. *Camponotus (Colobosis) strictus* [Jerdon], 1851 - India, Kerala, Malabar.
64. *Camponotus (Tanaemyrmex) sylvaticus basalis* Smith, 1878 - India.
65. *Camponotus (Tanaemyrmex) sylvaticus paradichrous* Emery, 1925 - India.
66. *Camponotus (Tanaemyrmex) thraso* Forel, 1893 - India; Sri Lanka, Myanmar, Maymyo, Taunggyi, Southern Shan States.
67. *Camponotus timidus* [Jerdon], 1851 - India, Kerala, Malabar.
68. *Camponotus (Myrmotemnus) varians* Roger, 1863 - India, Kerala; Sri Lanka.
69. *Camponotus (Tanaemyrmex) variegatus variegatus* [Smith], 1858 - India, Kerala; Sri Lanka, Upper Myanmar, the Shan States, Maymyo.
70. *Camponotus (Tanaemyrmex) variegatus fuscithorax* Dalla Torre, 1893 - India.
71. *Camponotus (Tanaemyrmex) variegatus infuscus* Forel, 1892 - India.
72. *Camponotus (Tanaemyrmex) variegatus kattensis* Bingham, 1903 - India, Himalayas.
73. *Camponotus (Tanaemyrmex) variegatus somificus* Forel, 1902 - India.
74. *Camponotus (Myrmentoma) varius* Donisthorpe, 1943 - Southern India.
75. *Camponotus velox* [Jerdon], 1851 - India, Kerala, Malabar.
76. *Camponotus (Myrmepomis) wasmani* Emery, 1893 - India.
77. *Camponotus (Myrmentoma) wroughtonii* Forel, 1893 - India, Himalayas; Upper Myanmar.

#### Genus 4. *LEPISIOTA* Santschi, 1926

1. *Lepisiota annaudalei* [Mukerjee], 1930 - India.
2. *Lepisiota anupama* sp. nov. - India, Kerala.
3. *Lepisiota capensis capensis* [Mayr], 1862 - India, Kerala, Himalaya, Poona; South Africa.

4. *Lepisiota capensis simplex* [Forel], 1892 - India, Hindustan; Africa, Rodesia, Somalia.
5. *Lepisiota fergusonii* [Forel], 1895 - India, Kerala.
6. *Lepisiota frauenfeldi frauenfeldi* [Mayr], 1855 - India, Barrackpore.
7. *Lepisiota frauenfeldi integra* [Forel], 1894 - India.
8. *Lepisiota malabarensis* sp. nov. - India, Kerala.
9. *Lepisiota modesta* [Forel], 1894 - India, Mussoorie.
10. *Lepisiota munnarensis* sp. nov. - India, Kerala, Munnar.
11. *Lepisiota opaca opaca* [Forel], 1892 - India, Kerala, Kanara.
12. *Lepisiota opaca pulchella* [Forel], 1892 - India, Kerala, Poona.
13. *Lepisiota rotheneyi rothneyi* [Forel], 1894 - India, Kerala.
14. *Lepisiota rothneyi wroughtonii* [Forel], 1902 - India.
15. *Lepisiota serecia* [Forel], 1892 - India, Hindustan.

#### Genus 5. OECOPHYLLA Smith, 1860

1. *Oecophylla smaragdina* [Fabricius], 1875 - India, New Britain, China, Java.

#### Genus 6. POLYRHACHIS Smith, 1857

1. *Polyrhachis (Hemioptic) aculeata aculeata* Mayr, 1879 - India.
2. *Polyrhachis (Hemioptic) aculeata gibbosa* Forel, 1908 - India; Sri Lanka.
3. *Polyrhachis (Myrmhopla) aedipus* Forel, 1893 - India; Sri Lanka.
4. *Polyrhachis (Myrmhopla) arachne* Emery, 1896 - India; Java, Upper Mianmar, the Ruby Mines, Shan states, Tenasserim, Karen Hills.
5. *Polyrhachis (Myrmhopla) armata* [Le Guillou], 1842 - India, Assam; Mianmar, Tenasserim, Borneo, Java, Philippines, Sumatra, Cochin-China.
6. *Polyrhachis bellicosa* Smith, 1859 - India; Indonesia, Mergui Forest, Singapore, Sumatra, Borneo, Java, Malacca, New Guinea, Philippines, New Britain, Oceanica, Waigeu.

7. *Polyrhachis (Myrmhopla) bicolor* Smith, 1858 - India, Bengal; Mianmar, Philippines, Molucca.
8. *Polyrhachis bihamata* [Drury], 1773 - India; Lower Mianmar, Pegu Yoma, Johanna Island, Tenasserim, Malay Peninsula, Sumatra, Borneo, Java, Madagascar, Philippines, Nais Islands.
9. *Polyrhachis (Myrmhopla) binghamii* Forel, 1893 - India; Mianmar.
10. *Polyrhachis (Myrmhopla) chalybea* Smith, 1857 - India; Singapore, Tenasserim, Malacca, Borneo.
11. *Polyrhachis (Myrma) convexa* Roger, 1863 - India; Sri Lanka, Kandy, Jaffna, Colombo.
12. *Polyrhachis (Pseudocryptomyrma) craddocki* Bingham, 1903 - India; Mianmar, Shan States.
13. *Polyrhachis (Myrmhopla) dives dives* Smith, 1857 - India; Mianmar, Tenasserim, Sri Lanka, Singapore, China, Japan, Siam, the Malayan Peninsula, Philippines, Molucca, Java.
14. *Polyrhachis (Myrmhopla) dives belli* Forel, 1912 - India, Kanara; Sri Lanka.
15. *Polyrhachis (Campomyrma) exercita exercita* [Walker], 1859 - India, Bengal, Western India, Travancore, Sri Lanka.
16. *Polyrhachis (Campomyrma) exercita lucideventris* Forel, 1907 - India.
17. *Polyrhachis (Campomyrma) exercita obtusisquama* Forel, 1902 - India.
18. *Polyrhachis (Campomyrma) exercita rastrata* Emery, 1889 - India; Tenasserim.
19. *Polyrhachis (Myrmhopla) fortis* Emery, 1893 - India; Mianmar.
20. *Polyrhachis (Myrmothrinax) frauenfeldi* Mayr, 1862 - India; Java, Sri Lanka.
21. *Polyrhachis (Myrmhopla) furcata* Smith, 1858 - India, Assam; Mianmar, Tenasserim, Indo-China, Borneo.
22. *Polyrhachis (Myrmhopla) gracilior* Forel, 1893 - India, Kerala, Travancore, Assam.

23. *Polyrhachis (Campomyrma) halidayi* Emery, 1889 - India; Mianmar, Tenasserim.
24. *Polyrhachis (Campomyrma) hauxwelli* Bingham, 1903 - India; Mianmar, Tenasserim, Taoo Plateau.
25. *Polyrhachis (Myrmhopla) hector* Smith, 1857 - India; Mianmar, Tenasserim, Sumatra, Singapore, Celebes.
26. *Polyrhachis (Myrma) hemiopticoides* Mukerjee, 1930 - India.
27. *Polyrhachis (Myrmhopla) hippomanes ceylonensis* Emery, 1893 - India; Sri Lanka.
28. *Polyrhachis (Myrmhopla) hodgsoni* Forel, 1902 - India; Tenasserim, Moulmein, Papun, Mianmar.
29. *Polyrhachis (Myrma) horni* Emery, 1901 - India; Sri Lanka, Nalanda.
30. *Polyrhachis (Myrma) illaudata illaudata* Walker, 1859 - India, Kerala, Travancore, Bengal; Sikkim, Kanara, Sri Lanka, Mianmar, Tenasserim, Malayan Subregion.
31. *Polyrhachis (Myrma) illaudata intermedia* Forel, 1886 - India, Kerala, Assam; Mianmar, Myitkyina, Bhamo, Ruby mines.
32. *Polyrhachis (Myrmhopla) indicans* (Jerdon), 1851 - India, Kerala, Malabar.
33. *Polyrhachis (Myrmhopla) jerdonii* Forel, 1892 - India, Sri Lanka.
34. *Polyrhachis (Myrmhopla) lacteipennis* Smith, 1858 - India, Kerala; Mianmar, Sri Lanka.
35. *Polyrhachis (Myrmhopla) lacteipennis obsoleta* Forel, 1893 - India, Poona.
36. *Polyrhachis (Myrmhopla) laevigata* Smith, 1857 - India; Mianmar, Pegu Yoma, Tenasserim, Malacca.
37. *Polyrhachis (Cryatomyrma) laevisissima laevisissima* Smith, 1879 - India, Bengal, Orissa, Assam, Singapore, Mianmar, Borneo.
38. *Polyrhachis (Cryatomyrma) laevisissima dichroa* Forel, 1893 - India, Assam.
39. *Polyrhachis [Cryatomyrma] malabarensis* sp. nov. - India, Kerala.

40. *Polyrhachis (Myrmhopla) menelas* Forel, 1904 - India
41. *Polyrhachis (Myrma) proxima proxima* Roger, 1863 - India; Indonesia.
42. *Polyrhachis (Myrma) pubescens* Mayr, 1879 - India; Mianmar, Philippines.
43. *Polyrhachis (Myrma) punctillata punctillata* Roger, 1863 - India, Kerala;  
Sri Lanka.
44. *Polyrhachis (Myrma) punctillata fergusonii* Forel, 1902 - India, Kerala.
45. *Polyrhachis (Myrma) punctillata smythiesii* Forel, 1895 - India.
46. *Polyrhachis (Crytomyrma) rastellata rastellata* [Latreille], 1802 - India, Kerala;  
Indonesia, Sumatra.
47. *Polyrhachis (Crytomyrma) rastellata pagana* Santschi, 1928 - India, Kerala.
48. *Polyrhachis (Myrmhopla) rufipes* Smith, 1858 - India, Tenasserim, Borneo.
49. *Polyrhachis (Myrmhopla) rupicapra* Roger, 1863 - India, Sri Lanka.
50. *Polyrhachis (Myrma) striatorugosa* Mayr, 1862 - India; Mianmar, Java.
51. *Polyrhachis (Myrma) striata striata* Mayr, 1862 - India; Sumatra, Indo-China,  
Java, Borneo, Malacca, Nais Is.
52. *Polyrhachis (Myrma) striata assamensis* Forel, 1902 - India, Assam; Java,  
Singapore, Philippines.
53. *Polyrhachis (Myrma) sumatrensis hamulata* Emery, 1887 - India, Assam;  
Mianmar, Tenasserim, Celebes, Sulawesi.
54. *Polyrhachis (Myrmhopla) sylvicola* [Jerdon], 1851 - India, Kerala, Malabar.
55. *Polyrhachis (Myrmhopla) thompsoni* Bingham, 1903 - India; Mianmar.
56. *Polyrhachis (Myrmothrinax) thrinax thrinax* Roger, 1863 - India, Kerala;  
Sri Lanka, Mianmar, Java.
57. *Polyrhachis (Myrmothrinax) thrinax lancearia* Forel, 1893 - India.
58. *Polyrhachis (Myrmhopla) tibialis tibialis* Smith, 1858 - India, Kerala; Mianmar,  
Borneo, Celebes.
59. *Polyrhachis (Myrmhopla) tibialis parsis* Emery, 1900 - India; Singapore,  
Celebes.

60. *Polyrhachis [Myrma] travencoricus* sp. nov. – India, Kerala.
61. *Polyrhachis (Myrmhopla) tubericeps* Forel, 1893 – India; Bengal, Barrackpore.
62. *Polyrhachis (Myrmhopla) venus* Forel, 1893 – India; Mianmar.
63. *Polyrhachis (Myrmhopla) vicina* Roger, 1863 – India, Borneo, Mianmar.
64. *Polyrhachis (Myrmhopla) wroughtonii* Forel, 1894 – India, Kerala, Kanara.
65. *Polyrhachis (Myrma) yerburyi* Forel, 1893 – India; Sri Lanka.
66. *Polyrhachis ypsilon* Emery, 1857 – India; Singapore.

### Subfamily 2: CERAPACHYINAE

#### Genus CERAPACHYS Smith, 1857

1. *Cerapachys longitarsus* [Mayr], 1879 – India.

### Subfamily 3: DOLICHODERINAE

#### Genus 1. DOLICHODERUS Lund., 1831

1. *Dolichoderus (Hypoclinea) affinis affinis* Emery, 1889 – India; Mianmar.
2. *Dolichoderus [Hypoclinea] affinis glabripes* Forel, 1879 – India.
3. *Dolichoderus (Hypoclinea) bituberculatus* [Mayr], 1862 – India; Philippines.
4. *Dolichoderus (Hypoclinea) burmanicus* Bingham, 1889 – India; Mianmar.
5. *Dolichoderus (Hypoclinea) feae feae* Emery, 1889 – India; Mianmar.
6. *Dolichoderus (Hypoclinea) feae fuscus* Emery, 1889 – India; Mianmar.
7. *Dolichoderus (Hypoclinea) moggridgei moggridgei* Forel, 1886 – India.
8. *Dolichoderus (Hypoclinea) moggridgei bicolor* Santschi, 1920 – India.
9. *Dolichoderus (Hypoclinea) moggridgei lugubris* Santschi, 1920 – India.
10. *Dolichoderus (Hypoclinea) sulcaticeps* [Mayr], 1870 – India, Borneo.

11. *Dolichoderus (Hypoclinea) taprobanae taprobanae* [Smith], 1858 - India; Sri Lanka.
12. *Dolichoderus (Hypoclinea) taprobanae graceilipes* [Mayr], 1879 - India.

### Genus 2. TAPINOMA Förster

1. *Tapinoma annaudalei* [Wheeler], 1928 - India.
2. *Tapinoma indicum indicum* Forel, 1895 - Western India, Kerala
3. *Tapinoma luffae* [Kurian], 1955 - India.
4. *Tapinoma melanocephalum melanocephalum* [Fabricius], 1793 - India, Kerala.
5. *Tapinoma wroughtonii* Forel, 1904 - India.

### Genus 3. TECHNOMYRMEX Mayr.

1. *Technomyrmex albipes albipes* [Smith], 1861 - India, Kerala.
2. *Technomyrmex albipes brunncipes* Forel, 1895 - India.
3. *Technomyrmex albipes brunneus* Forel, 1895 - India, Kerala; Sikkim, Mianmar.
4. *Technomyrmex bicolor bicolor* Emery, 1893 - India; Sri Lanka.
5. *Technomyrmex elatior* Forel, 1902 - India, Kerala, Assam; Upper Mianmar  
Bhamo, Southern Shan States.
6. *Technomyrmex incisus* [Mukerjee], 1930 - India.

## SUMMARY

This present systematic work deals with the study of three subfamilies of Formicidae viz. Formicinae, Cerapachyinae and Dolichoderinae. The work reveals the diversity exhibited by these subfamilies in Kerala. Under these subfamilies sixty one species and thirty three subspecies have been presented along with the formerly known fourteen species from Kerala. Hence the thesis altogether contains the descriptions of sixty three species and thirty two subspecies including eight new species. The following table illustrates the total number of species and subspecies in each genera reported from Kerala and number of new species under each of them.

Subfamilies	Genera	No. of known species	No. of known subspecies	No. of New species
Formicinae	1. <i>Acropyga</i>	1	--	--
	2. <i>Anoplolepis</i>	1	--	--
	3. <i>Camponotus</i>	29	14	3
	4. <i>Lepisiota</i>	7	4	3
	5. <i>Oecophylla</i>	1	--	--
	6. <i>Polyrhachis</i>	16	10	2
Cerapachyinae	1. <i>Cerapachys</i>	1	--	--
Dolichoderinae	1. <i>Dolichoderus</i>	2	--	--
	2. <i>Tapinoma</i>	2	2	--
	3. <i>Technomyrmex</i>	3	2	--

A brief outline of taxa studied is given below.

### Subfamily Formicinae

Tribe	-	Plagiolepidini
Genus	-	<i>Acropyga</i> Roger
Species	-	1
Tribe	-	Plagiolepidini
Genus	-	<i>Anoplolepis santschi</i>
Species	-	1
Tribe	-	Camponotini
Genus	-	<i>Camponotus</i> Mayr
Species	-	29
Subspecies	-	14
Tribe	-	Plagiolepidini
Genus	-	<i>Lepisiota</i> Santschi
Species	-	7
Subspecies	-	4
Tribe	-	Oecophyllini
Genus	-	<i>Oecophylla</i> F. Smith
Species	-	1
Tribe	-	Camponotini
Genus	-	<i>Polyrhachis</i> F. Smith
Species	-	16
Subspecies	-	10
Tribe	-	Cerapachyini
Genus	-	<i>Cerapachys</i>
Species	-	1

Tribe	-	Dolichoderini
Genus	-	<i>Dolichoderus</i>
Species	-	2
Tribe	-	Tapinomini
Genus	-	<i>Tapinoma</i>
Species	-	2
Subspecies	-	2
Tribe	-	Technomyrmini
Genus	-	<i>Technomyrmex</i>
Species	-	3
Subspecies	-	2

Poorly described species are redescribed and illustrations of all available species are included. All known synonyms and complete relevant literature are also included. For describing and redescribing various taxa, the latest style and classification of the recent myrmecologists are followed.



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## **Plates and Figures**

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Plate I

**Collection Locality  
Vithura,  
Thiruvananthapuram.**



Plate II

**Collection Locality  
Vettukad  
Thiruvananthapuram**



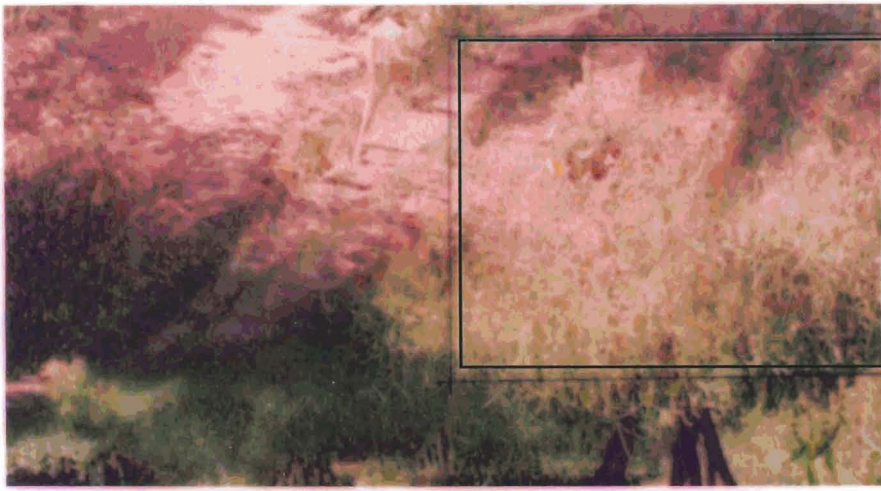
Plate III

**Collection Locality  
Vithura  
Thiruvananthapuram**



Plate IV

**Collection Locality  
Vithura  
Thiruvananthapuram**



**V**

**Collection Locality  
Aluva**



**VI**

**Collection Locality  
Vithura  
Thiruvananthapuram**



**VII**

**Collection Locality  
Kareekad  
Ernakulam**



**VIII**

**Collection Locality  
Kalamasshery  
Ernakulam**

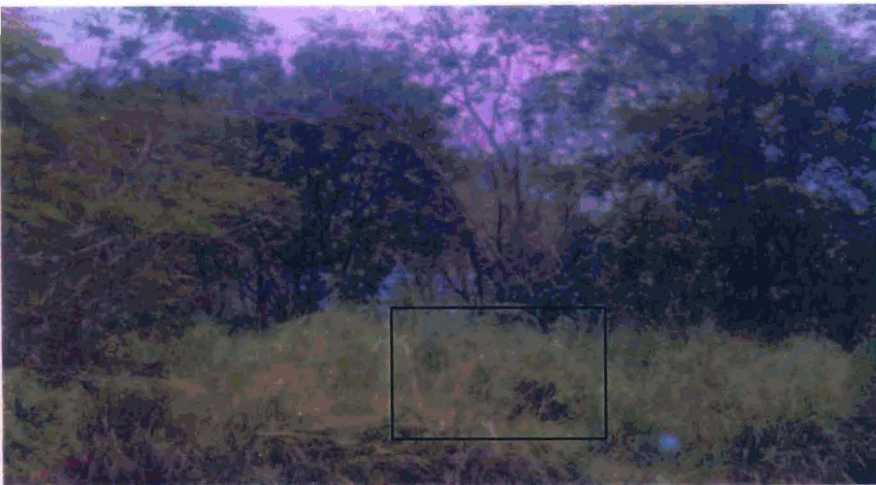


Plate IX

**Collection Locality  
Thrissur  
(Vellanikkara)**



Plate X

**Collection Locality  
Kodungalloor  
Manalikkad**



Plate XI

**Collection Locality  
Palakkad, Kottekkad**



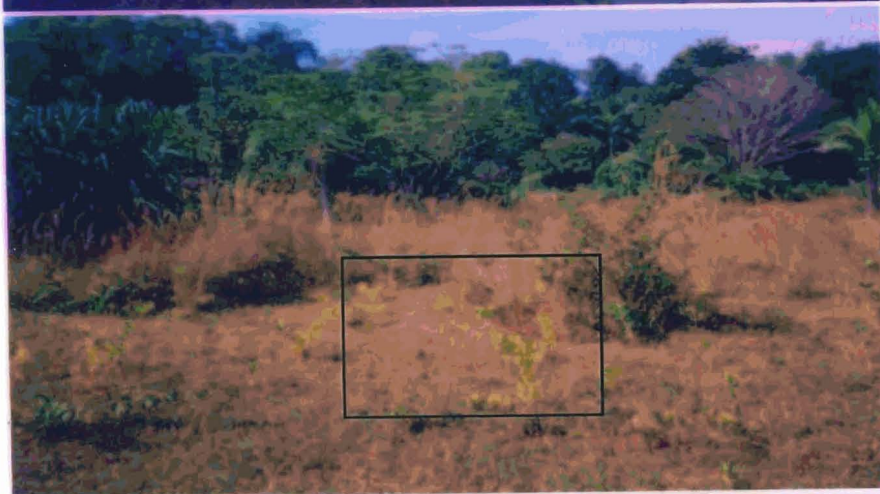
Plate XII

**Collection Locality  
Parambikulam**



**XIII**

**Collection Locality  
Silent Valley**



**XIV**

**Collection Locality  
Calicut University  
Botanical garden**



**XV**

**Collection Locality  
Kohinoor**



**XVI**

**Collection Locality  
Devagiri, Calicut**



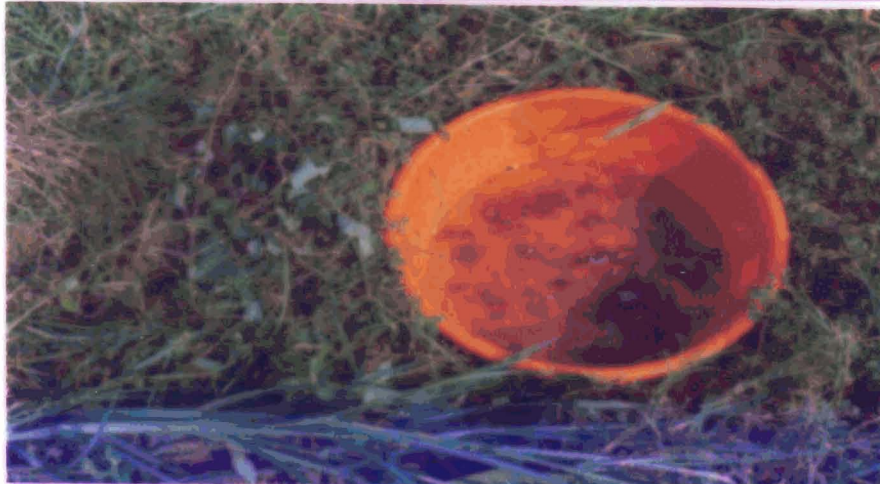
**Plate XVII**

**Collection Locality  
Cherkala, Kasaragode**



**Plate XVIII**

**Collecting ants  
with brush**



**Plate XIX**

**Pit-fall trap**



**Plate XX**

**Nest of *Camponotus  
siemsseni* Forel**



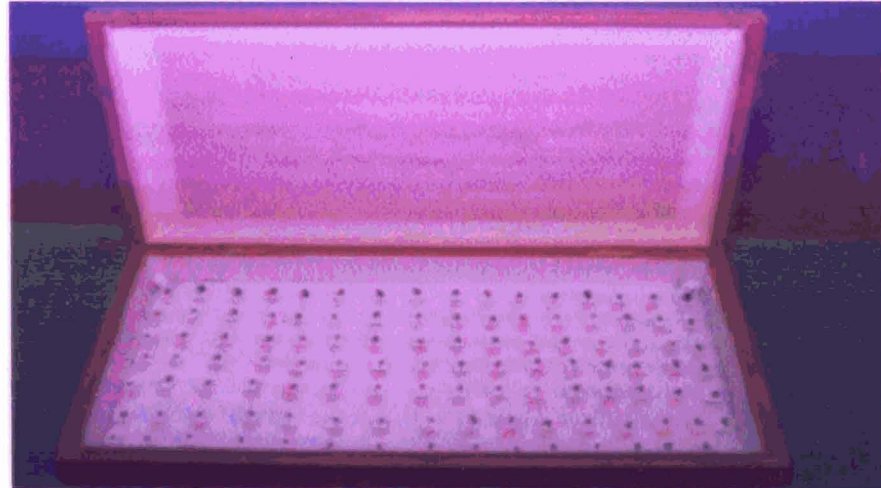
**Plate XXI**

**Nest of *Oecophylla smaragdina* (Fabricius)**



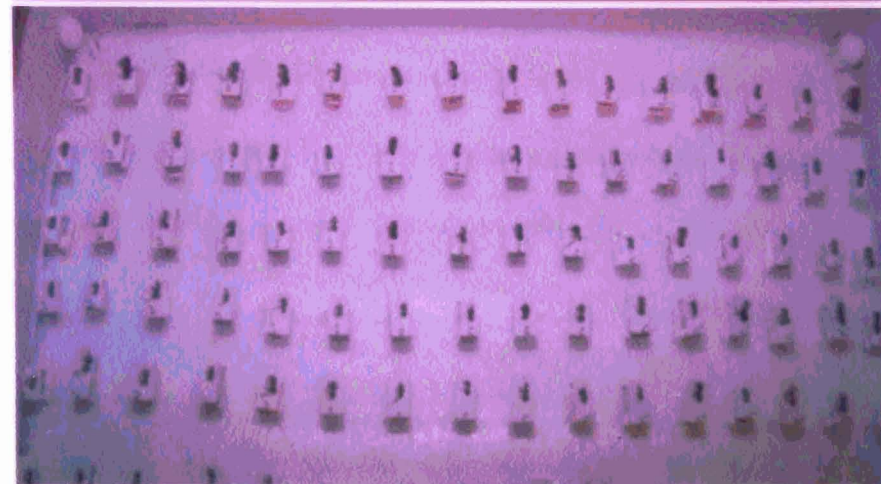
**Plate XXII**

**Nest of *Oecophylla smaragdina* (Fabricius)**



**Plate XXIII**

**Ants arranged in  
Insect Box**



**Plate XXIV**

**Ants arranged in  
Insect Box**

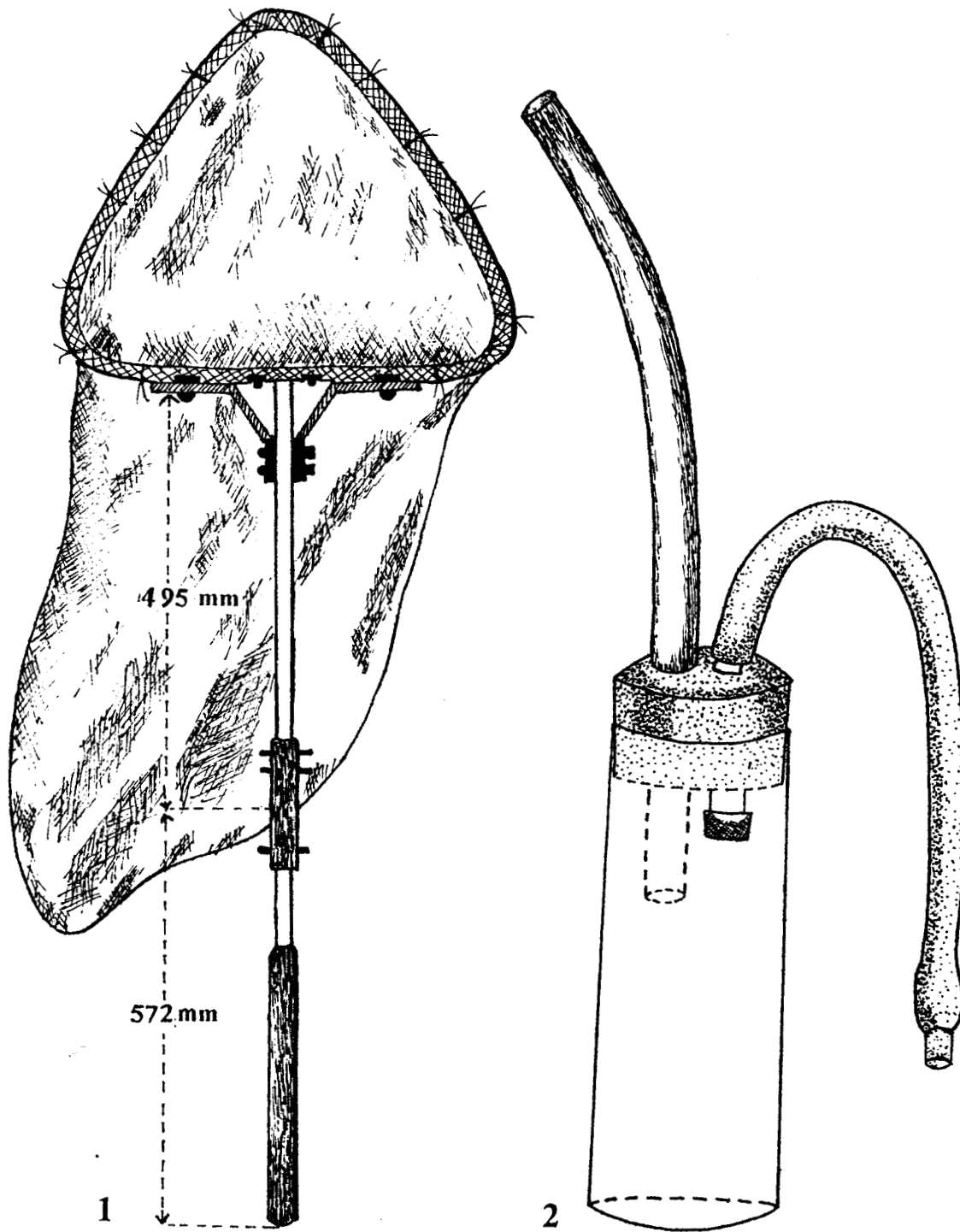


Fig. 1 Sweep net

Fig. 2 Aspirator

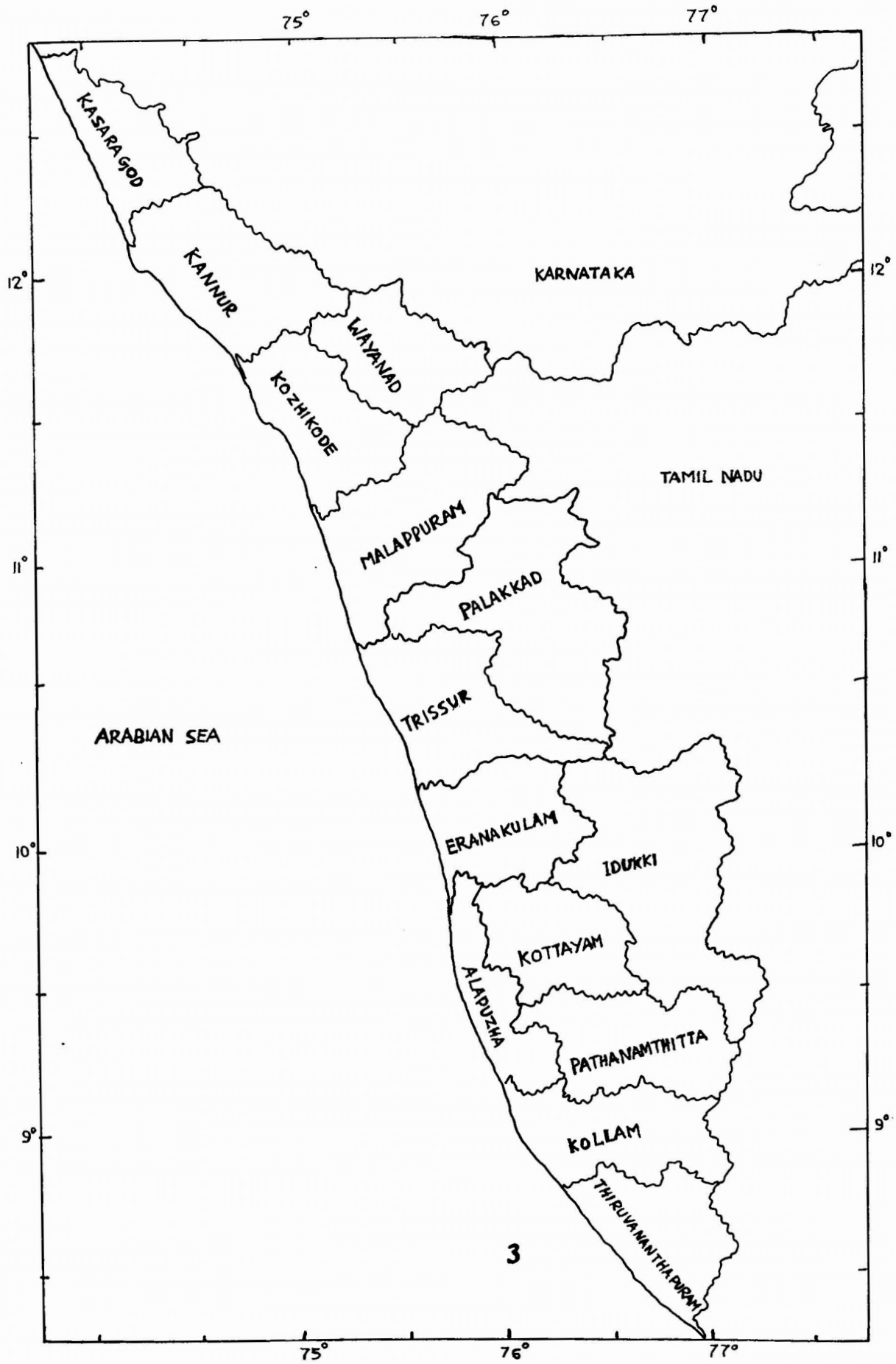


Fig. 3 Kerala Districts

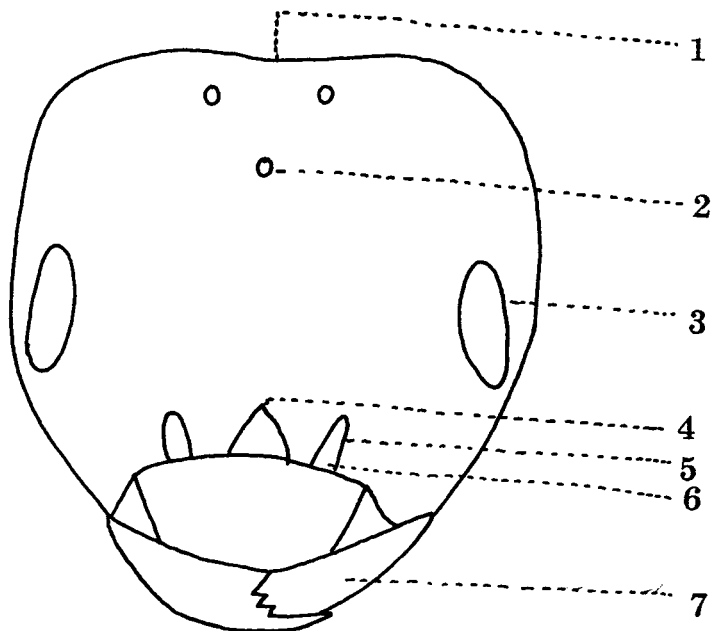
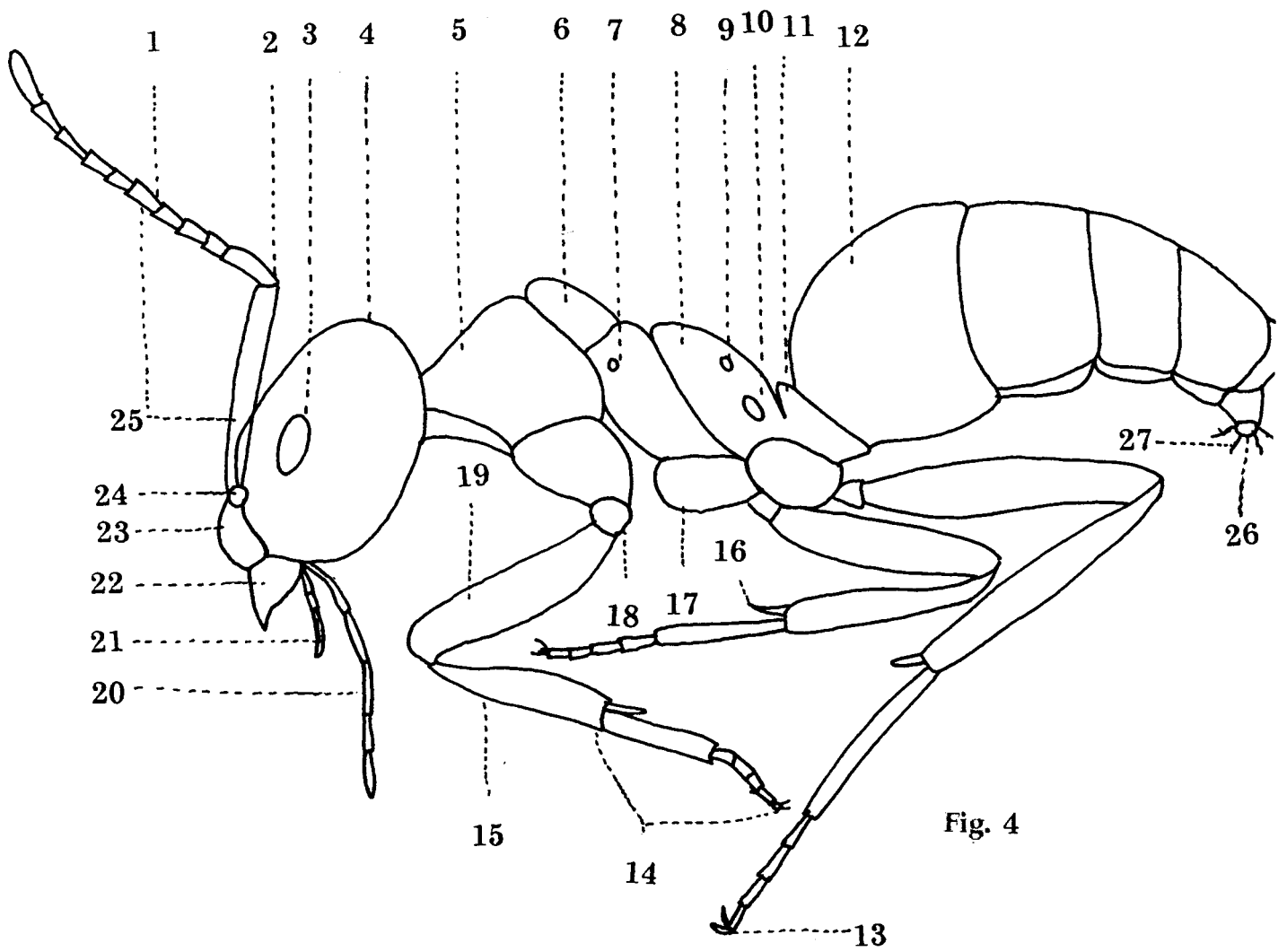
**Figs. 4-5. General diagrams**

**4. Body profile**

1. Flagellum
2. Scape
3. Eye
4. Occiput
5. Pronotum
6. Mesonotum
7. Metathoracic spiracle
8. Propodeum
9. Propodeal spiracle
10. Orifice
11. Petiole
12. Gaster
13. Tarsal claw
14. Tarsus
15. Tibia
16. Tibial spine
17. Coxa
18. Trochanter
19. Femur
20. Maxillary palp
21. Labial palp
22. Mandible
23. Clypeus
24. Antennal fossa
25. Antenna
26. Apical opening
27. Guard hairs

**5. Head in front view**

1. Vertex
2. Ocellus
3. Eye
4. Clypeus
5. Antennal socket
6. Torulus
7. Mandible



- Figs. 6 & 7.      Petiole spines**
- 6.    *Polyrhachis bighamata* Drury
  - 7.    *Polyrhachis ypsilon* Emery
- Figs. 8 & 9.      Petiole and post petiole with abdomen**
- 8.    Dorylinae, Worker
  - 9.    Ponerinae, Worker
- Figs. 10 & 11.    Pronotal spines**
- 10.   *Polyrhachis bighamata* Drury
  - 11.   *Polyrhachis bellicosa* Smith
- Figs. 12 - 14.    Metanotal spines**
- 12.   *Polyrhachis furcata* Smith
  - 13.   *Polyrhachis arachne* Emery
  - 14.   *Polyrhachis venus* Forel
- Figs. 15 & 16.    Head : front view**
- 15.   *Polyrhachis tubericeps* Forel
  - 16.   *Polyrhachis thompsoni* Bingham
- Fig. 17.          Petiole**
- Polyrhachis hauxwelli* Bingham
- Fig. 18.          Thorax**
- Polyrhachis laevissima* Smith

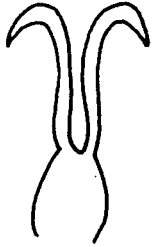
[Figs. 6-18 [except 11] Modified from Bingham, 1903. Fig. 11 modified from Kohout, 1994].

M

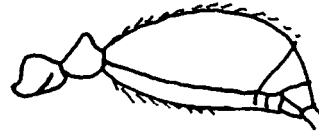
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8



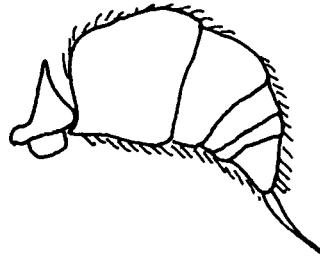
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11



9



12



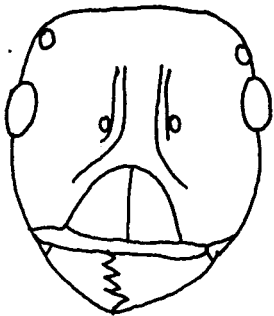
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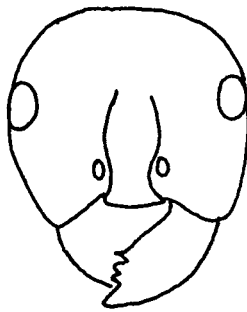
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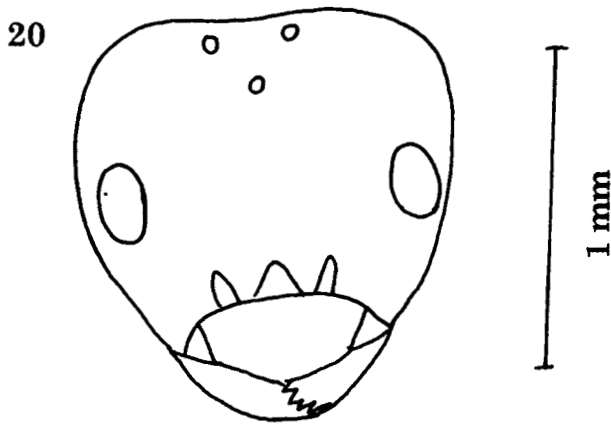
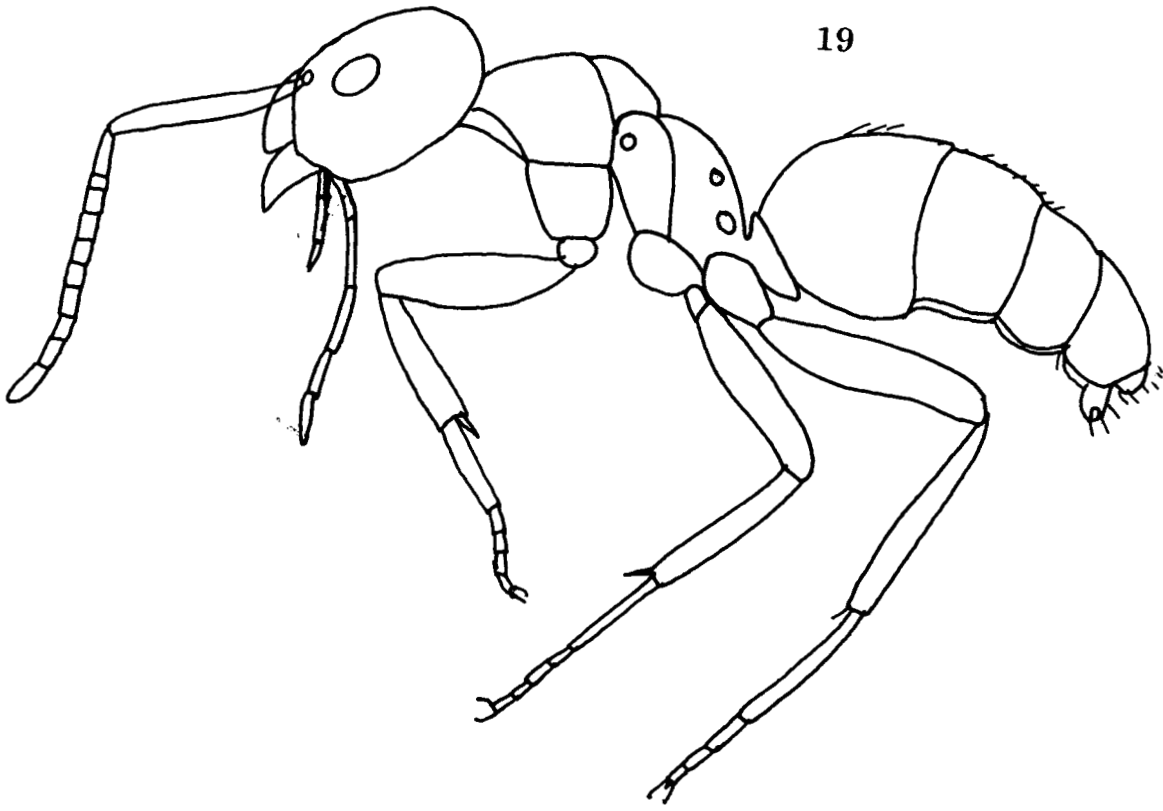
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18



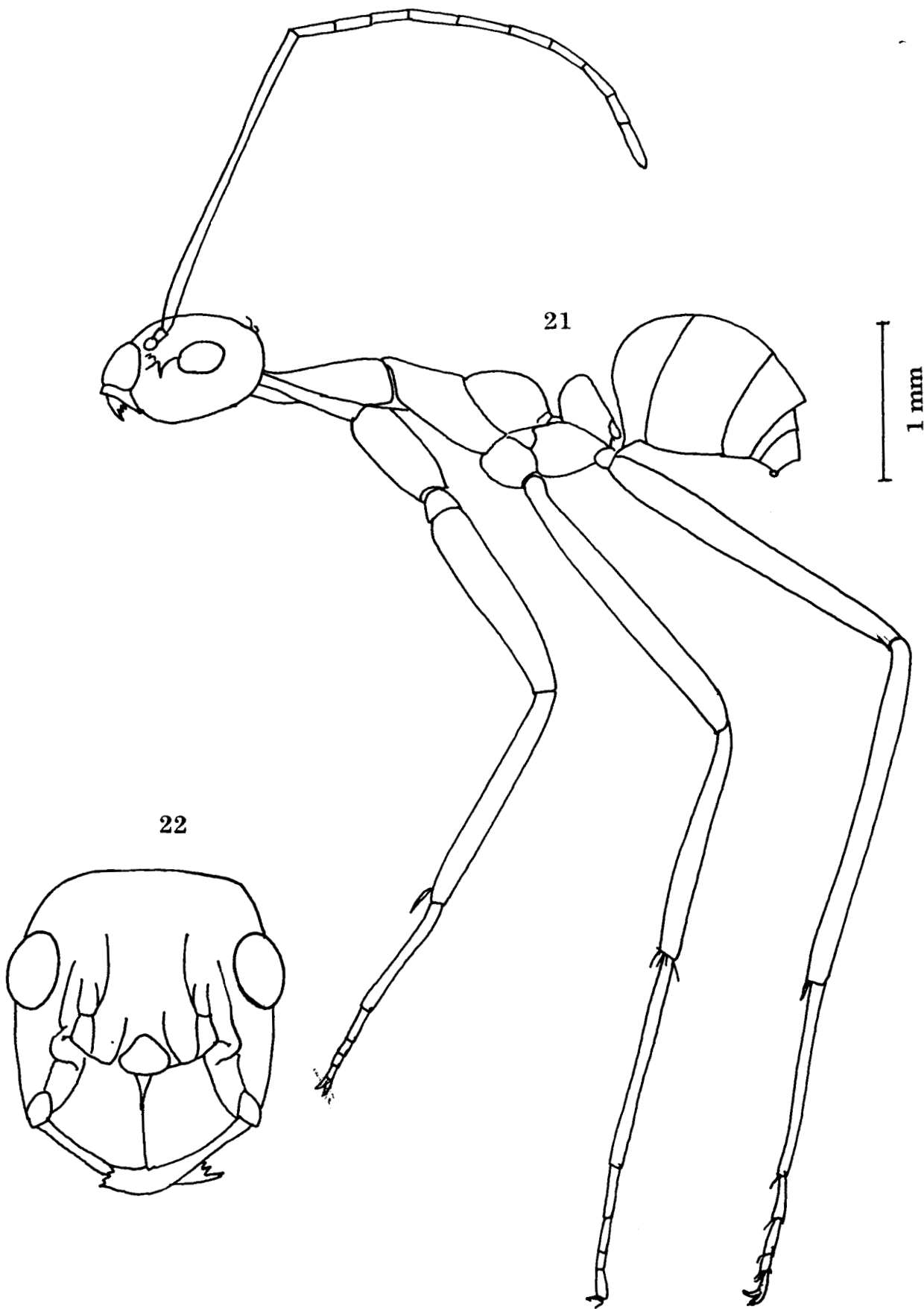
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Figs. 19 - 20. *Acropyga acutiventris* Roger

19. Body profile

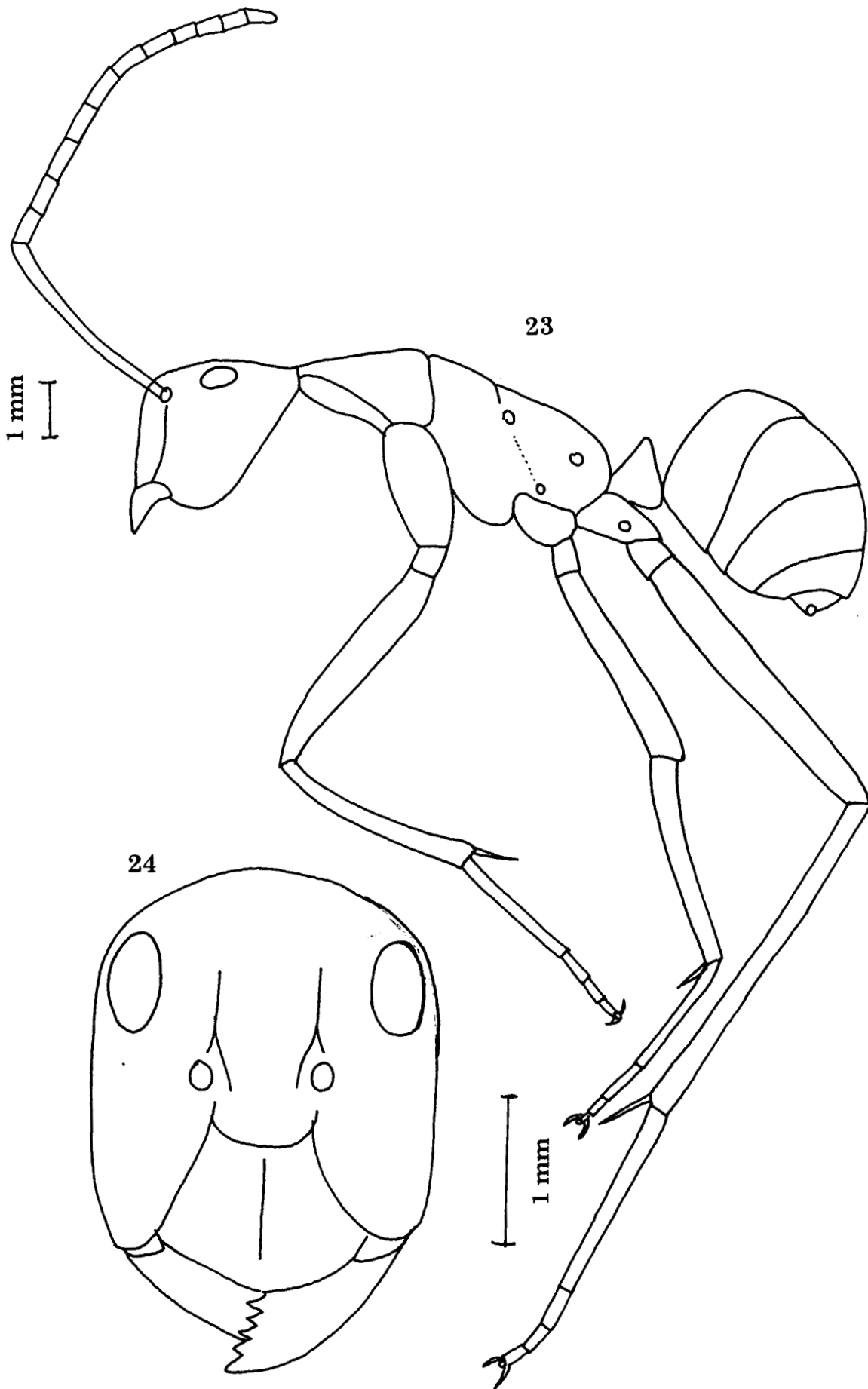
20. Head front view



Figs. 21 - 22. *Anoplolepis gracilipes* (Smith)

- 21. Body profile
- 22. Head front view.

P



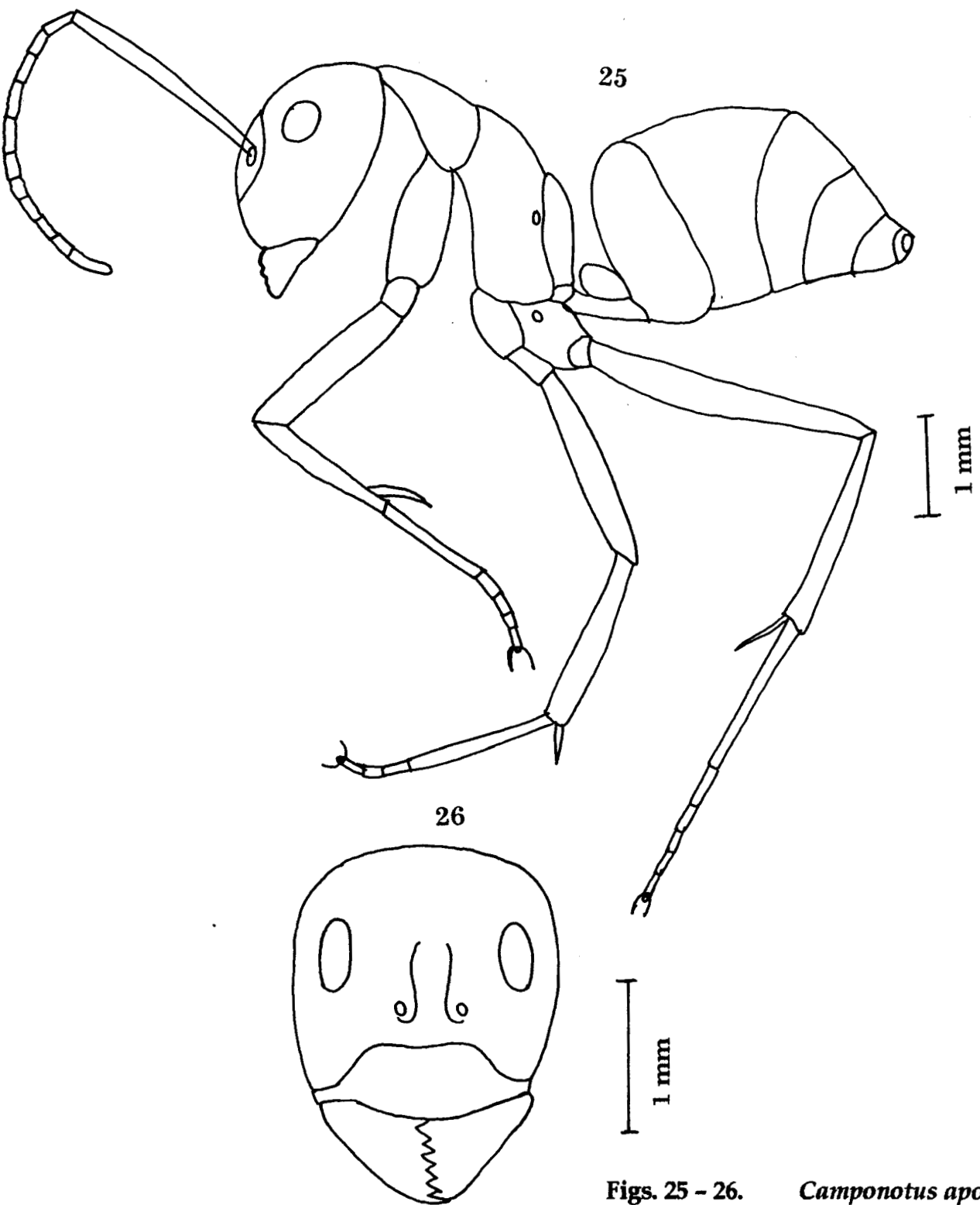
Figs. 23 - 24.

*Camponotus angusticollis angusticollis* [Jerdon]

23. Body profile

24. Head front view

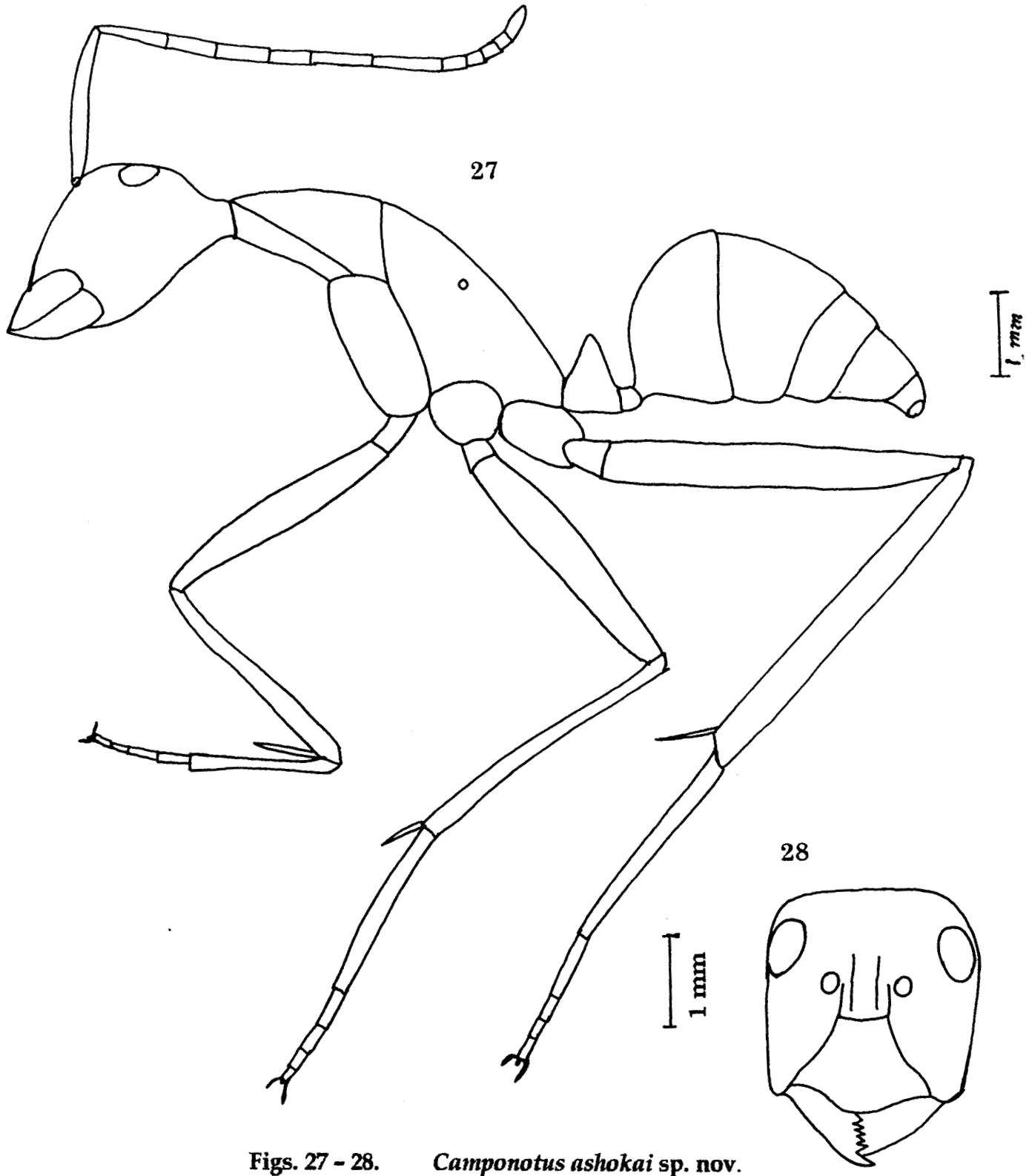
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Figs. 25 - 26. *Camponotus apoorvus* sp. nov.

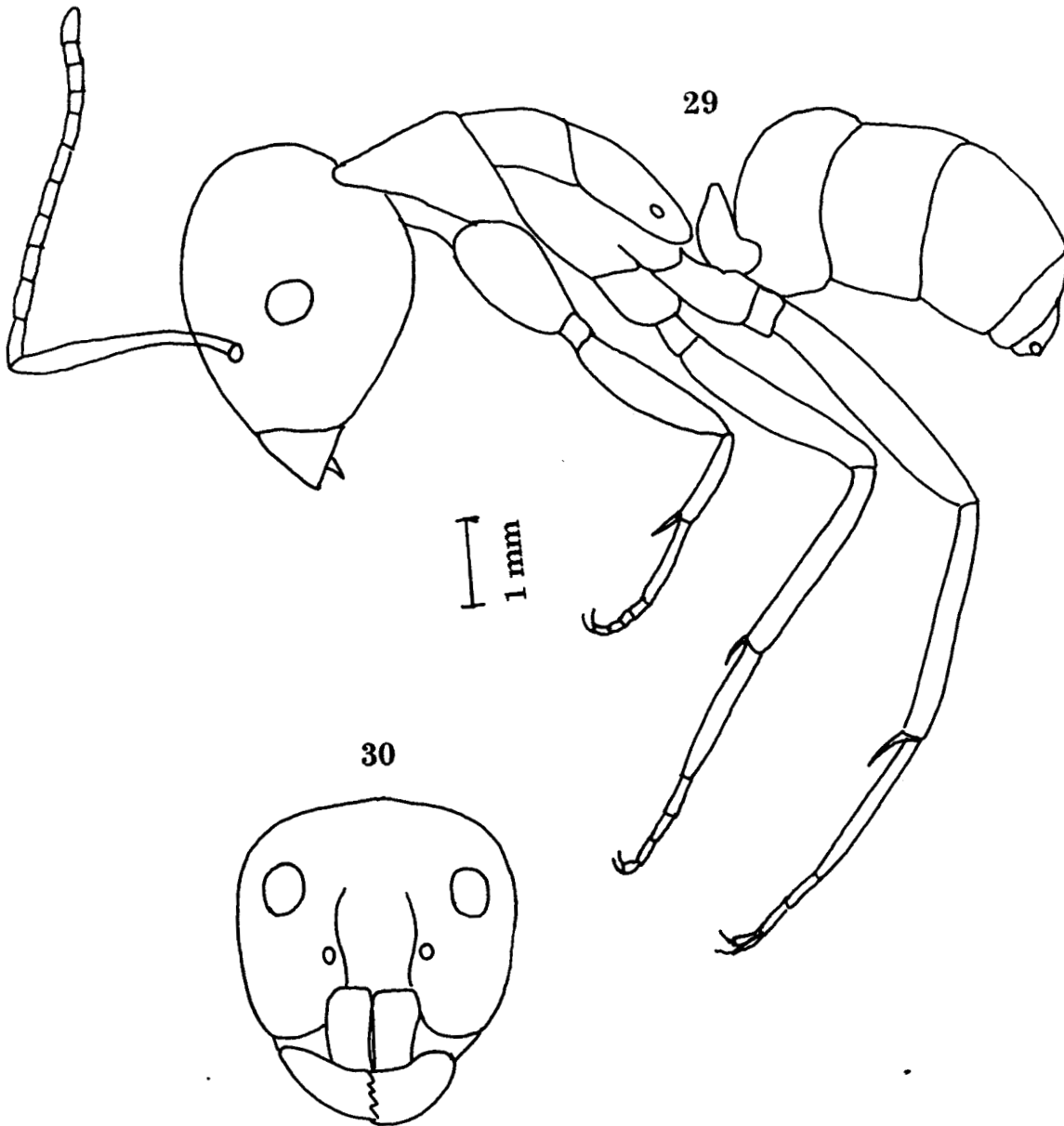
- 25. Body profile
- 26. Head front view

R



Figs. 27 - 28. *Camponotus ashokai* sp. nov.

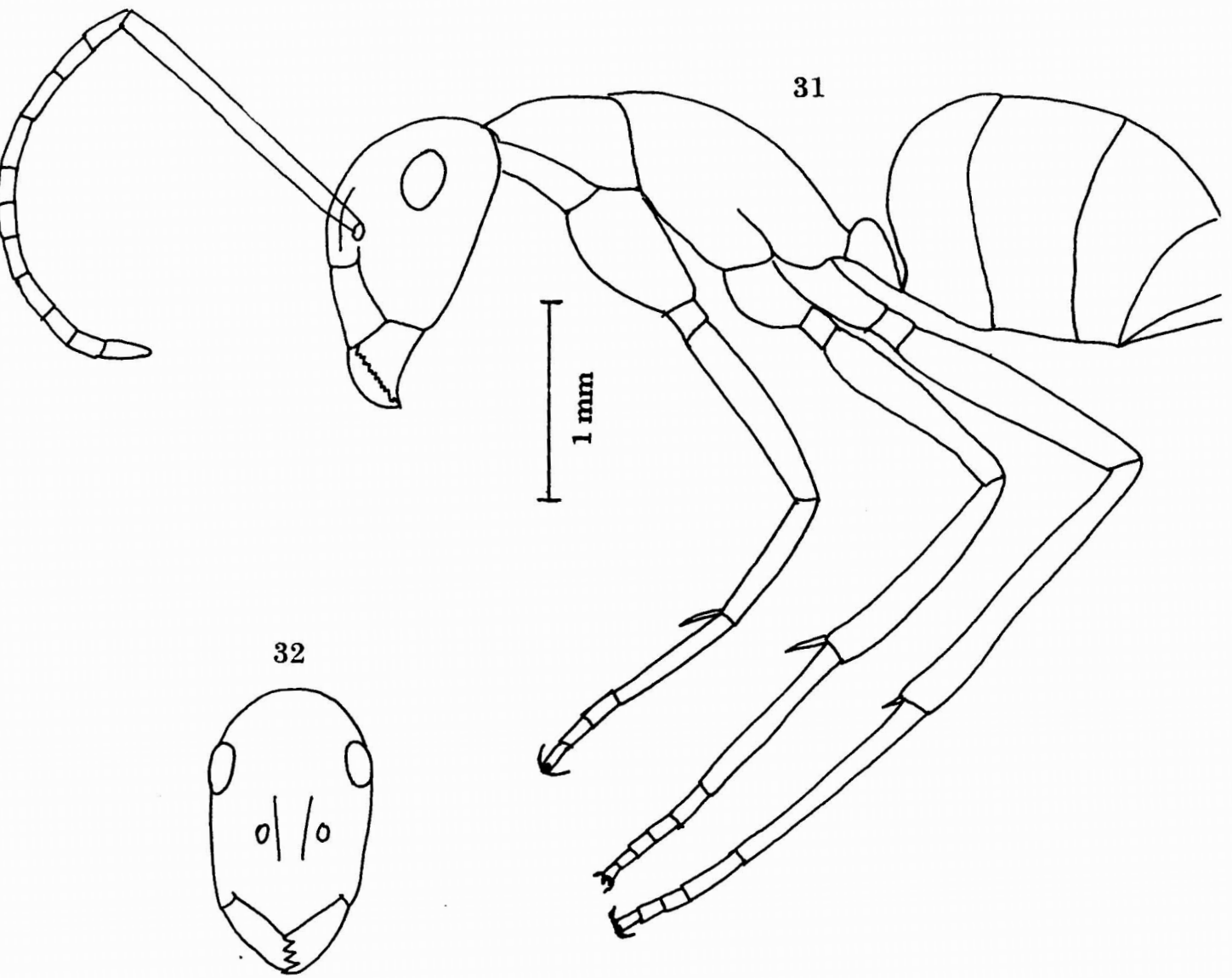
- 27. Body profile
- 28. Head front view.



Figs. 29 - 30. *Camponotus badius* [Smith]

29. Body profile

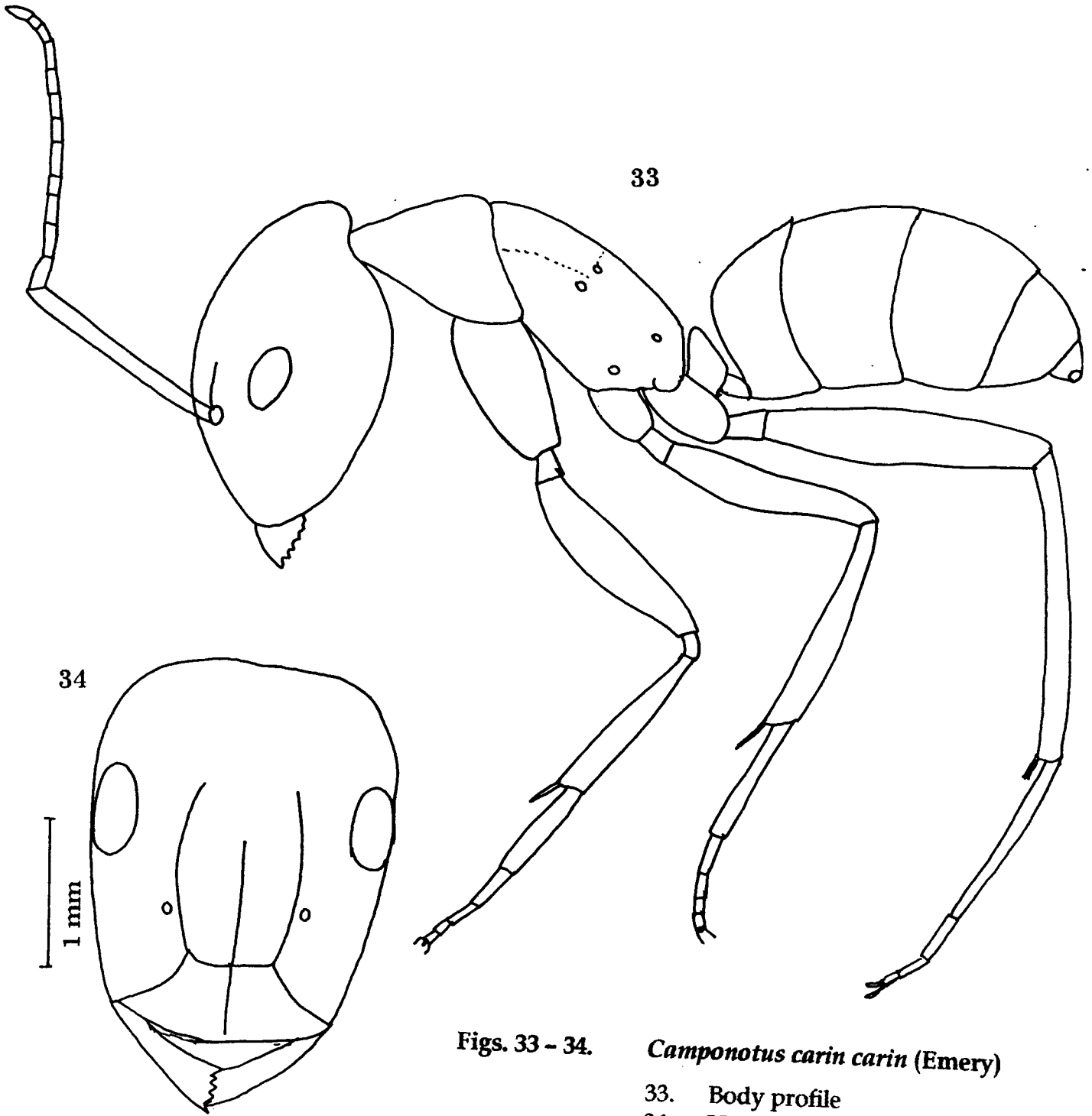
30. Head front view



**Figs. 31 - 32. *Camponotus binghamii* Forel.**

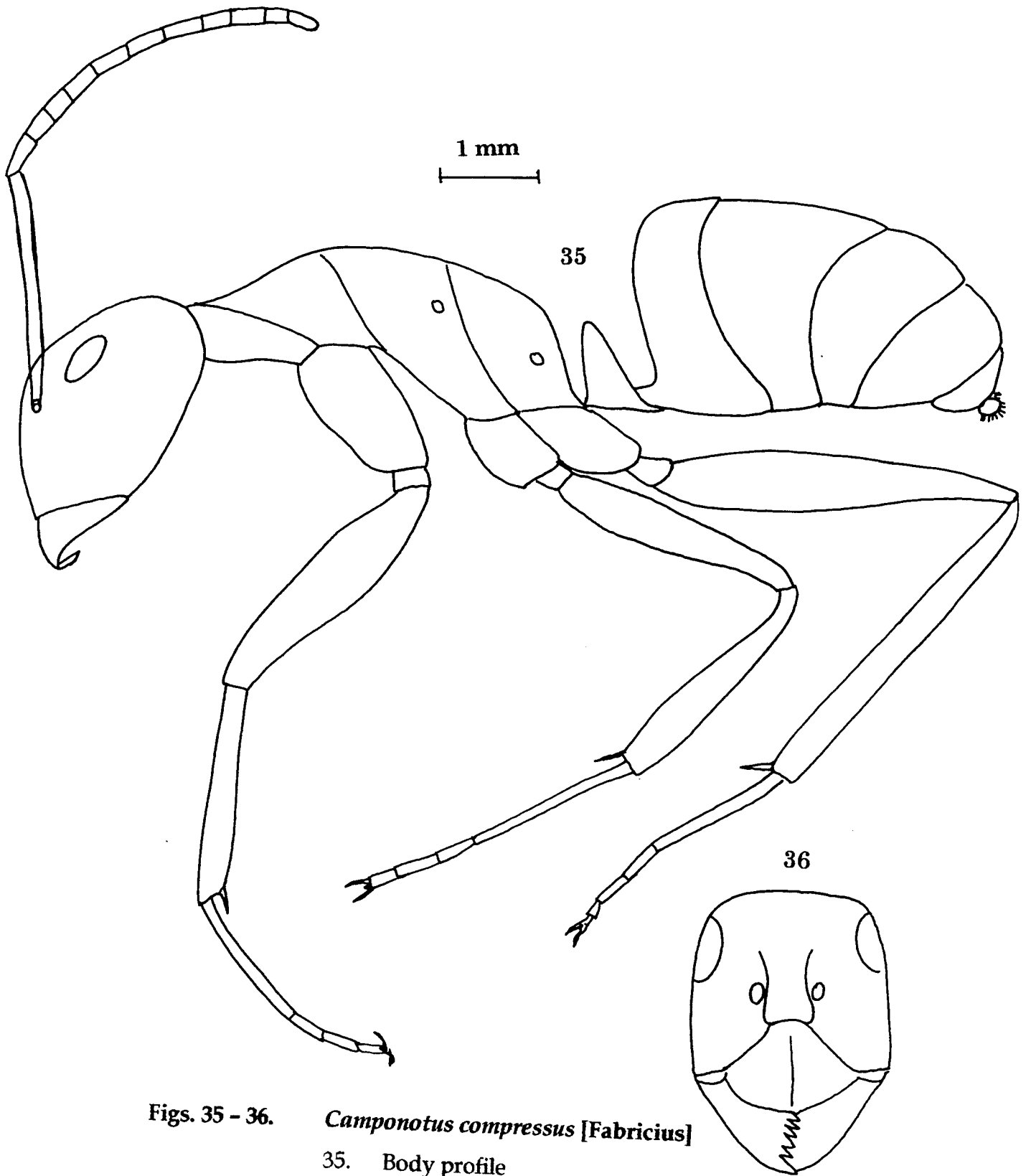
31. Body profile

32. Head front view

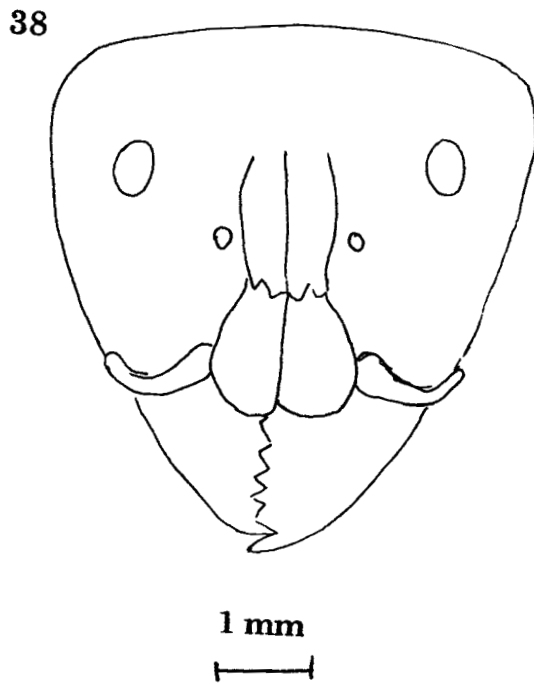
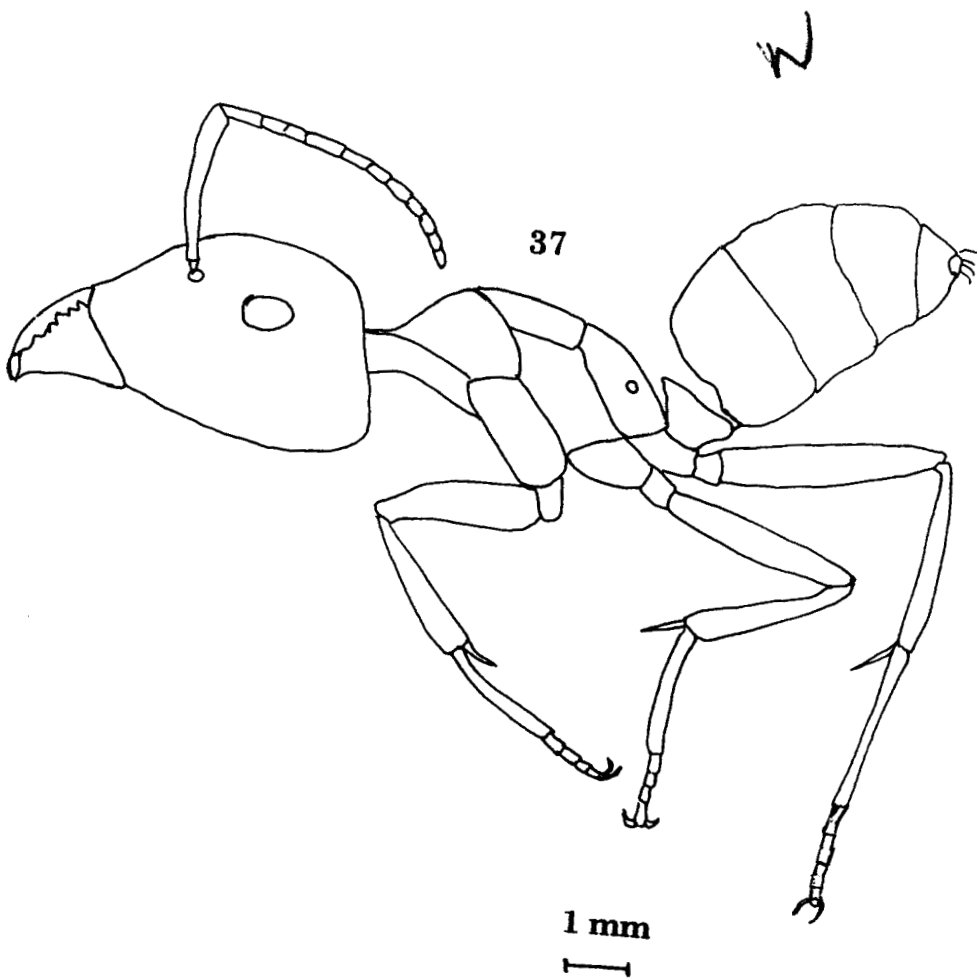


Figs. 33 - 34. *Camponotus carin carin* (Emery)

- 33. Body profile
- 34. Head front view



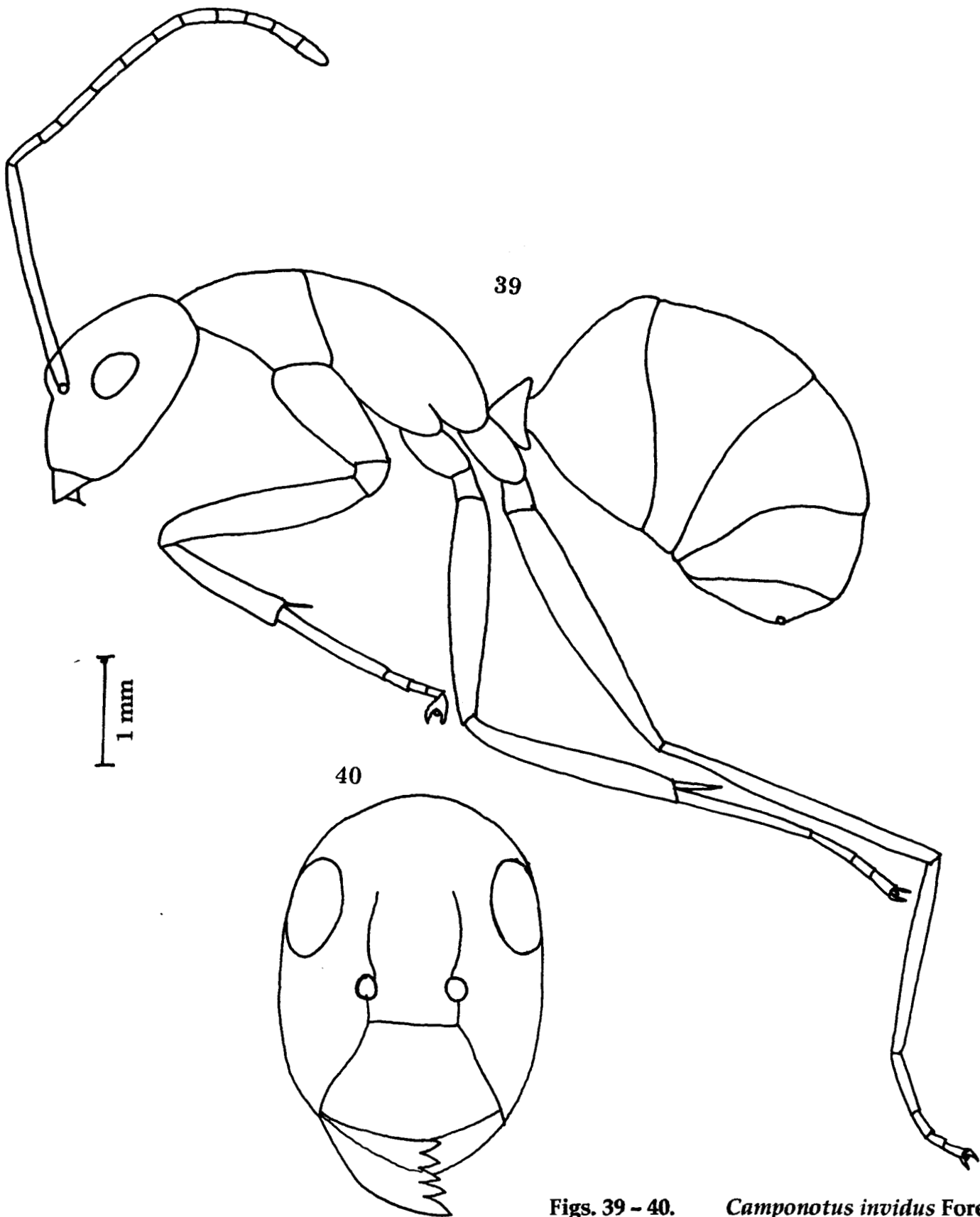
Figs. 35 - 36. *Camponotus compressus* [Fabricius]  
35. Body profile  
36. Head front view



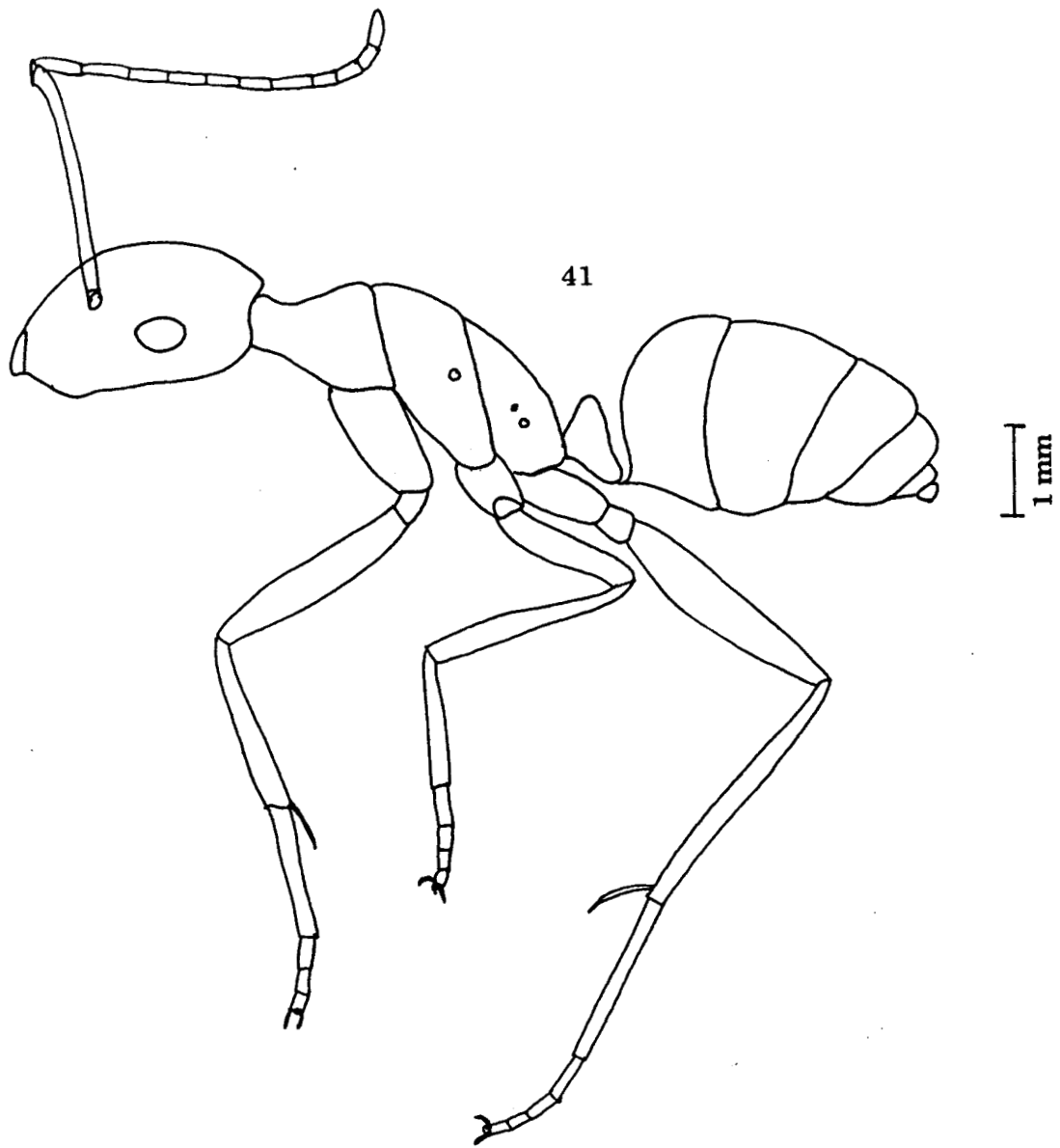
Figs. 37 - 38. *Camponotus dolendus* Forel

37. Body profile  
38. Head front view

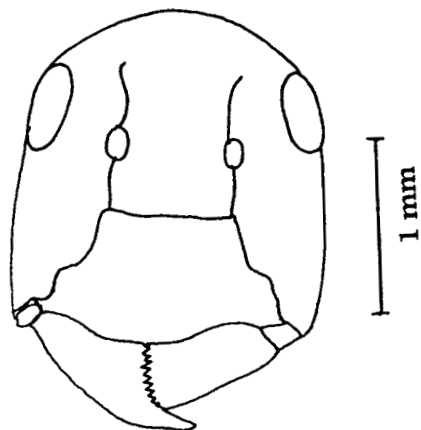
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Figs. 39 - 40. *Camponotus invidus* Forel  
39. Body profile  
40. Head front view



42

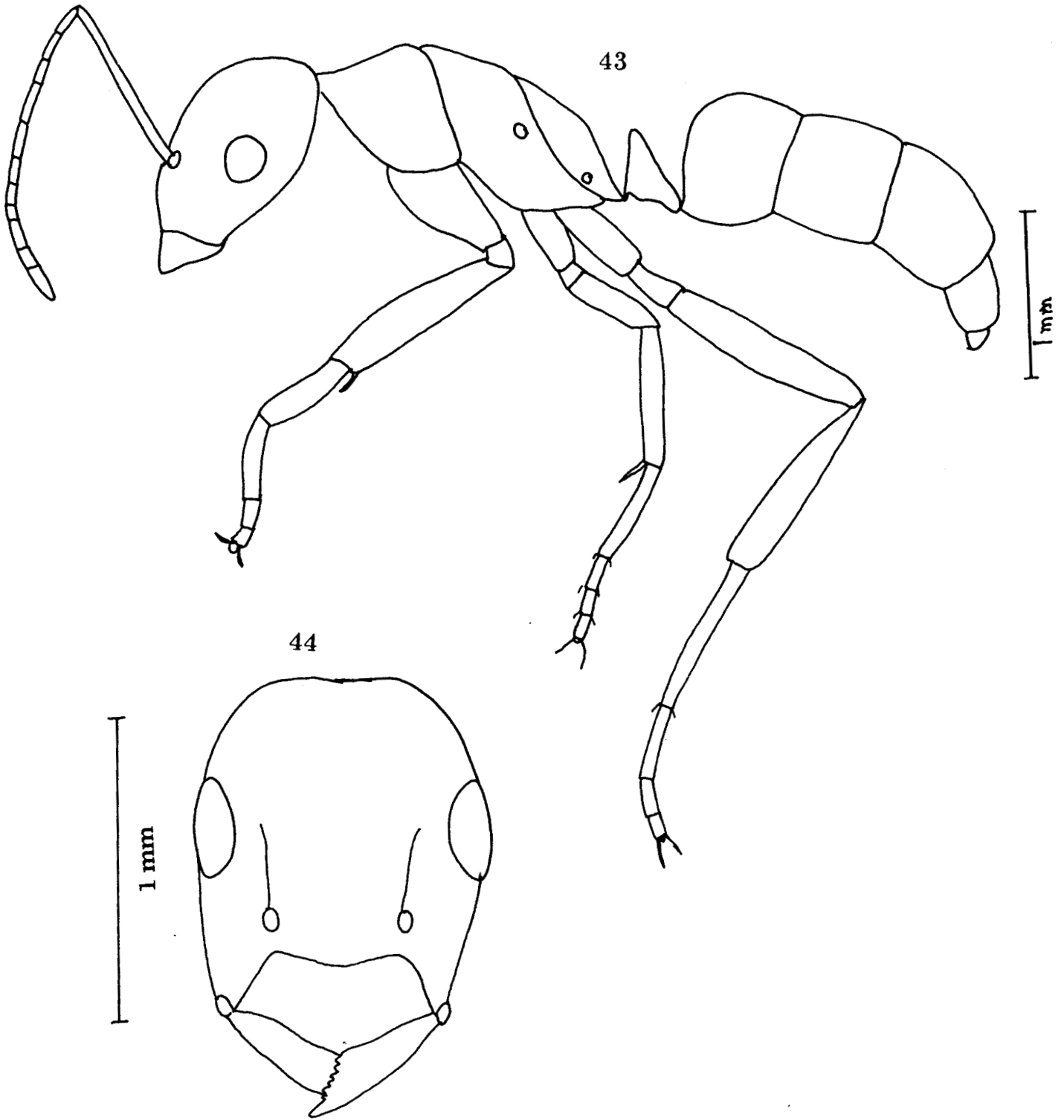


Figs. 41 - 42. *Camponotus irritans irritans* [Smith]

41. Body profile

42. Head front view

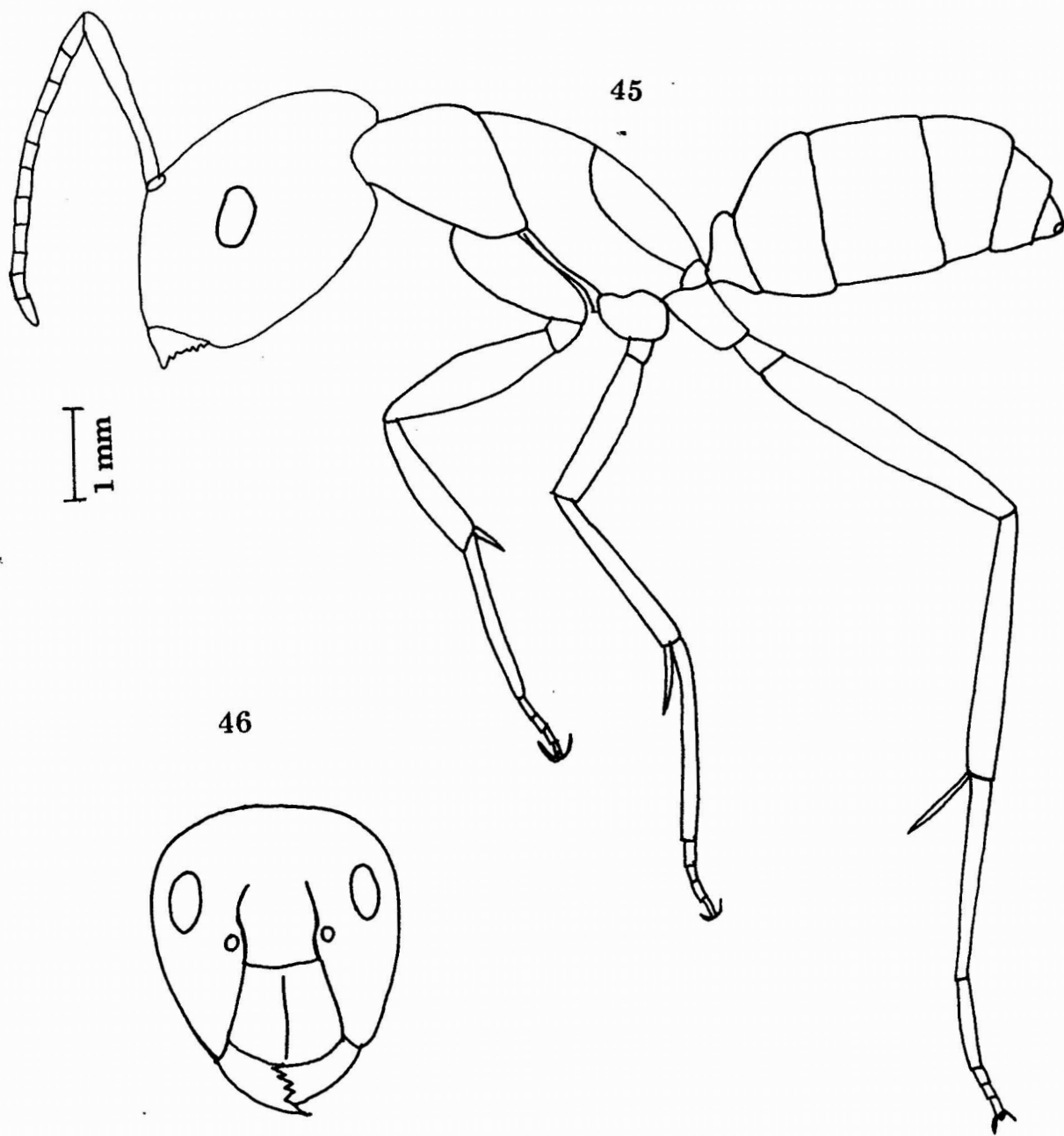
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Figs. 43 - 44. *Camponotus keralensis* sp. nov.

43. Body profile

44. Head front view



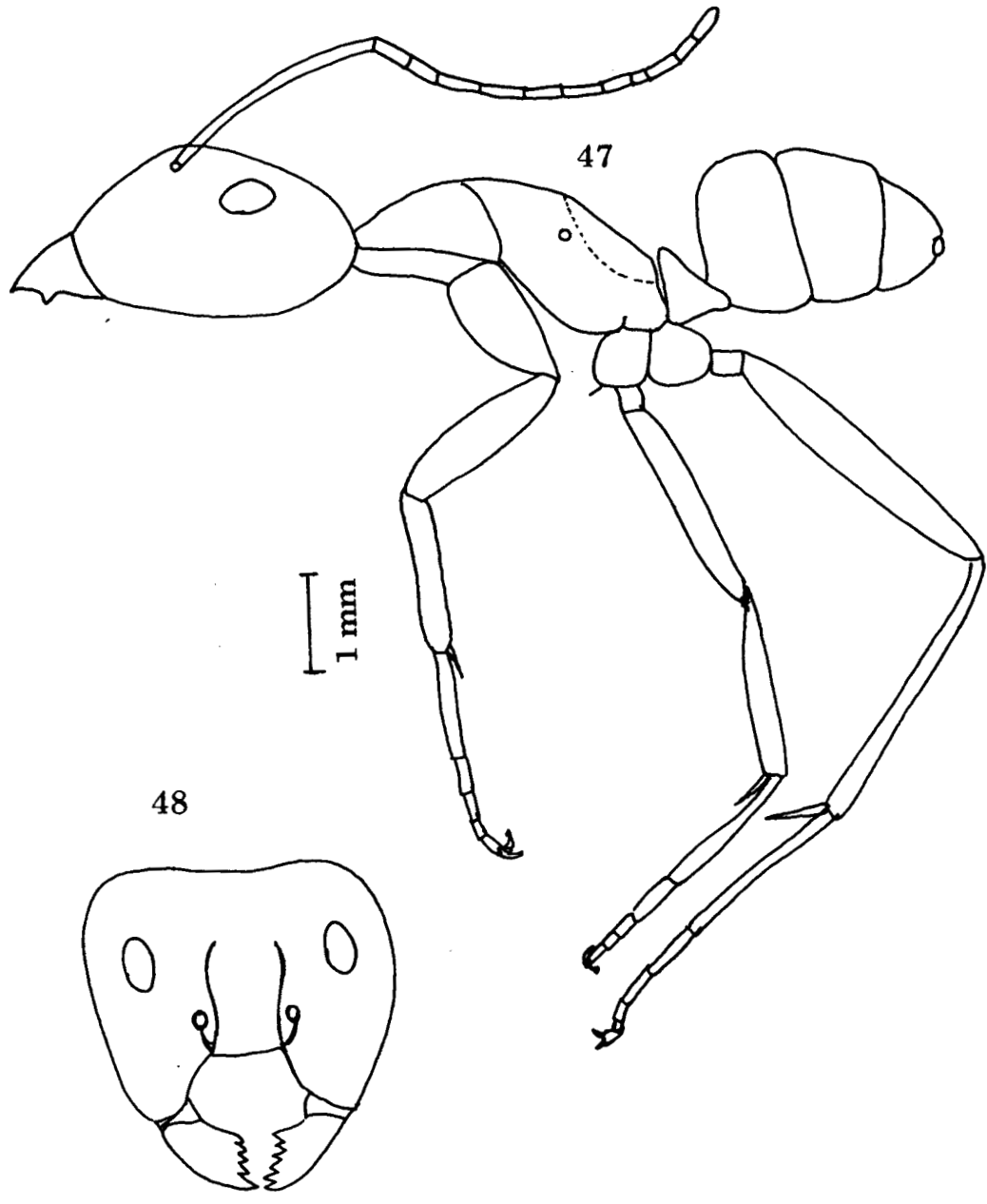
Figs. 45 - 46.

*Camponotus lamarckii* Forel

45. Body profile

46. Head front view

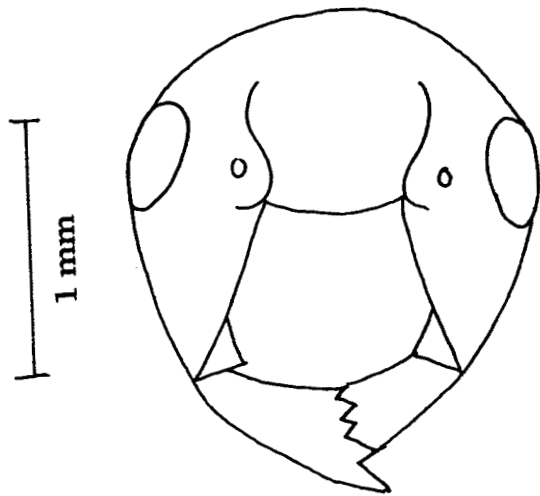
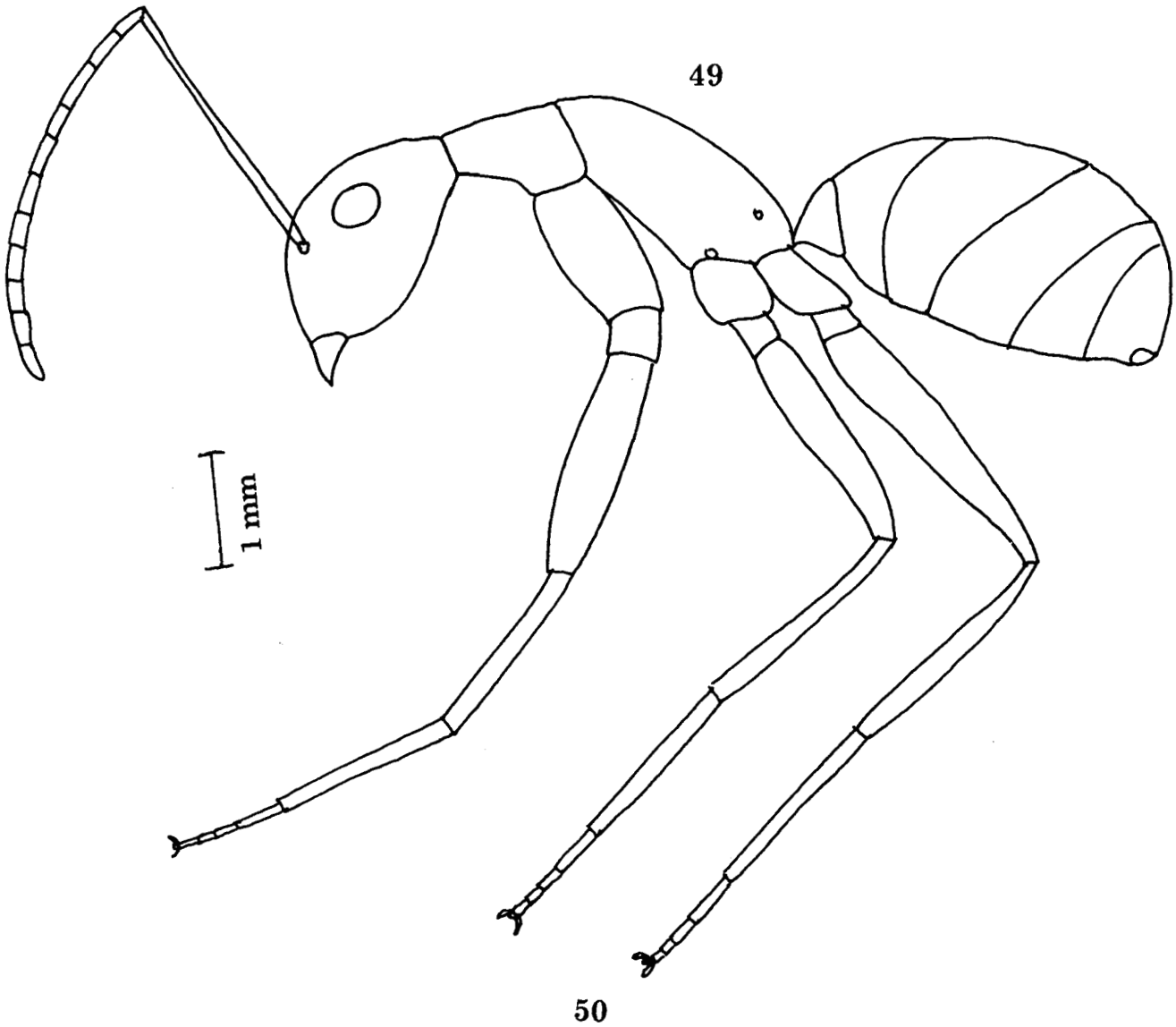
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**Figs. 47 - 48.** *Camponotus mendax mendax* Forel

- 47. Body profile
- 48. Head front view

43



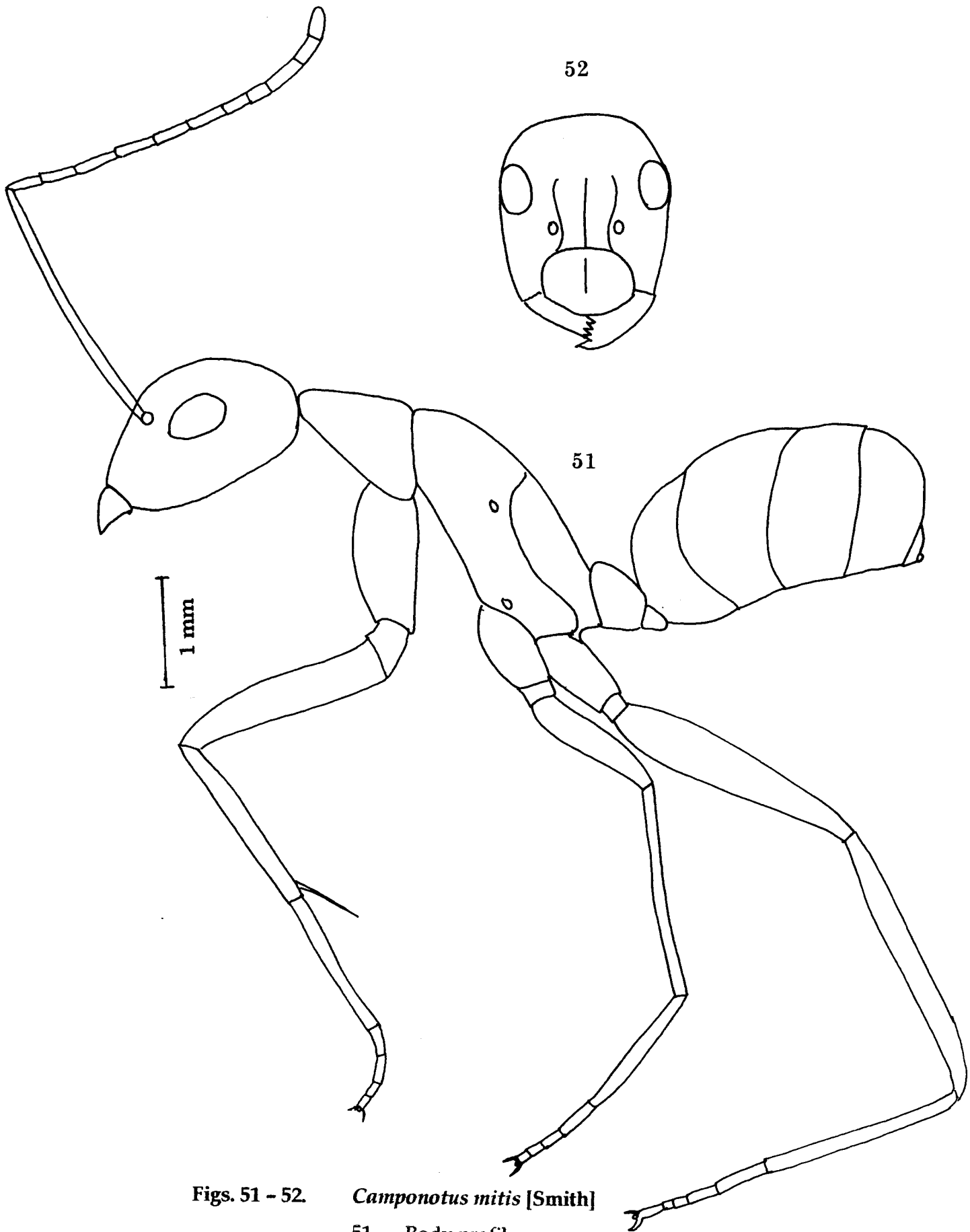
Figs. 49 - 50.

*Camponotus misturus formaronis* Forel

49. Body profile

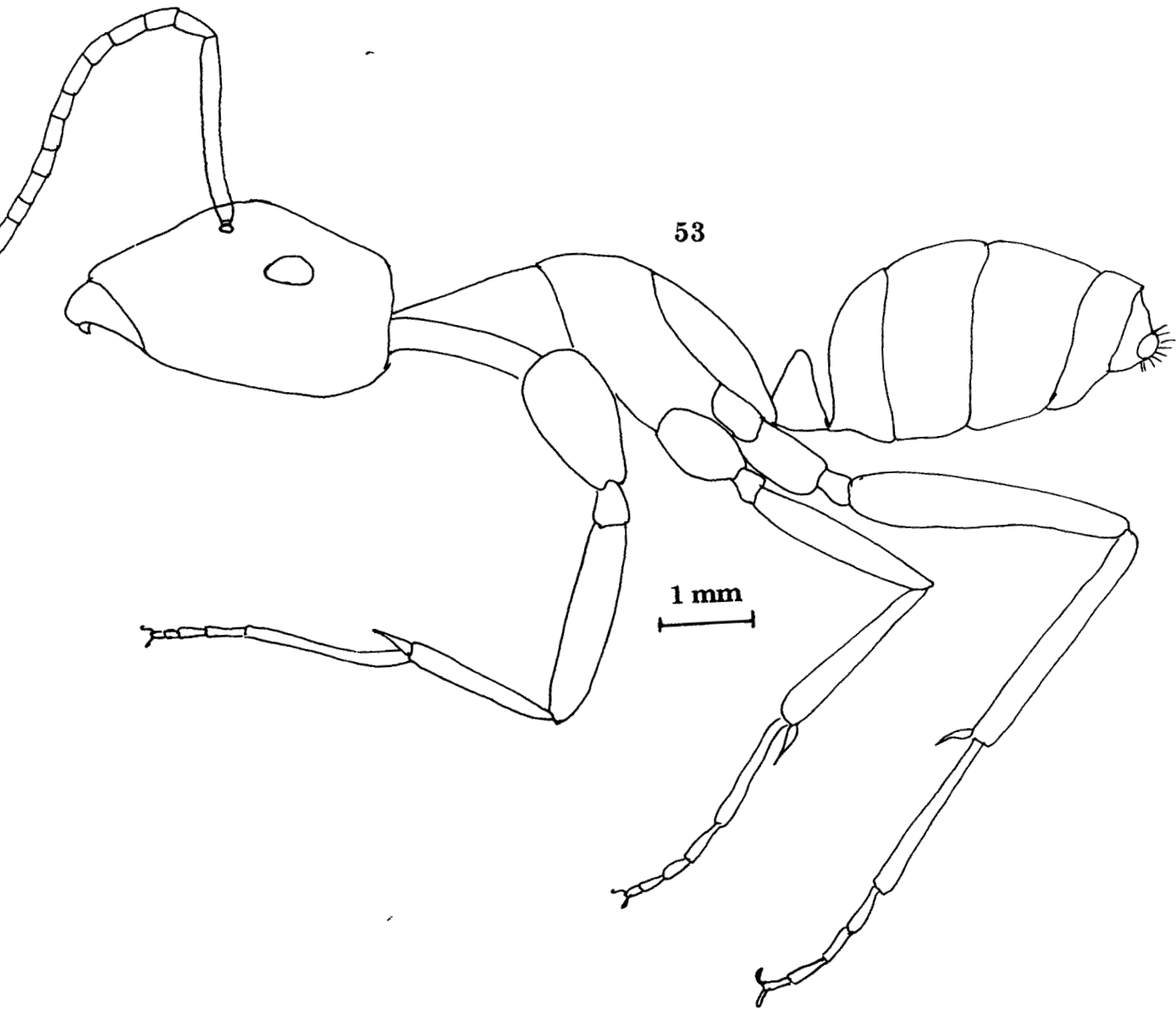
50. Head front view

04

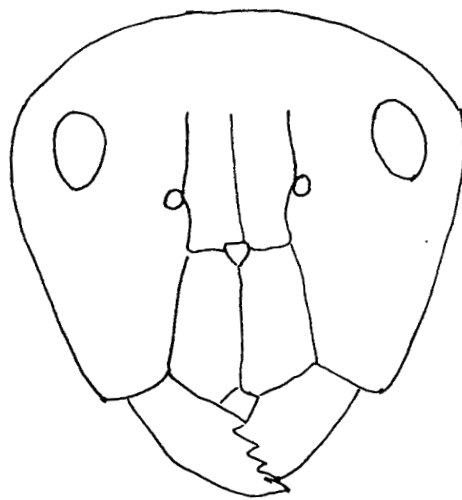


Figs. 51 - 52. *Camponotus mitis* [Smith]

- 51. Body profile
- 52. Head front view

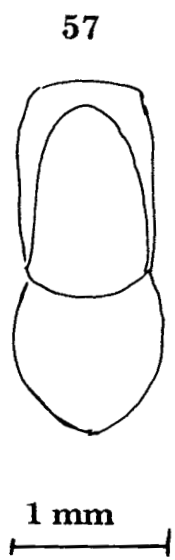
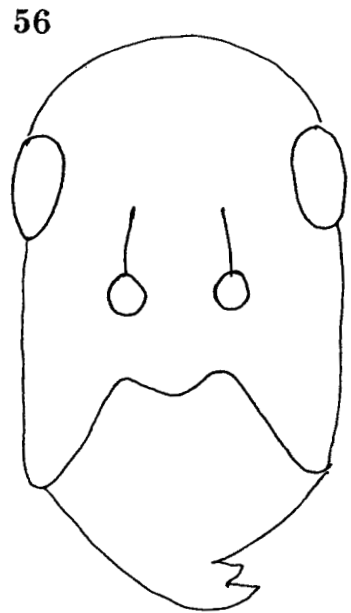
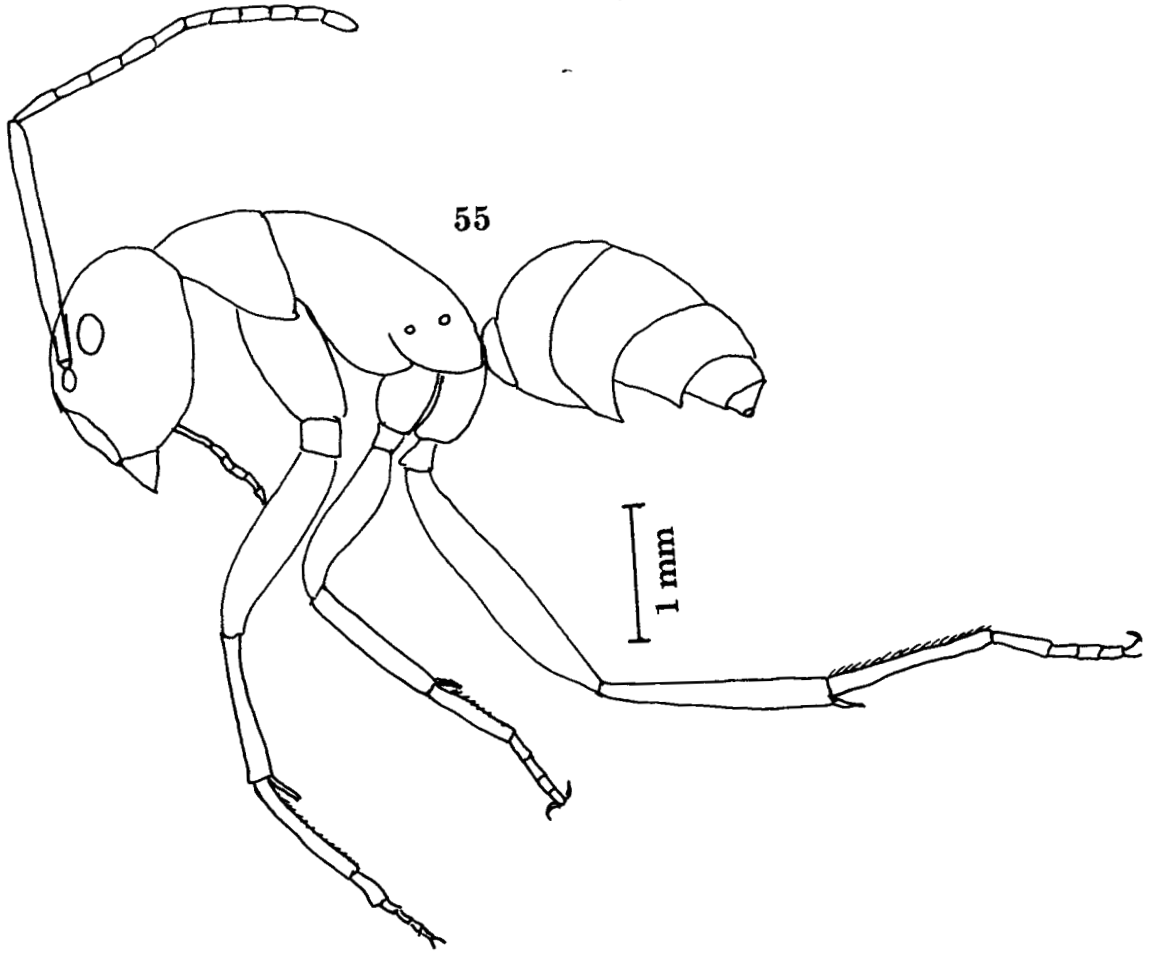


54



Figs. 53 - 54. *Camponotus nicobarensis nicobarensis* Mayr  
53. Body profile 54. Head front view

Ab



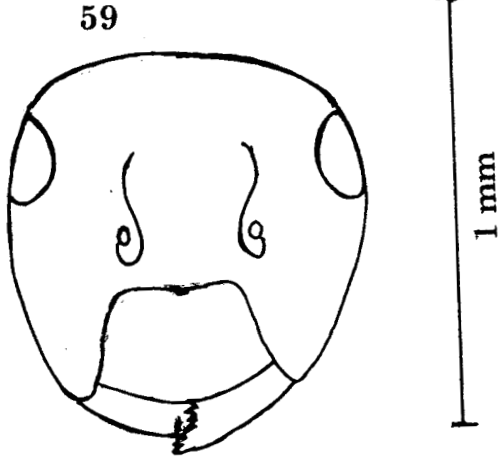
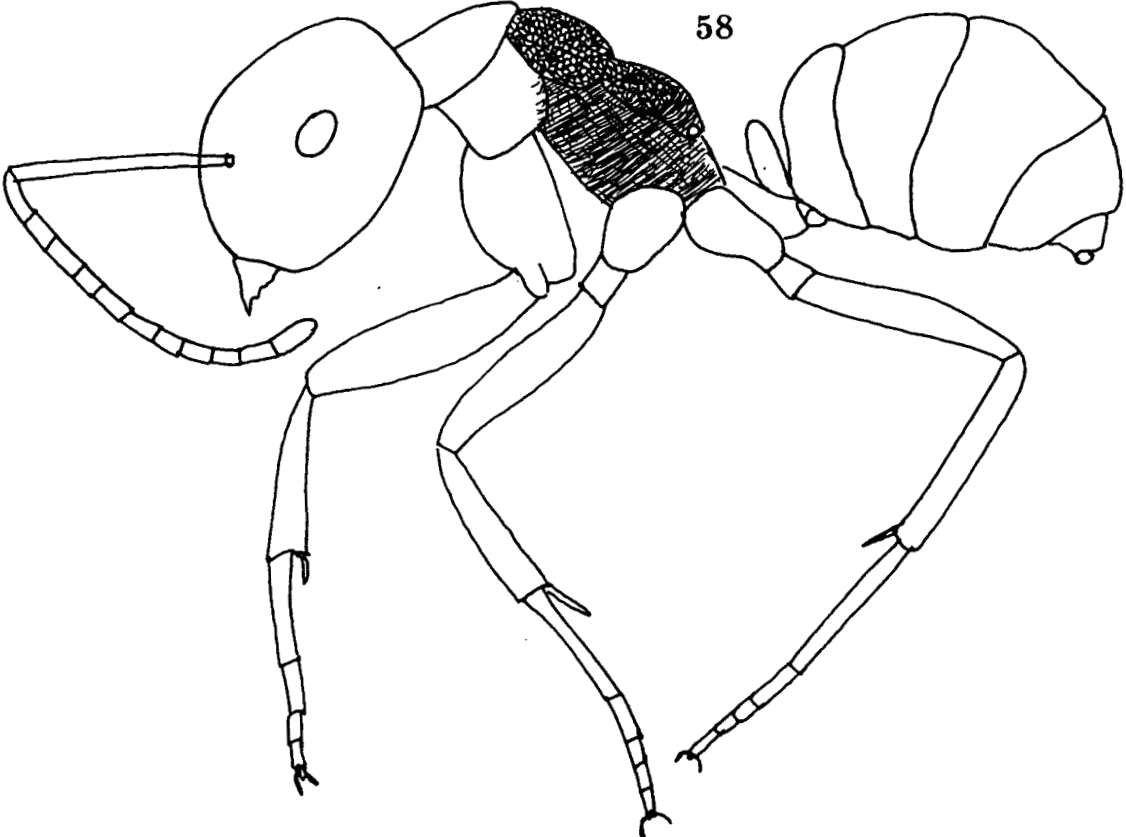
Figs. 55 - 57.

*Camponotus parius* Emery

- 55. Body profile
- 56. Head front view
- 57. Thorax and abdomen dorsal view

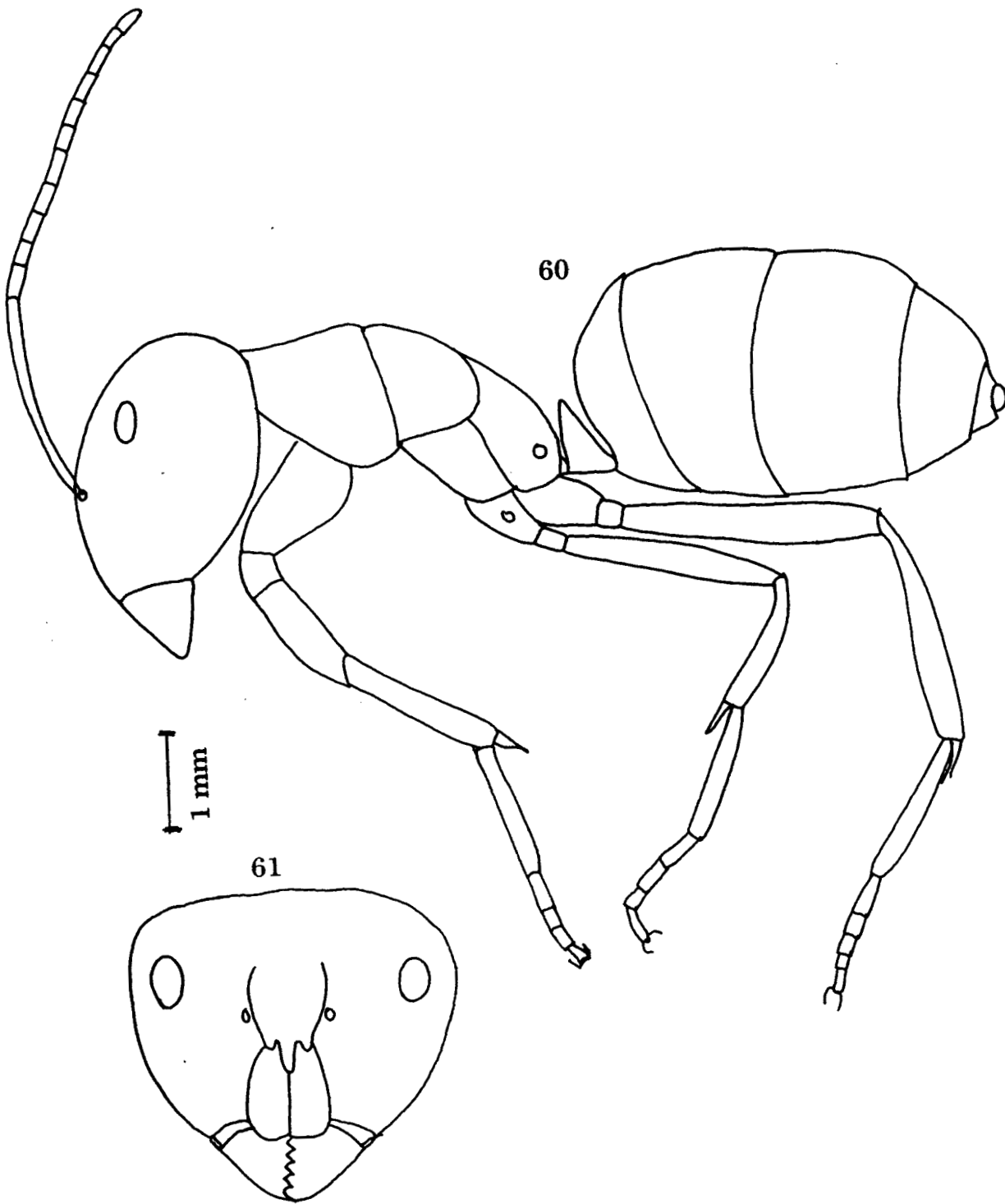
92

1 mm



Figs. 58 - 59. *Camponotus reticulatus reticulatus* Roger  
58. Body profile  
59. Head front view

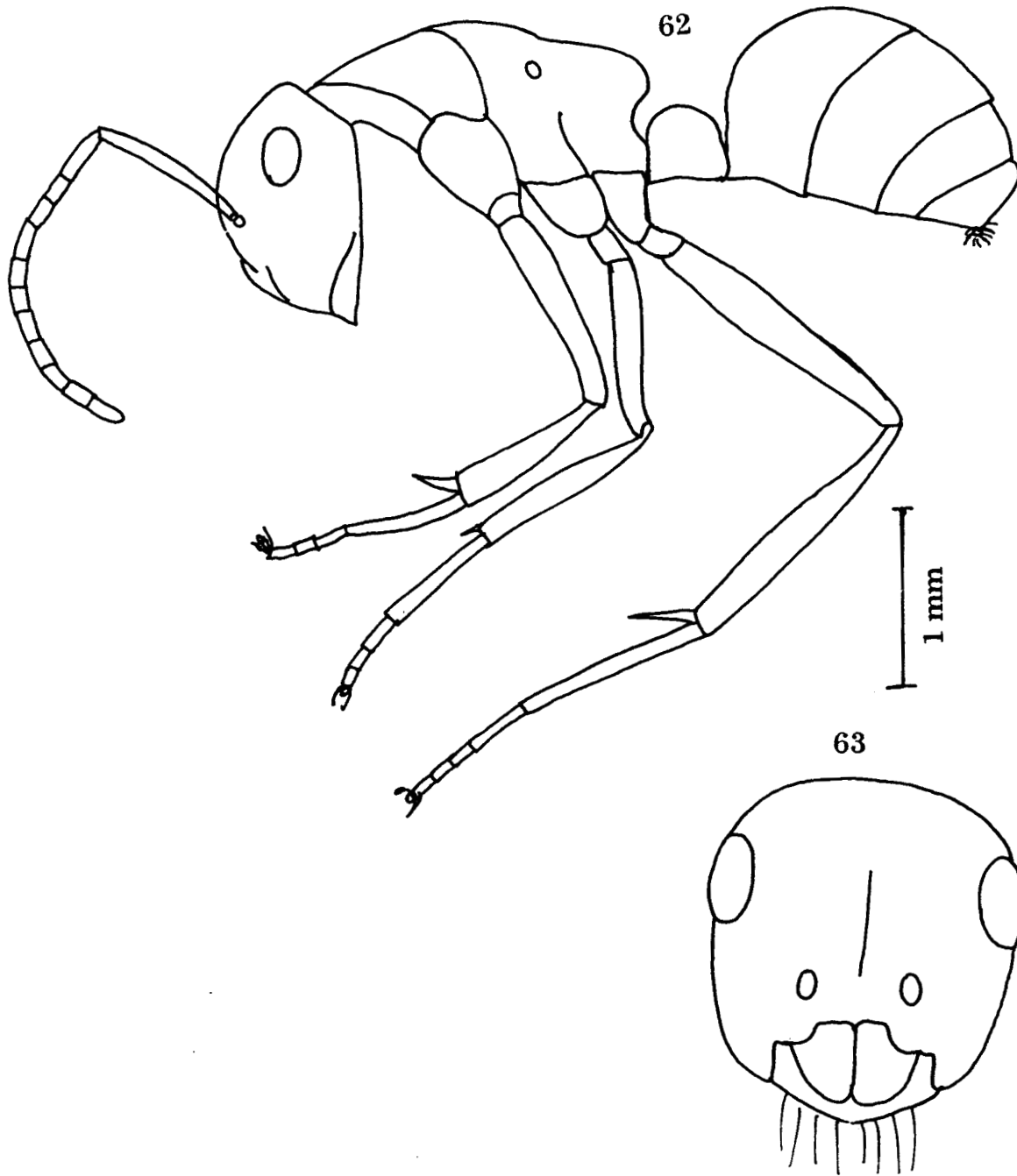
208



Figs. 60 - 61. *Camponotus rufoglaucus rufoglaucus* [Jerdon]

60. Body profile

61. Head front view

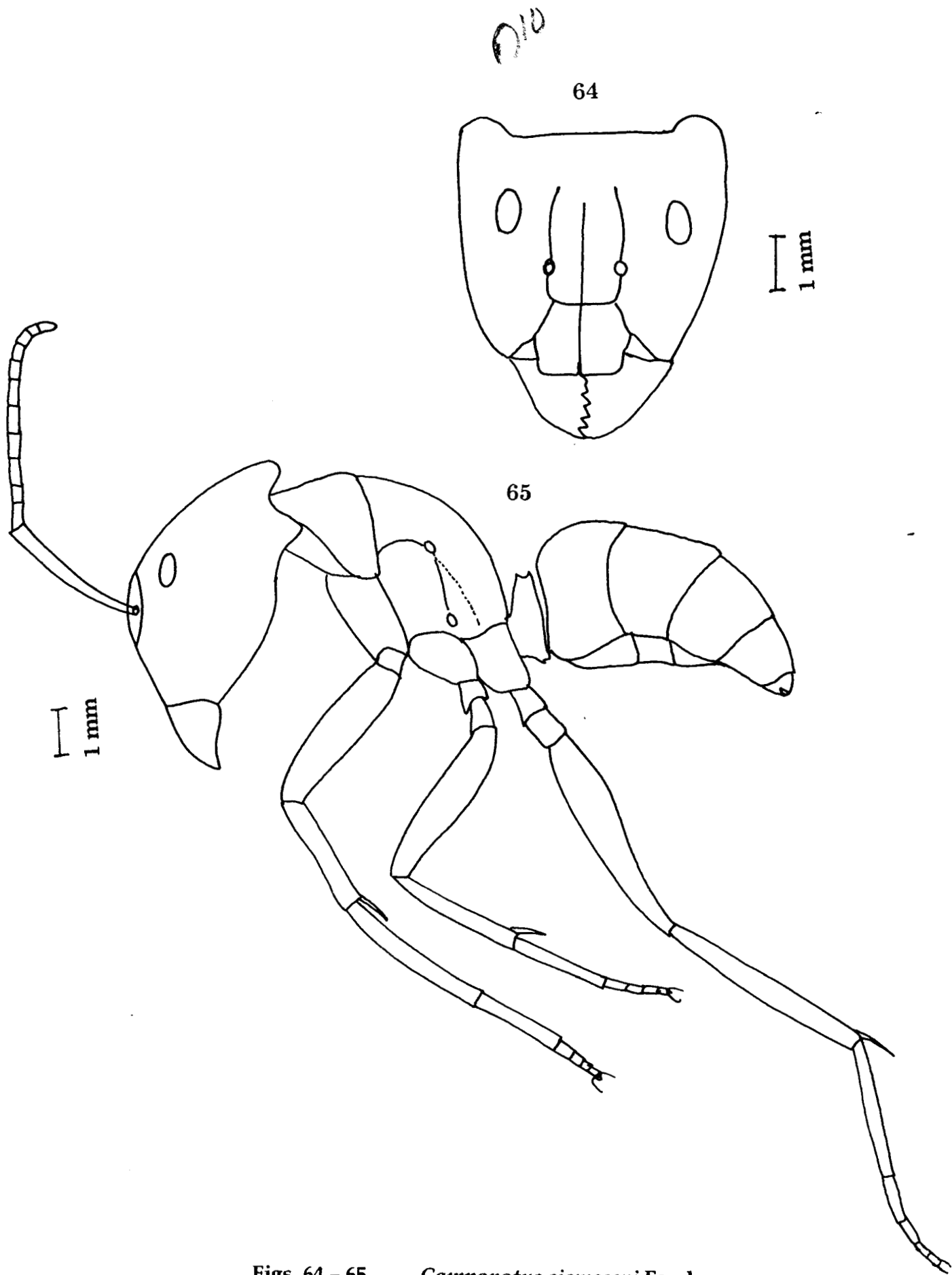


Figs. 62 - 63.

*Camponotus sericeus sericeus* [Fabricius]

62. Body profile

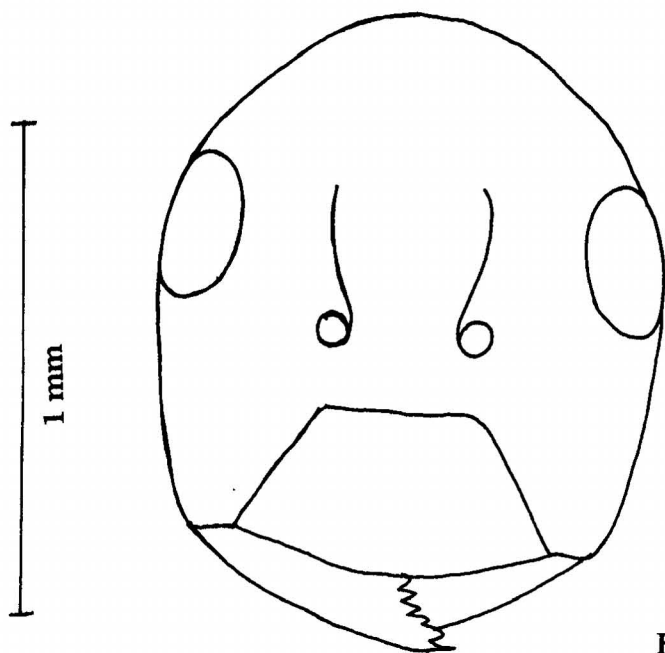
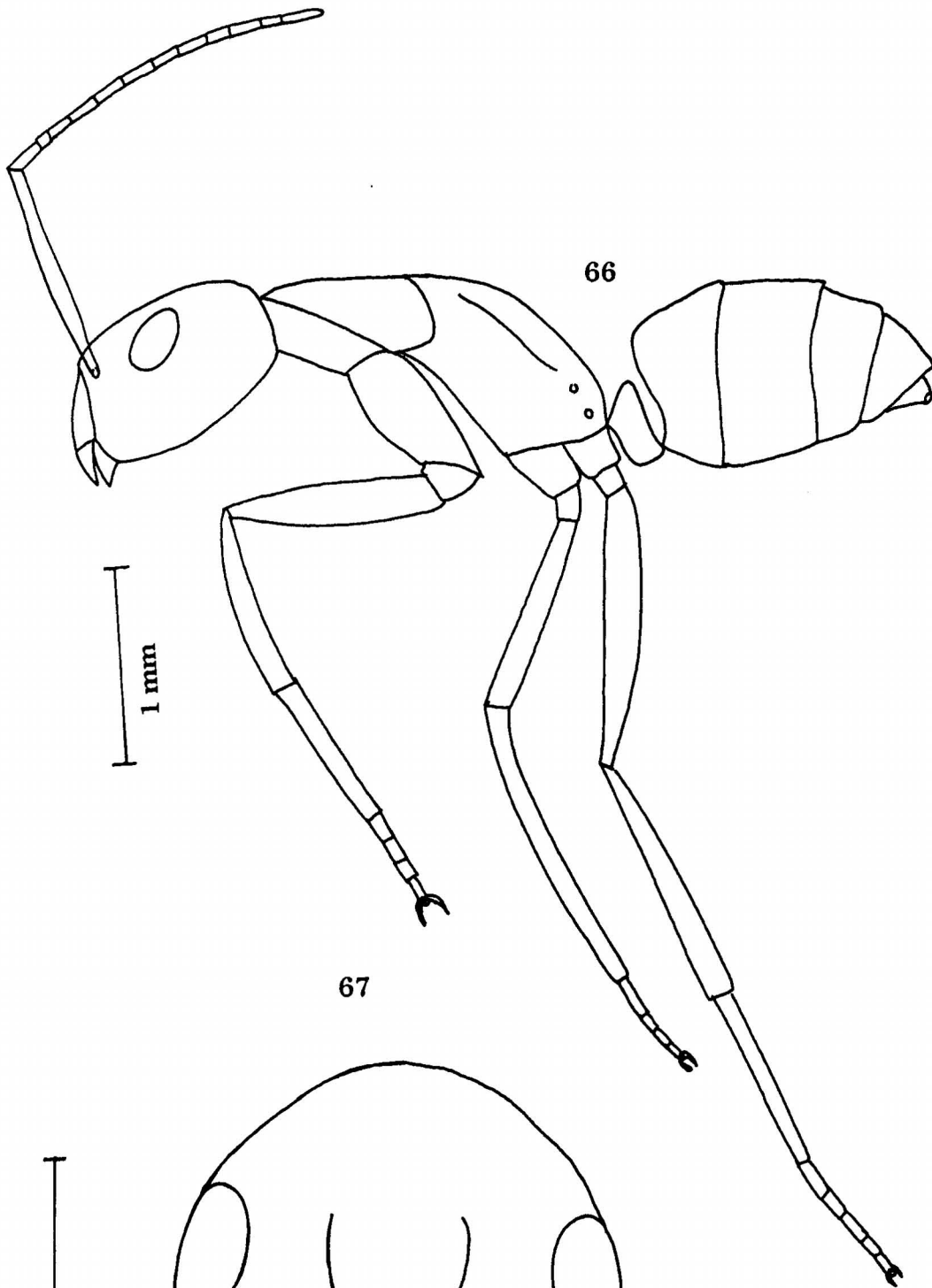
63. Head front view



Figs. 64 - 65. *Camponotus siemsseni* Forel

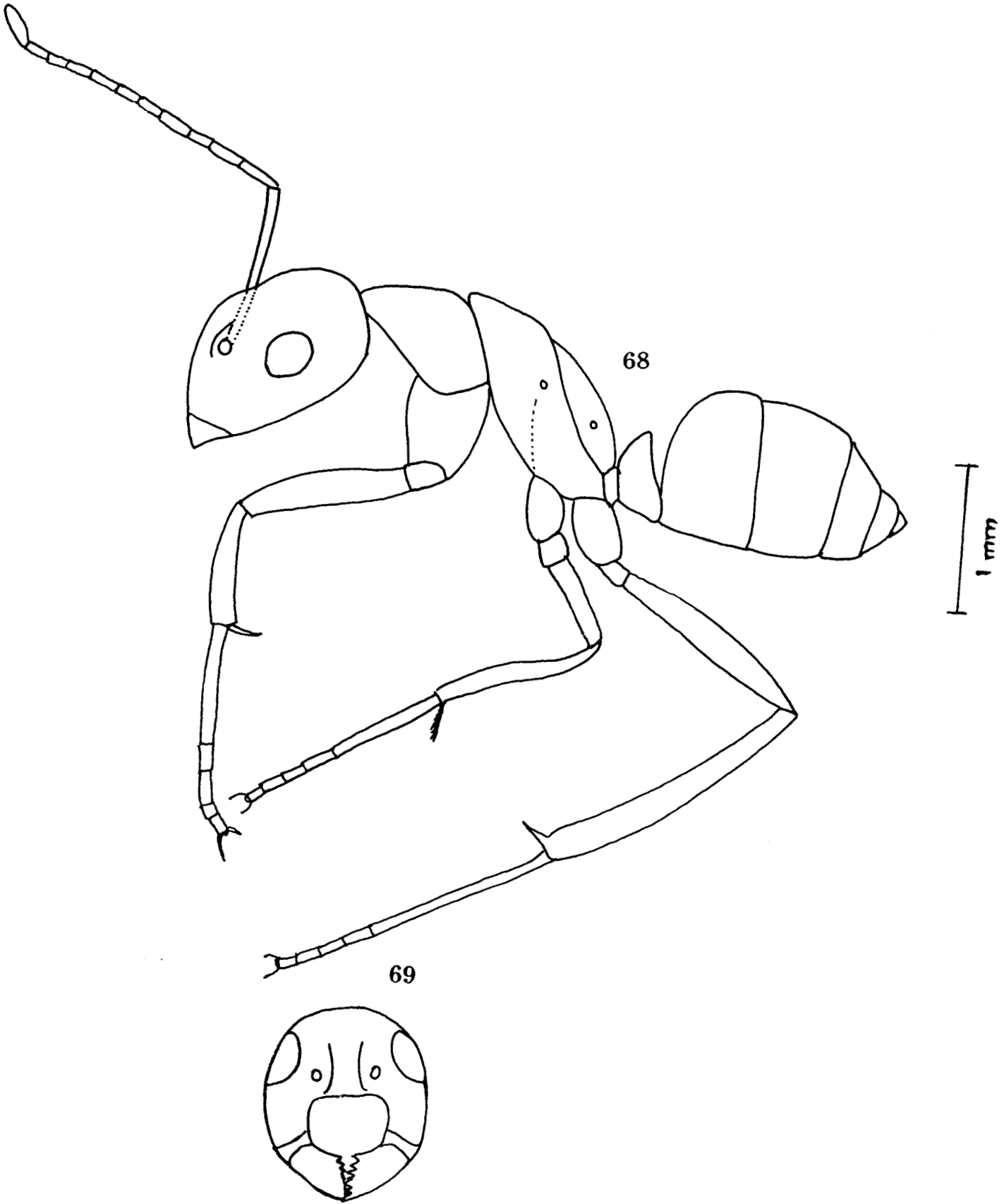
64. Head front view

65. Body profile



Figs. 66 - 67. *Camponotus varians* Roger  
66. Body profile  
67. Head front view

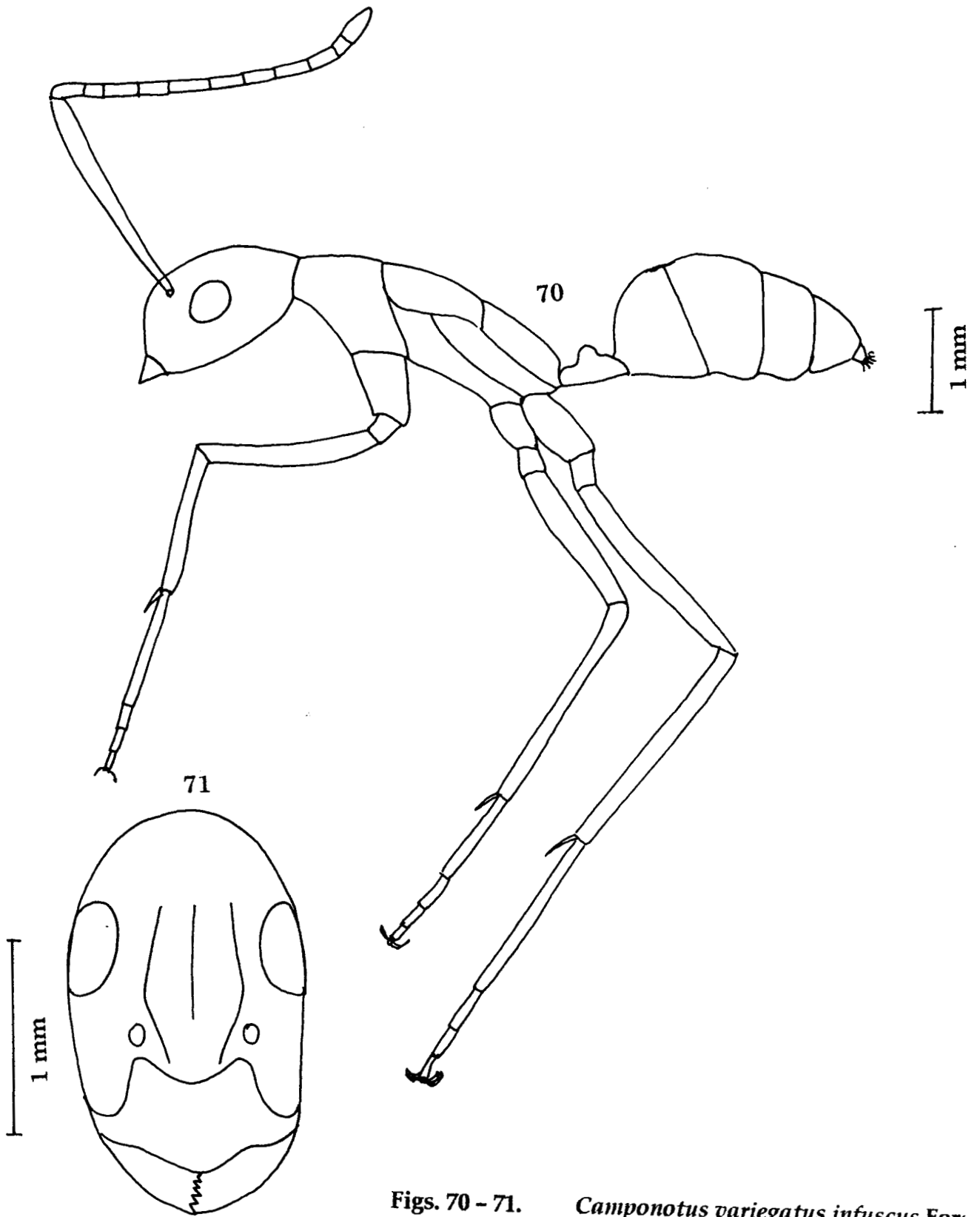
9/12



Figs. 68 - 69. *Camponotus variegatus variegatus* [Smith]

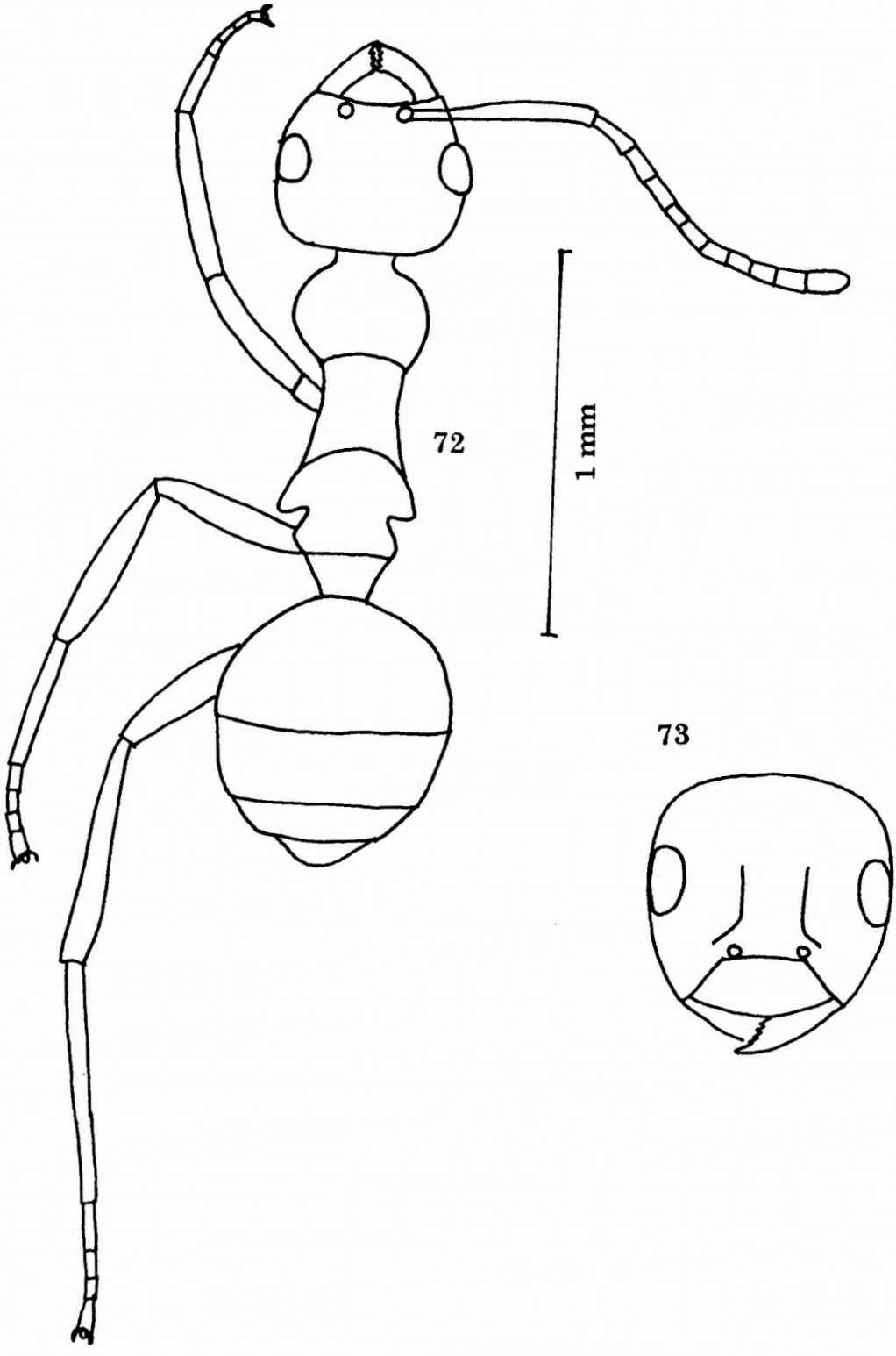
- 68. Body profile
- 69. Head front view

213



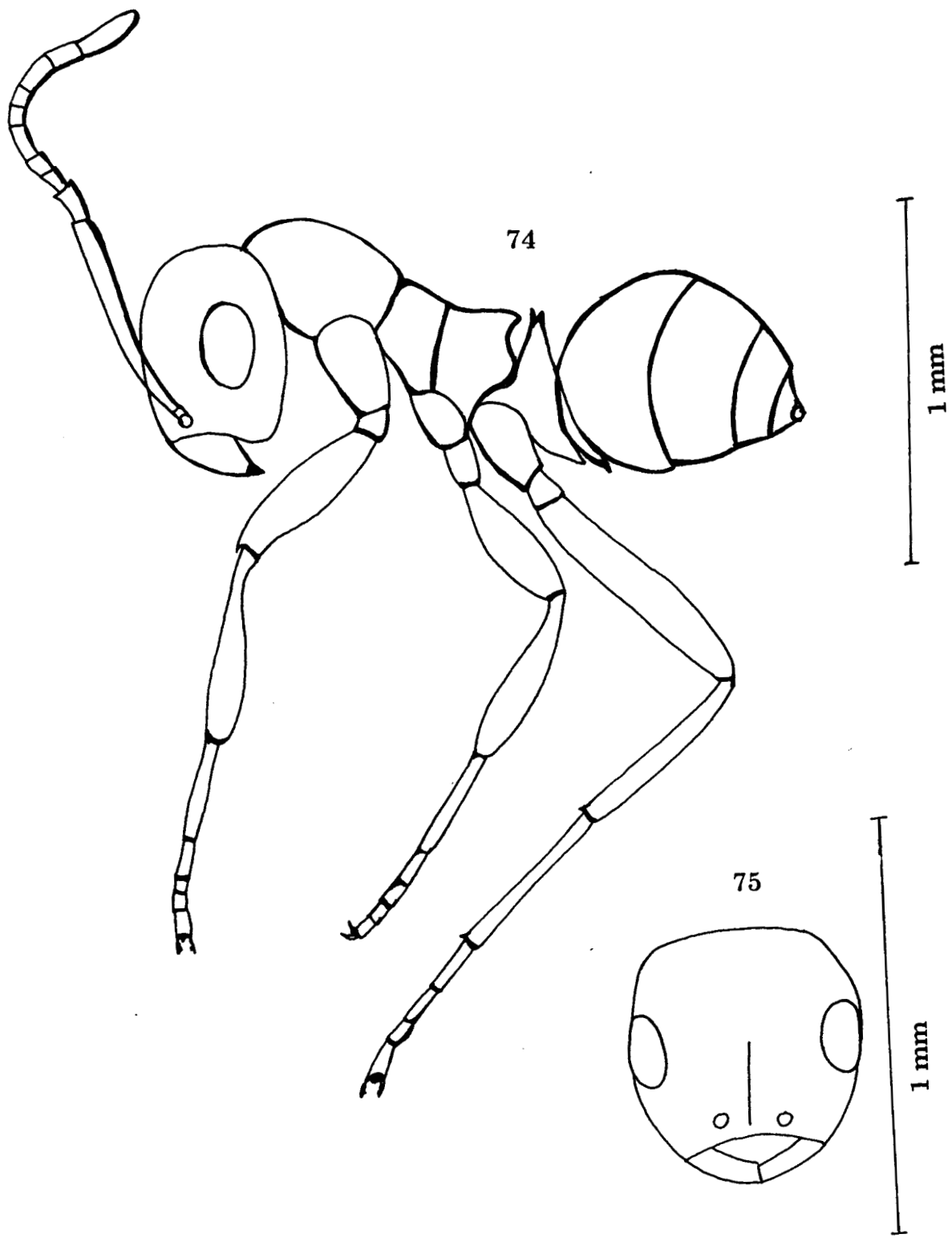
Figs. 70 - 71. *Camponotus variegatus infuscus* For.  
70. Body profile  
71. Head front view

114



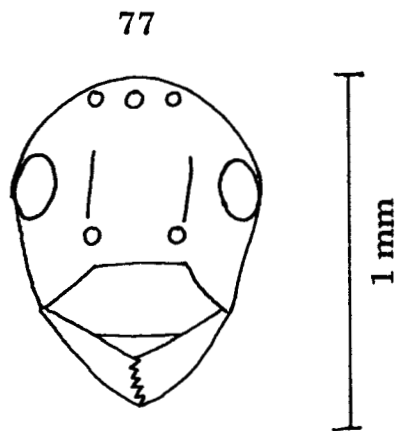
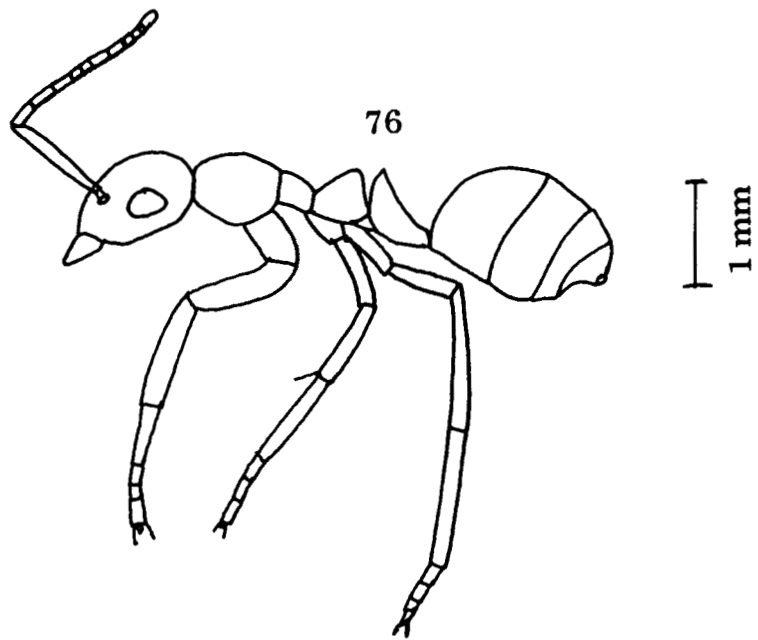
Figs. 72 - 73. *Lepisiota anupama* sp. nov.  
72. Body dorsal view  
73. Head front view

2/5



Figs. 74 - 75. *Lepisiota capensis capensis* [Mayr]

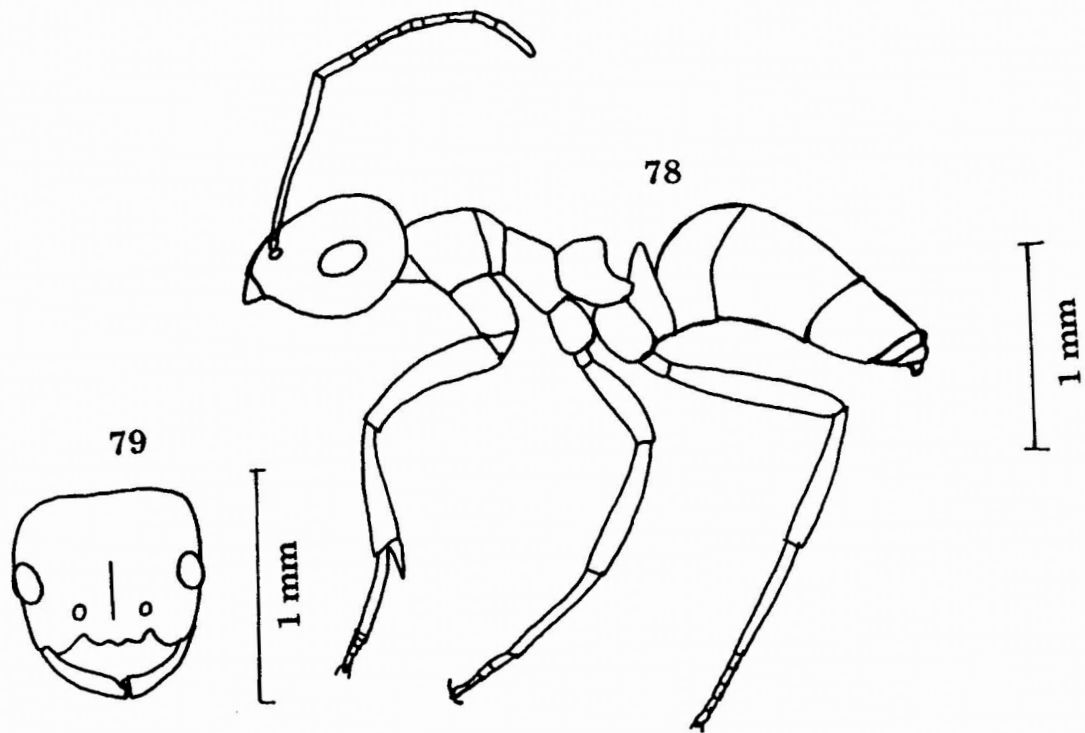
- 74. Body profile
- 75. Head front view



Figs. 76 - 77. *Lepisiota malabarensis* sp. nov.

76. Body profile

77. Head front view

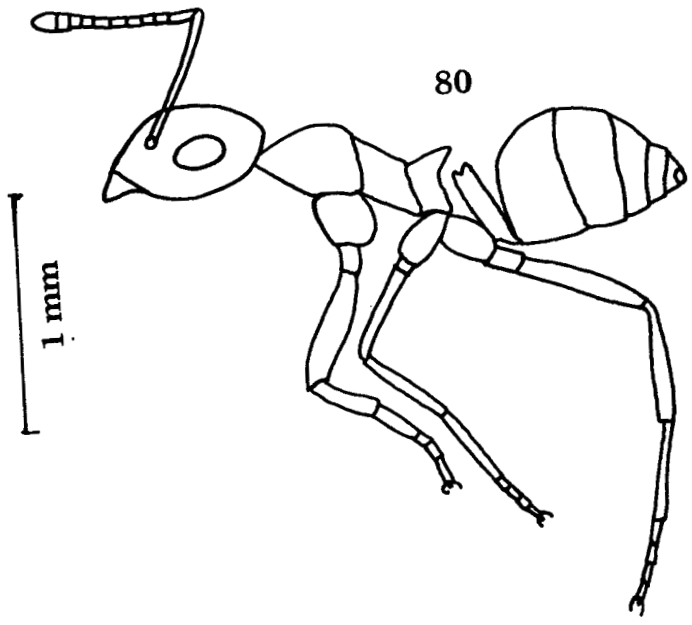


Figs. 78 - 79. *Lepisiota munnarensis* sp. nov.

78. Body profile

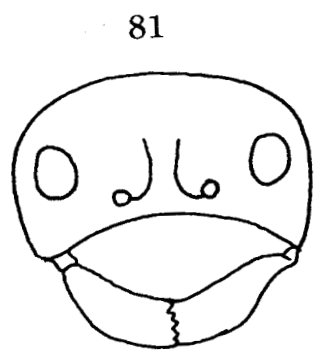
79. Head front view

AMB



80

1 mm

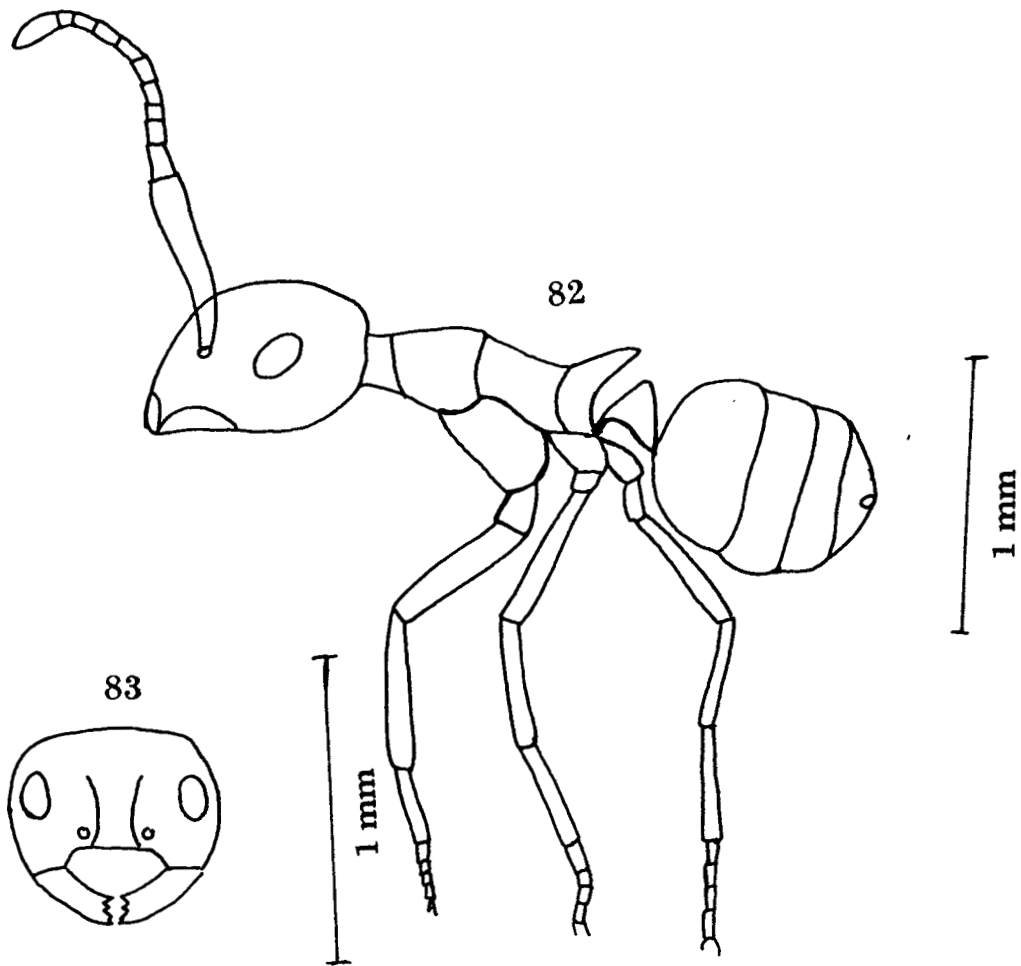


81

1 mm

Figs. 80 - 81. *Lepisiota opaca opaca* [Forel]  
80. Body profile  
81. Head front view

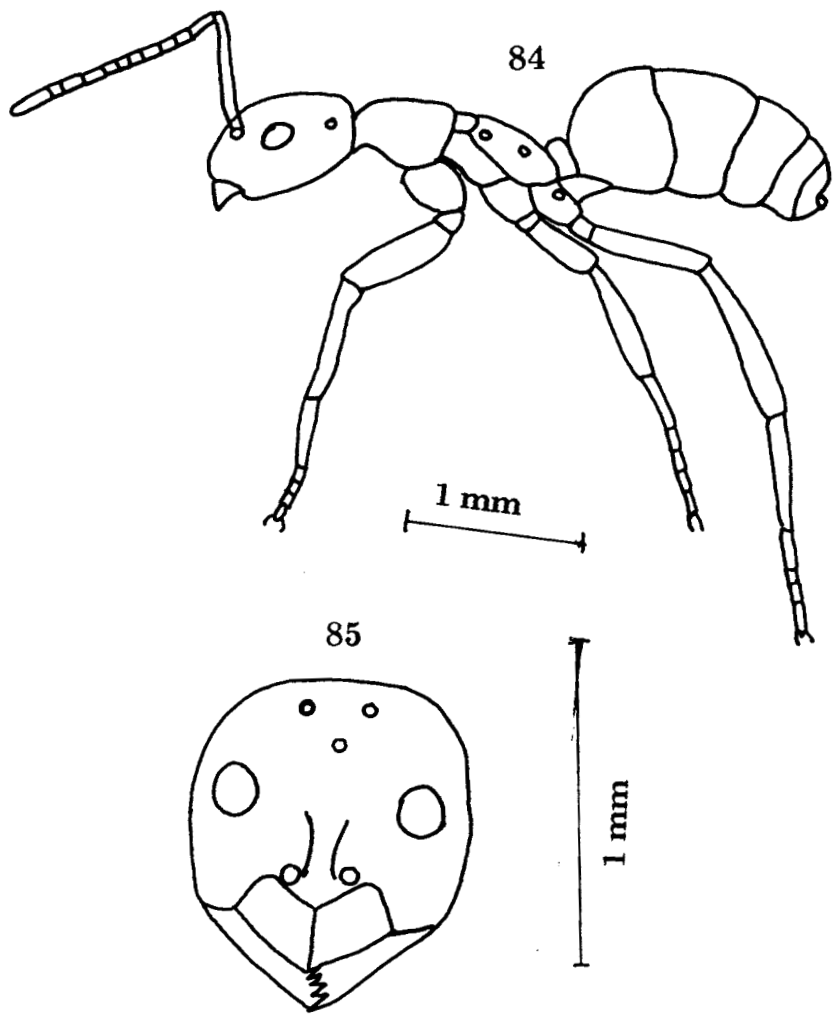
019



Figs. 82 - 83. *Lepisiota opaca pulchella* [Forel]

- 82. Body profile
- 83. Head front view

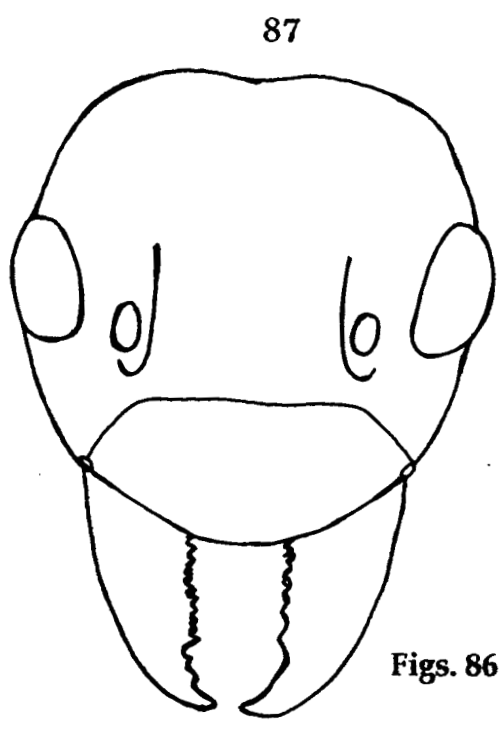
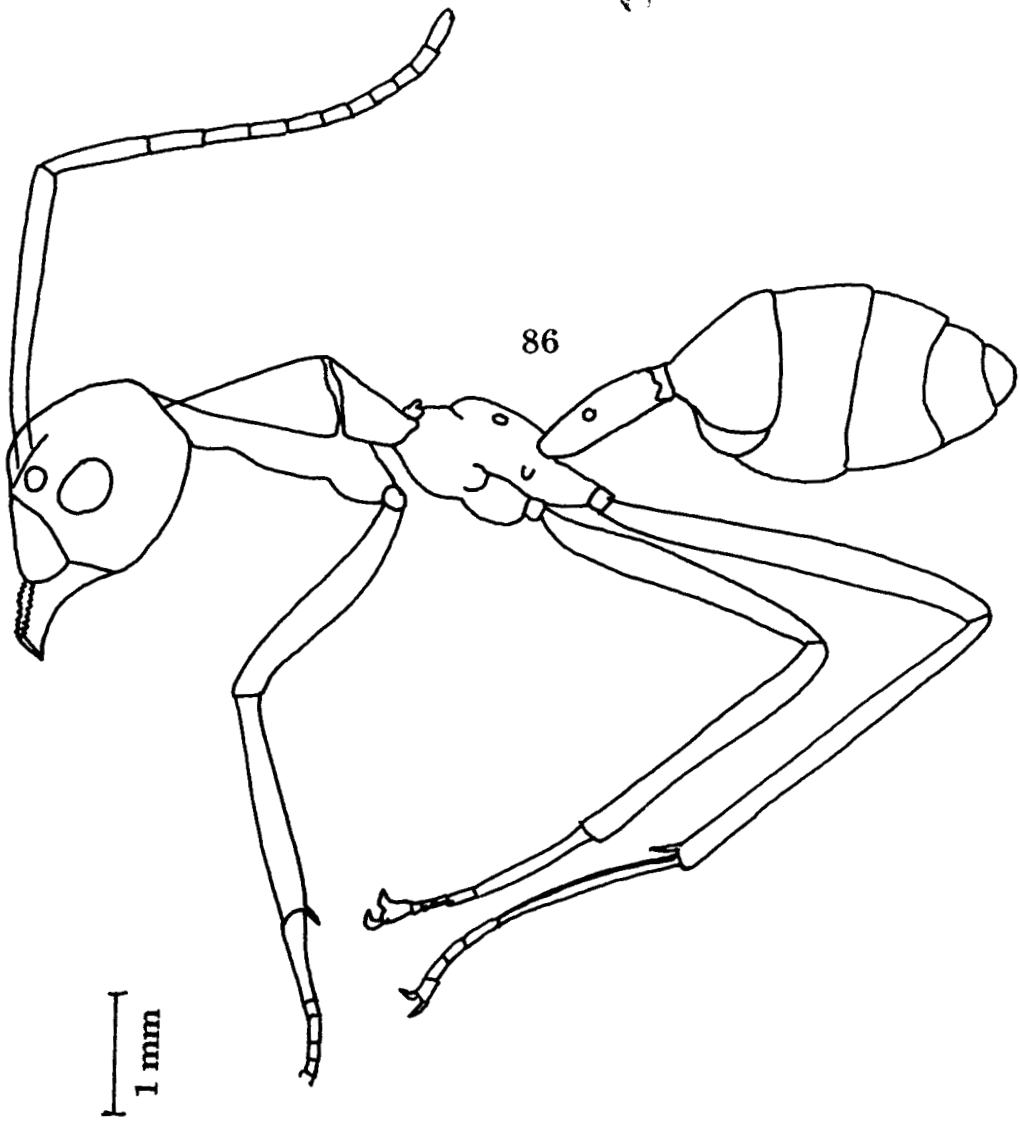
A20



Figs. 84 - 85. *Lepisiota rothneyi rothneyi* [Forel]

- 84. Body profile
- 85. Head front view

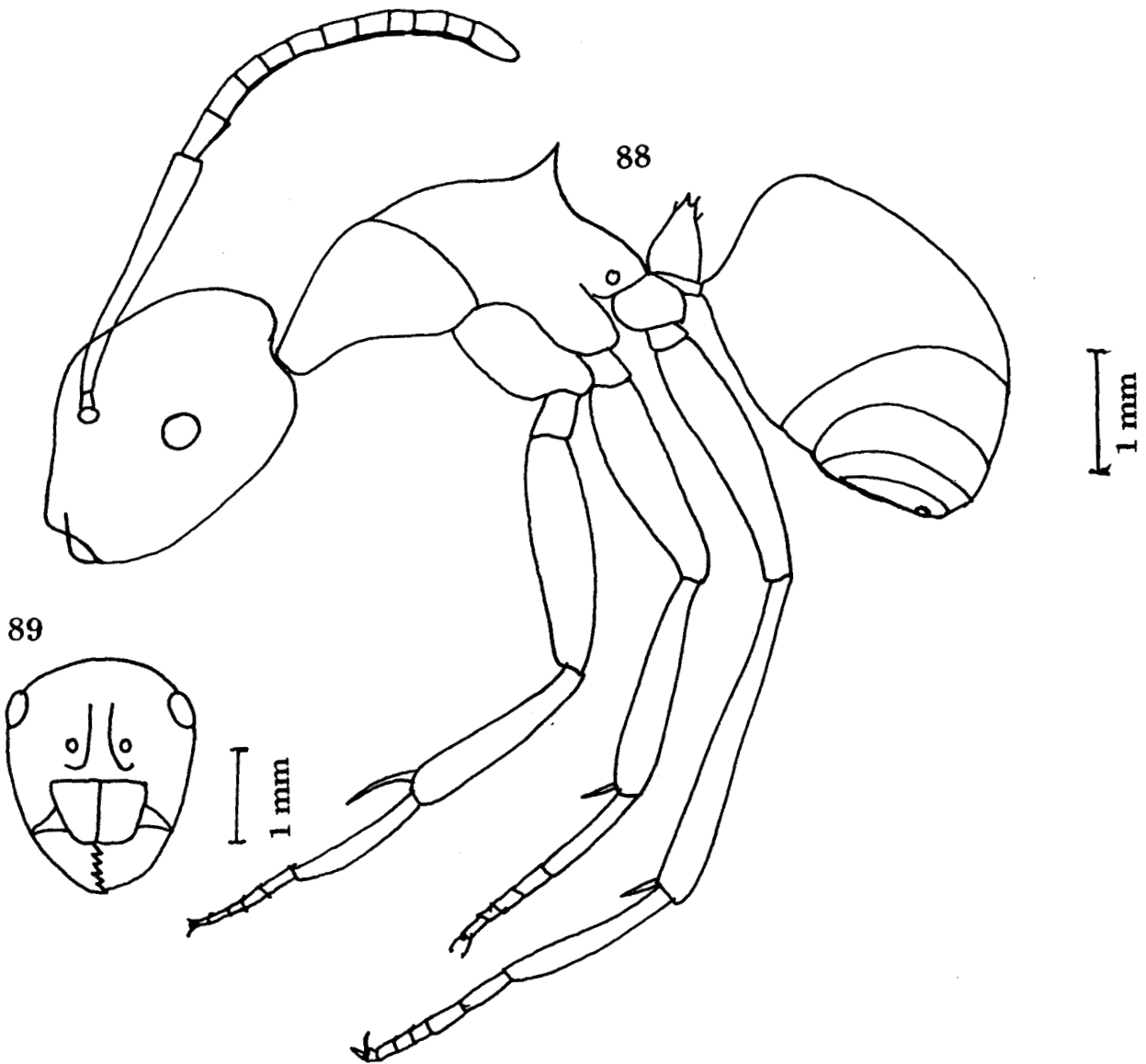
021



Figs. 86 - 87. *Oecophylla smaragdina* [Fabricius]  
86. Body profile  
87. Head front view

69

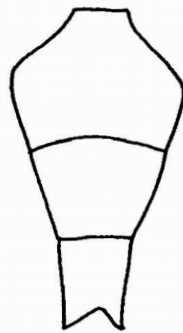
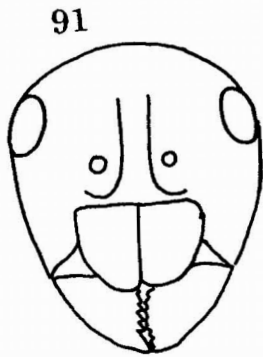
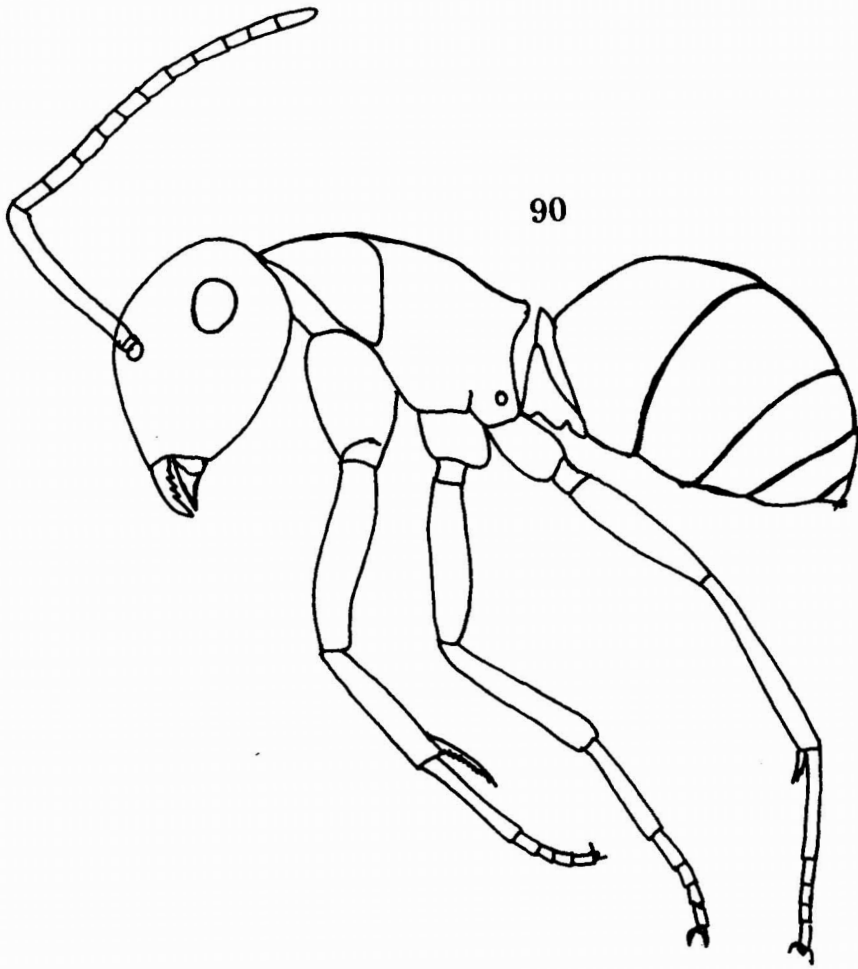
922



Figs. 88 - 89. *Polyrhachis exercita exercita* [Walker]

- 88. Body profile
- 89. Head front view

62



Figs. 90 - 92.

*Polyrhachis exercita rastrata* Emery

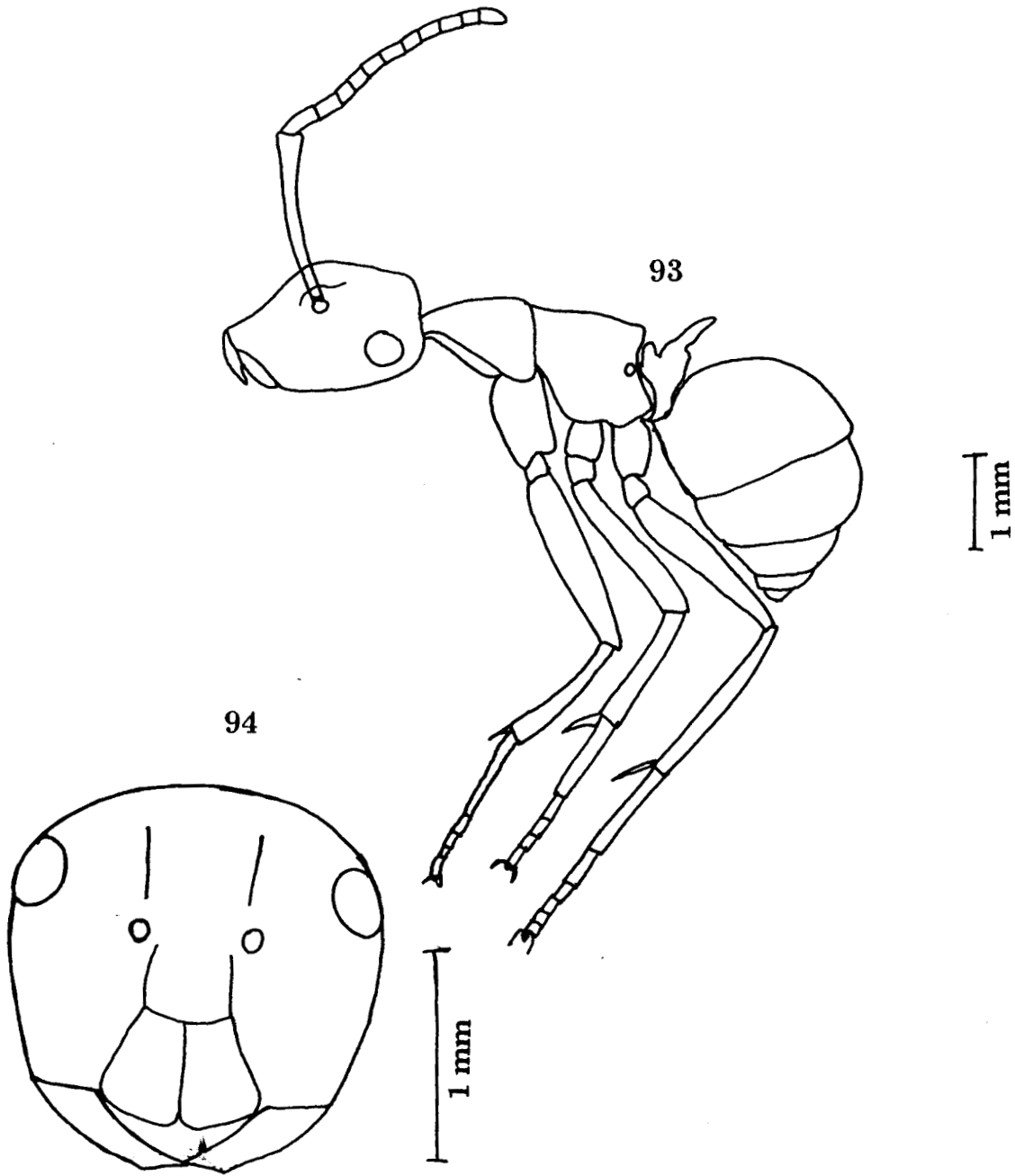
90. Body profile

91. Head front view

92. Thorax dorsal view

64

024



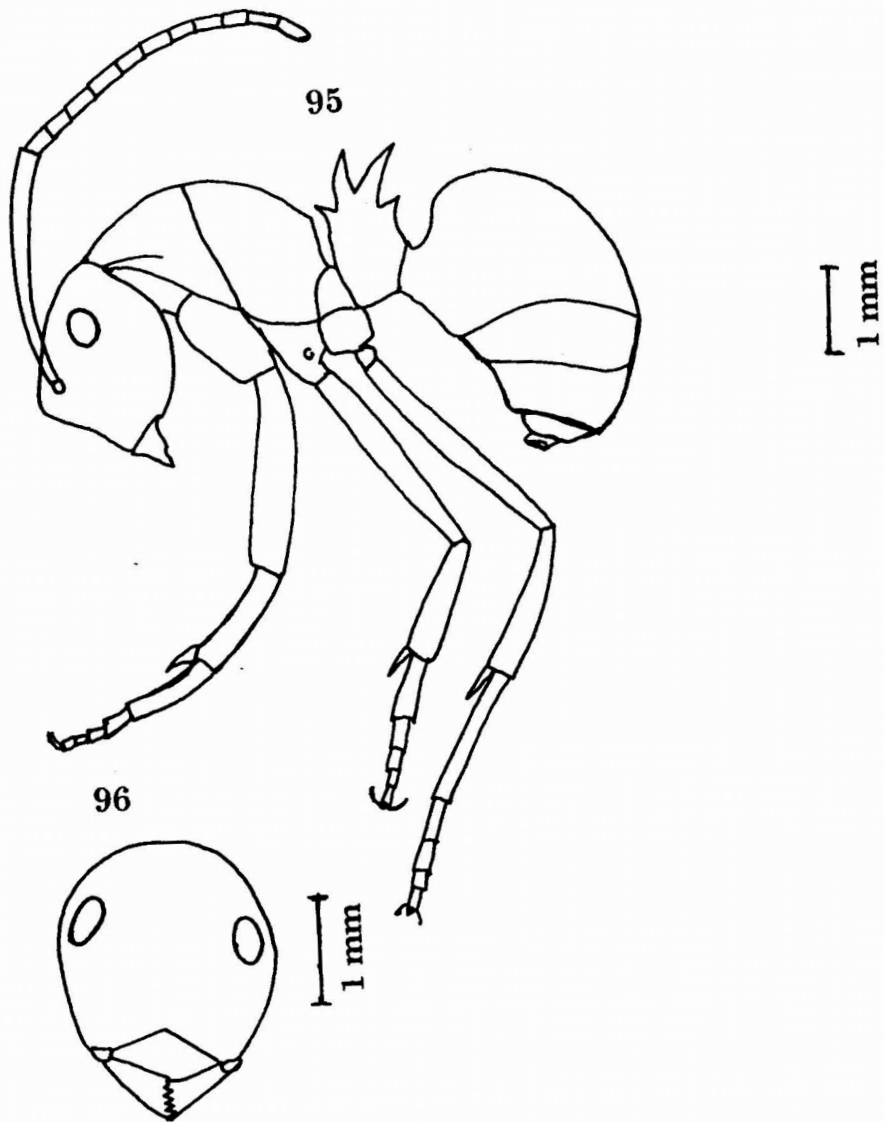
Figs. 93 -94. *Polyrhachis halidayi* Emery

93. Body profile

94. Head front view

65

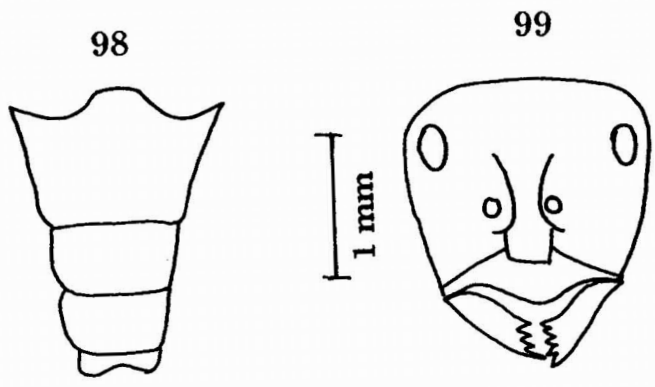
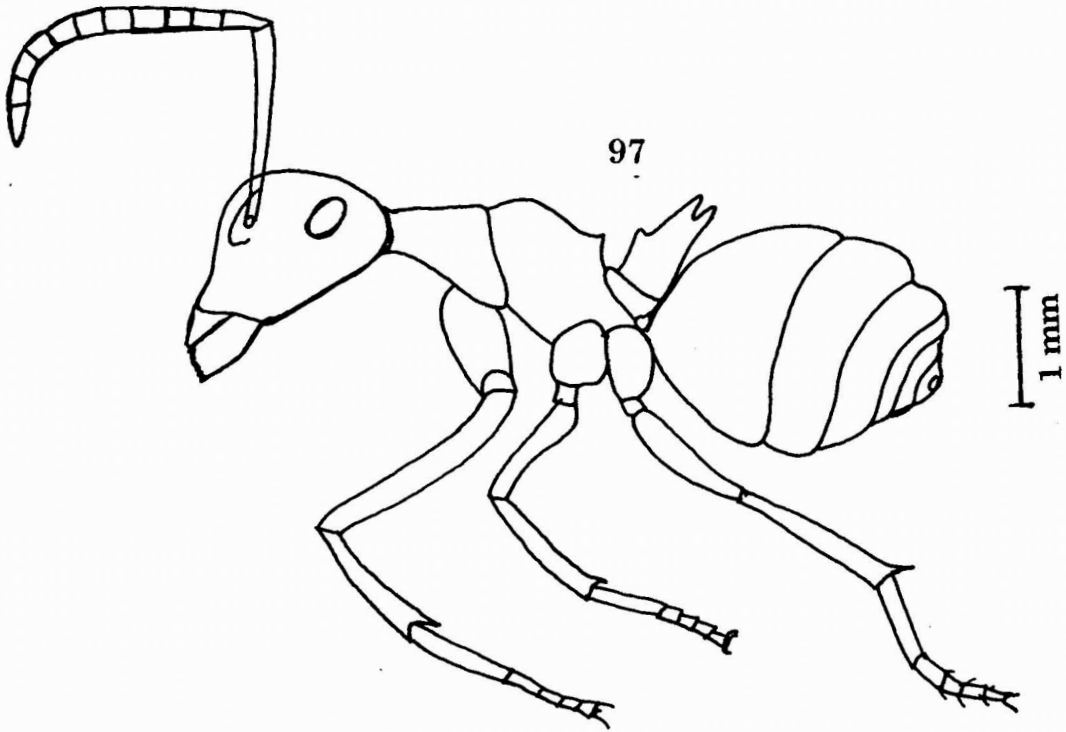
025



Figs. 95 - 96. *Polyrhachis illaudata illaudata* Walker

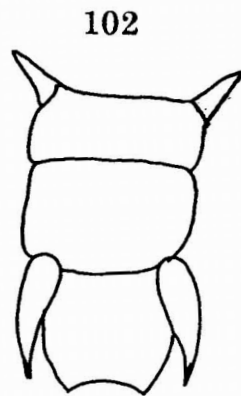
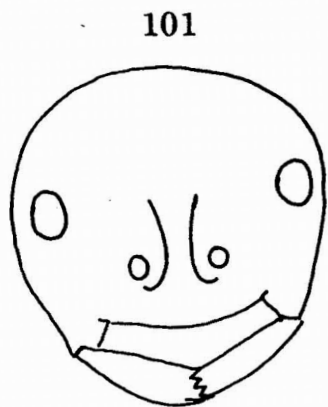
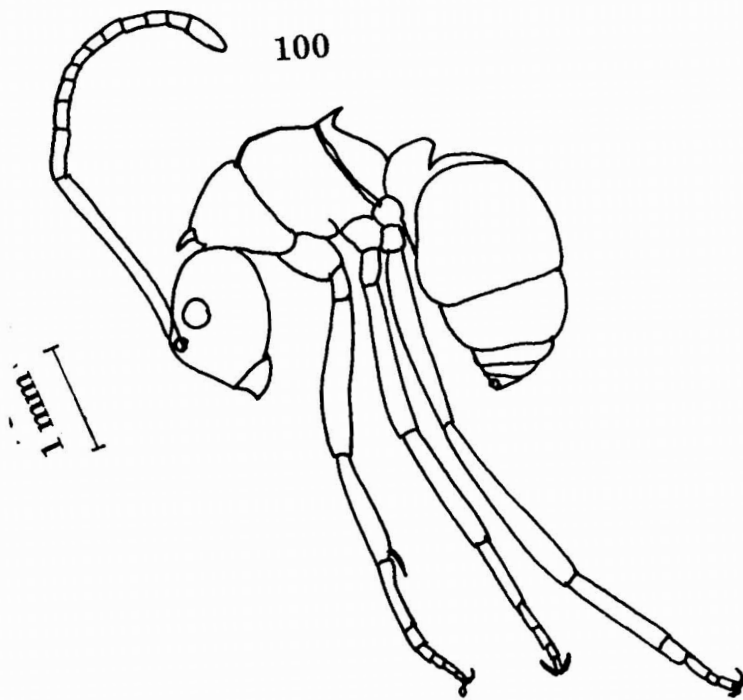
- 95. Body profile
- 96. Head front view

A26



Figs. 97 - 99. *Polyrhachis illaudata intermedia* Forel.

- 97. Body profile
- 98. Thorax dorsal view
- 99. Head front view

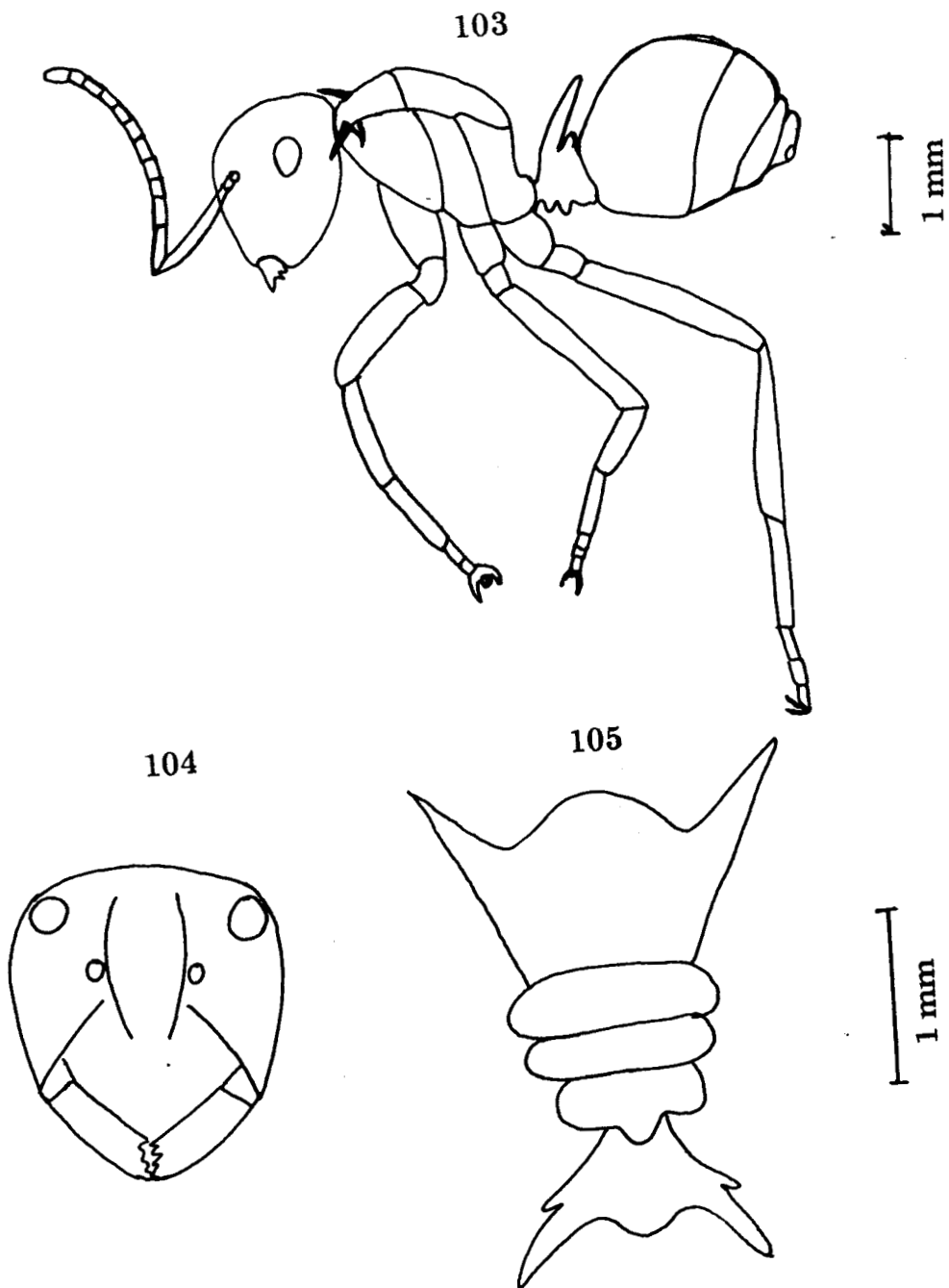


Figs. 100 - 102. *Polyrhachis lacteipennis* Smith, F.

100. Body profile

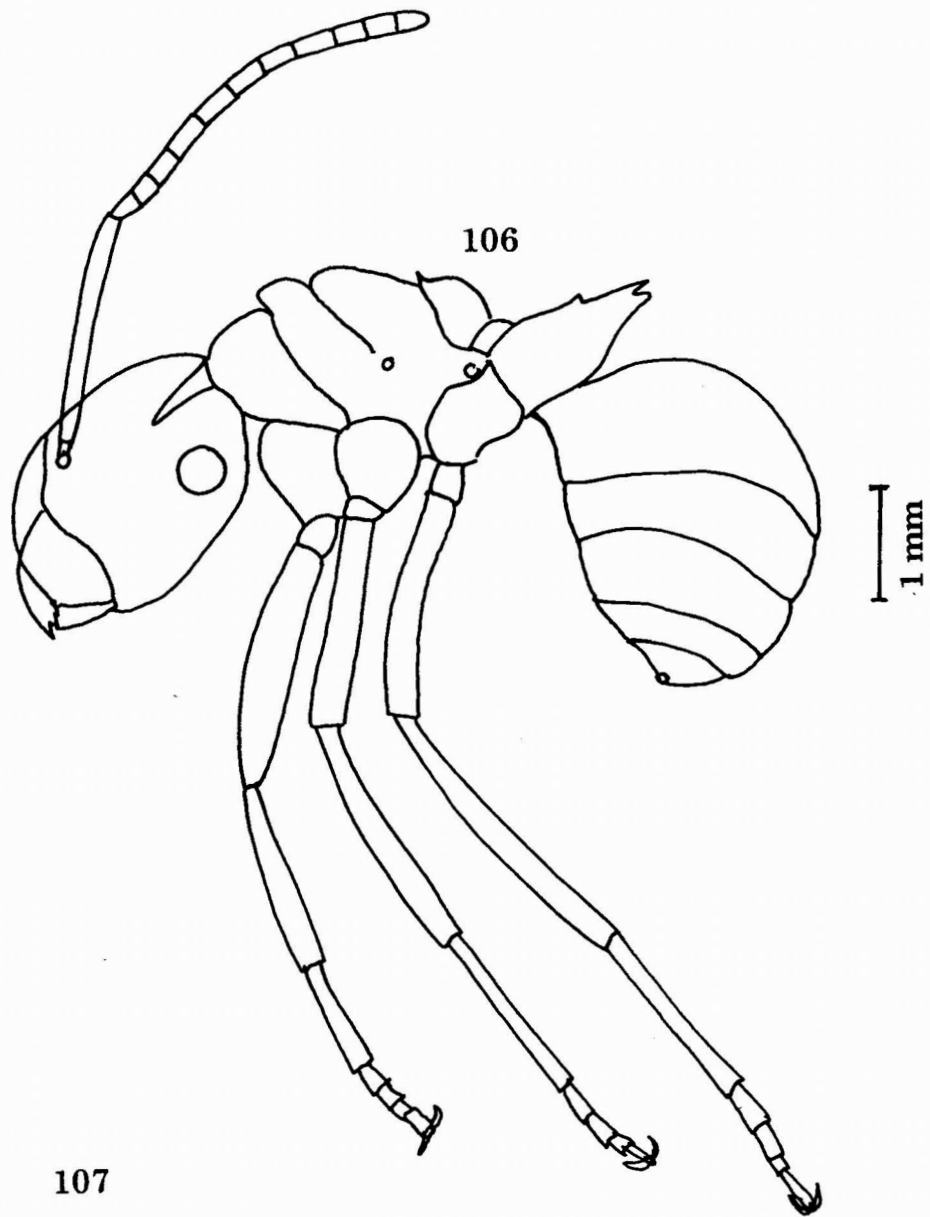
101. Head front view

102. Thorax dorsal view

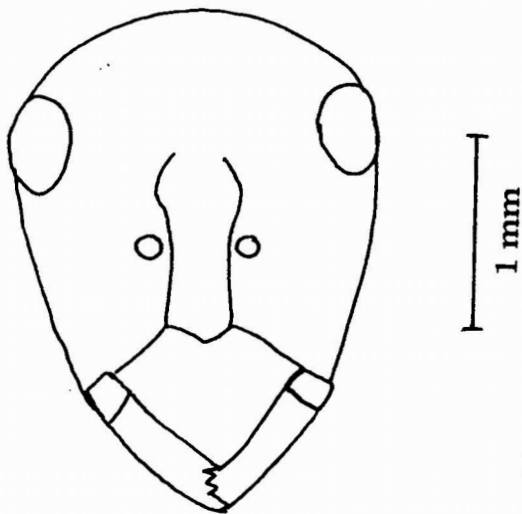


Figs. 103 - 105. *Polyrhachis malabarensis* sp. nov.

- 103. Body profile
- 104. Head front view
- 105. Thorax and petiole dorsal vi



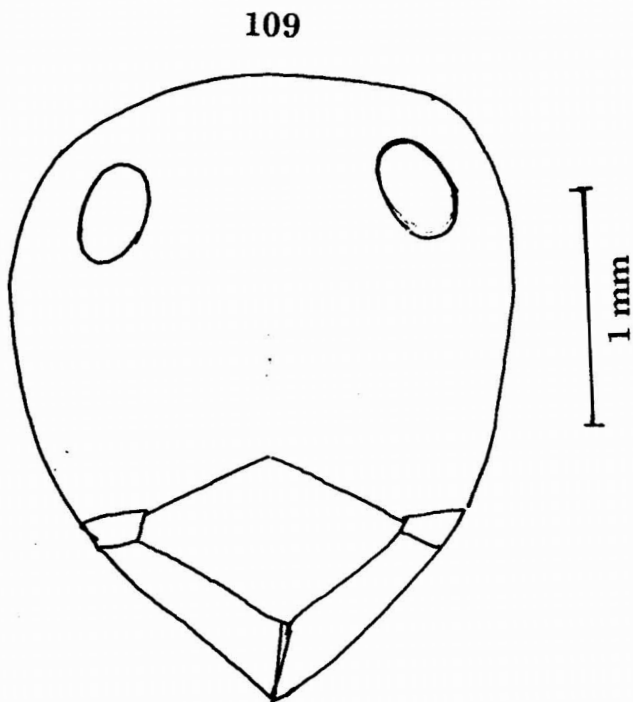
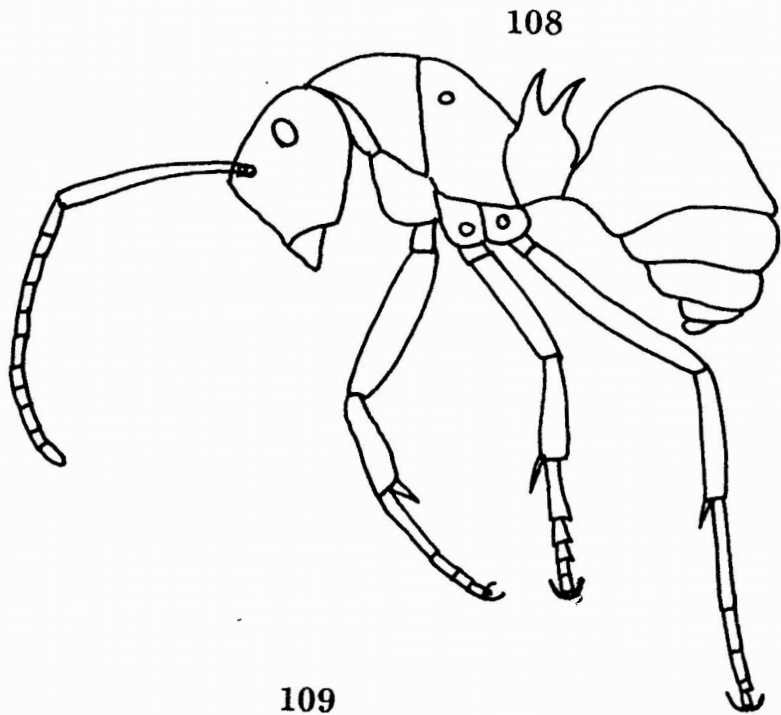
107



Figs. 106 - 107. *Polyrhachis proxima proxima* Roger

106. Body profile

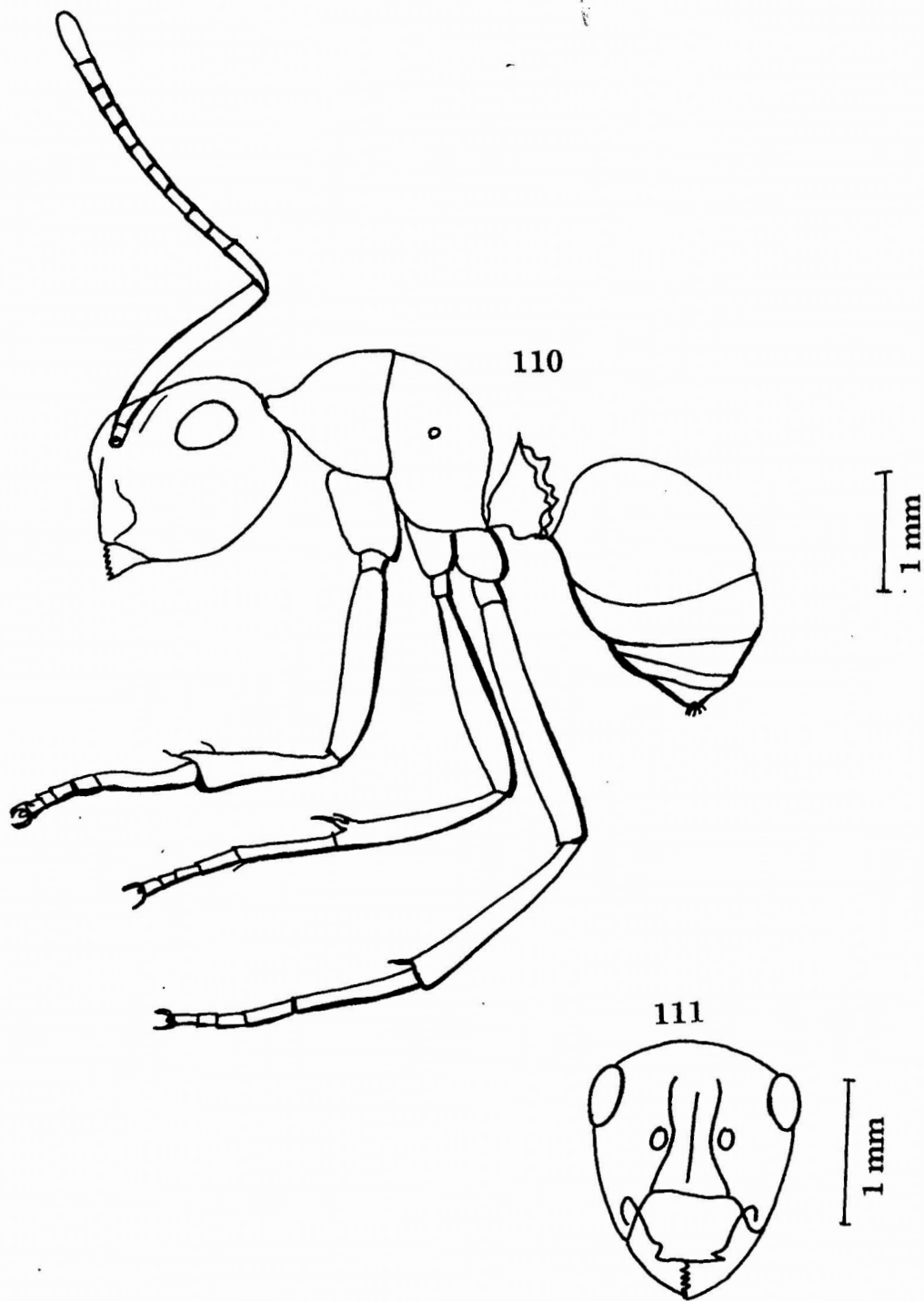
107. Head front view



Figs. 108 - 109. *Polyrhachis punctillata punctillata* Roger

108. Body profile

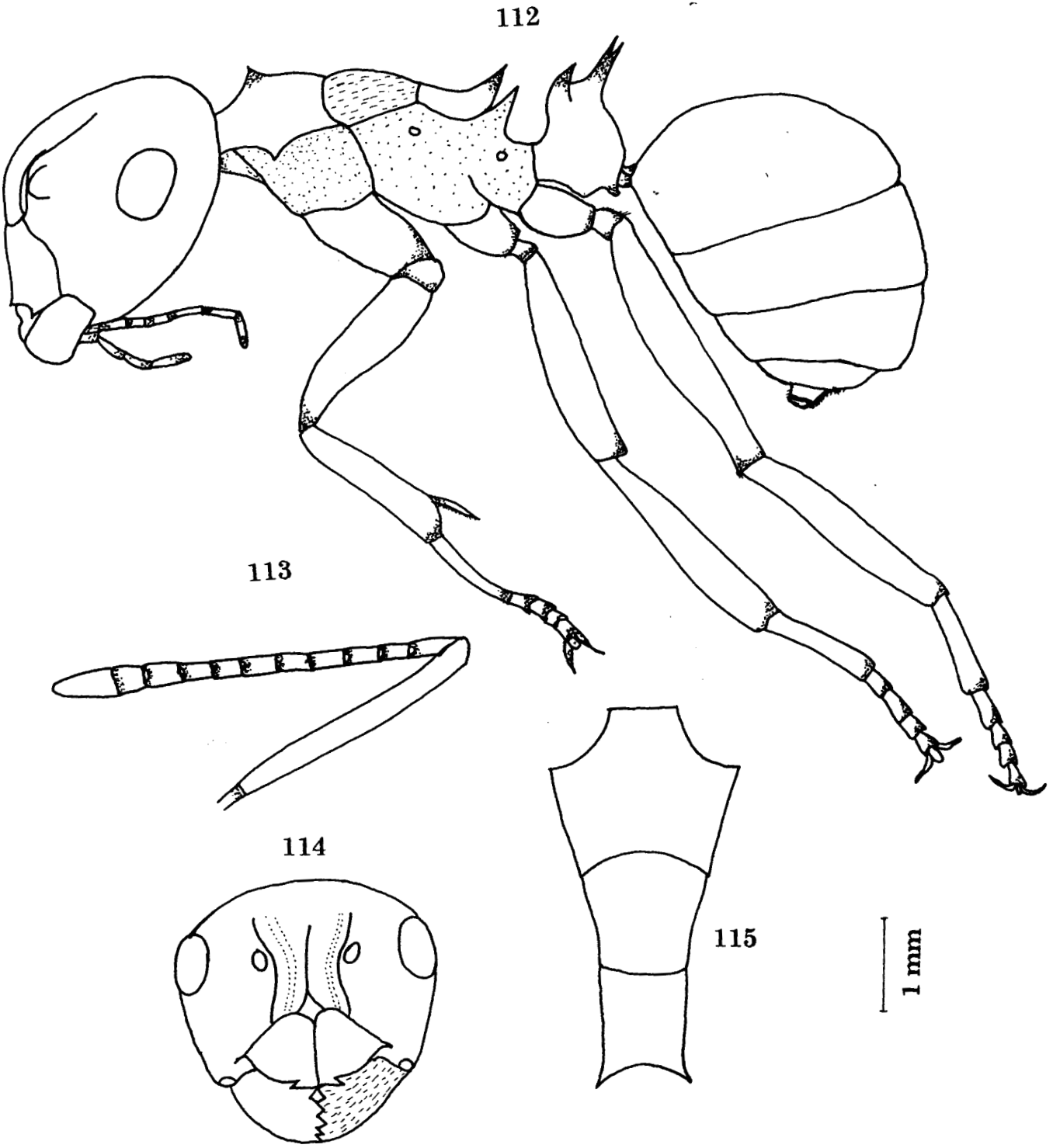
109. Head front view



Figs. 110 - 111. *Polyrhachis rastellata rastellata* [Latreille]

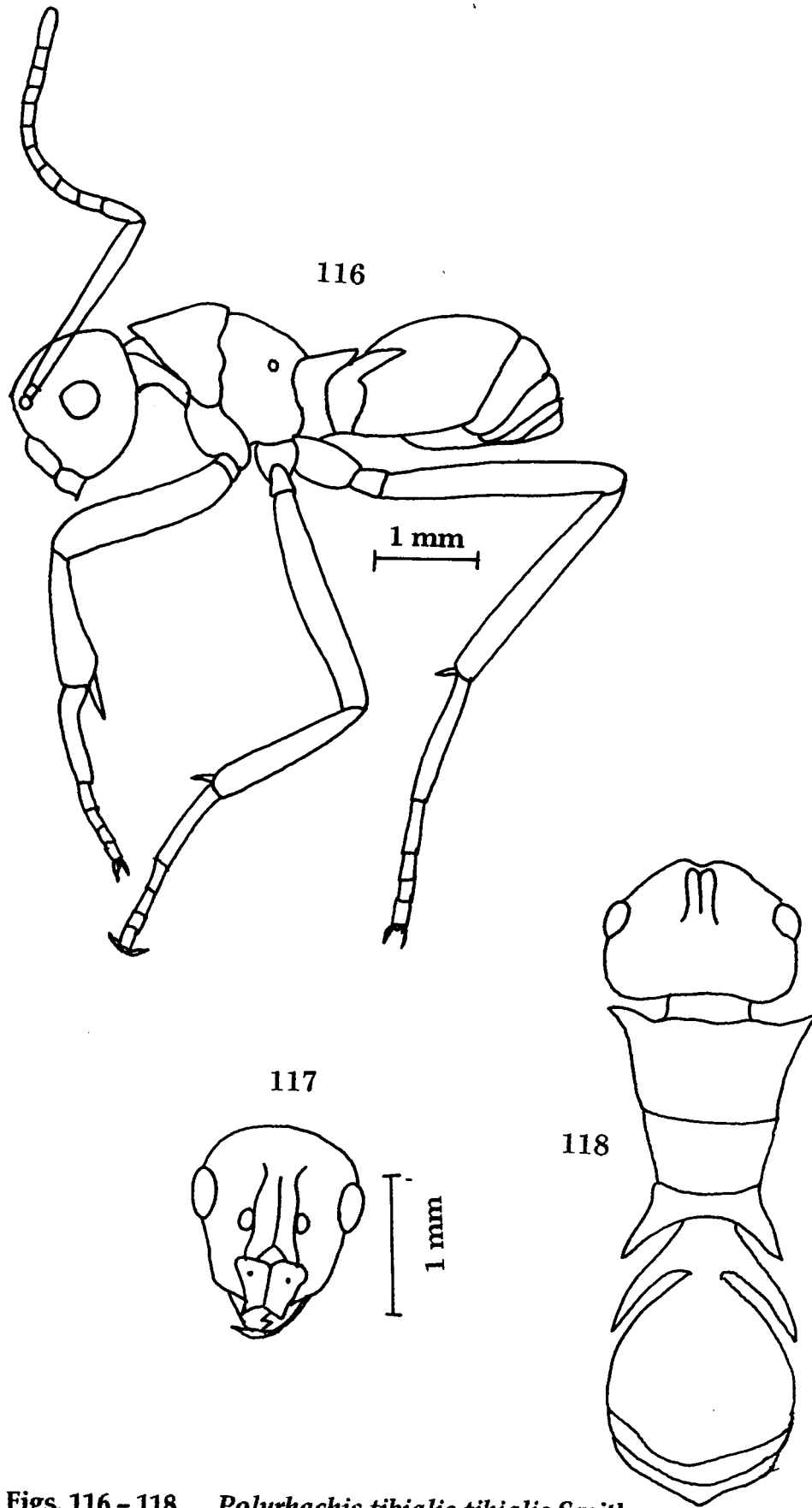
110. Body profile

111. Head front view



Figs. 112 - 115. *Polyrhachis thrinax thrinax* Roger

- 112. Body profile
- 113. Antenna
- 114. Head front view
- 115. Thorax dorsal view

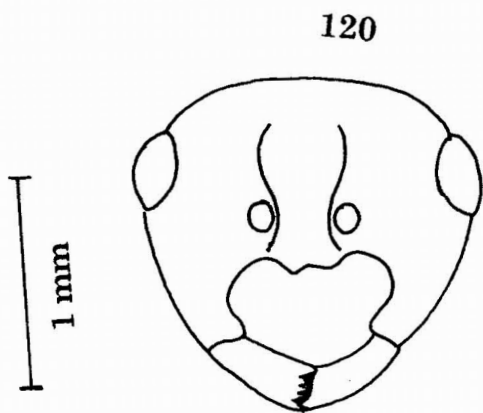
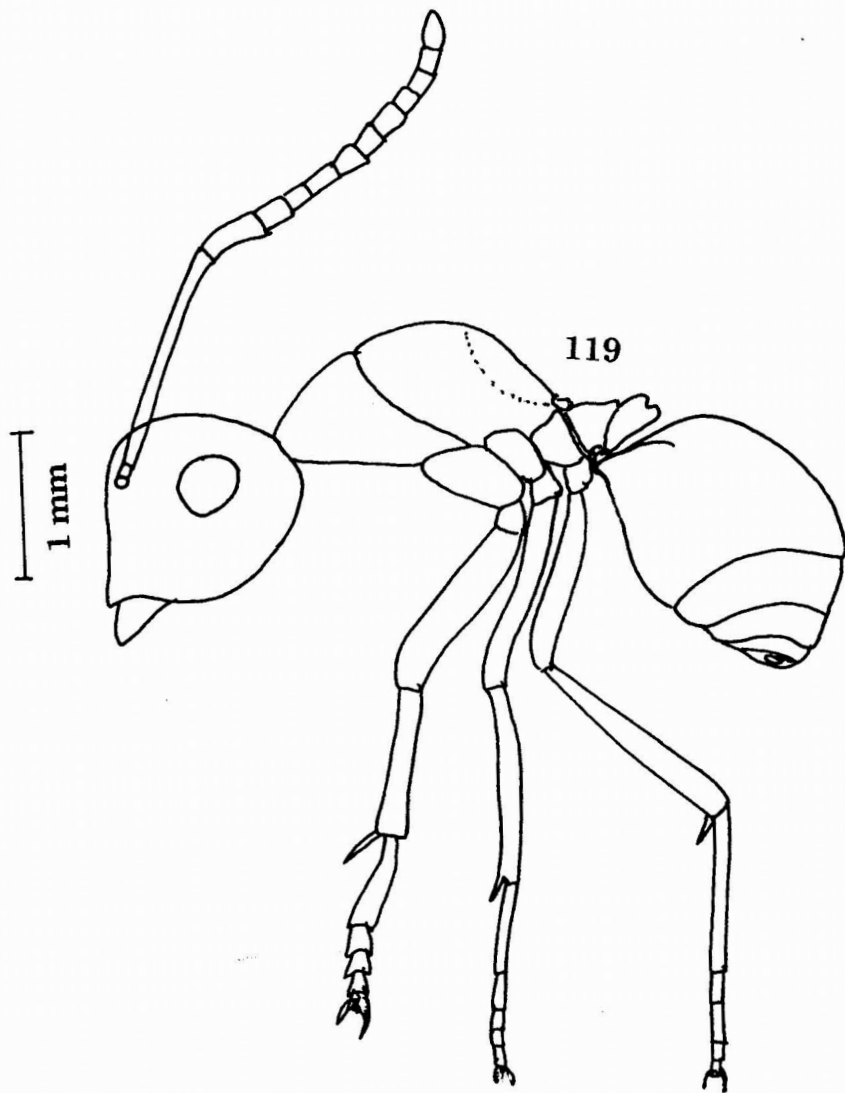


Figs. 116 - 118. *Polyrhachis tibialis tibialis* Smith

116. Body profile

117. Head front view

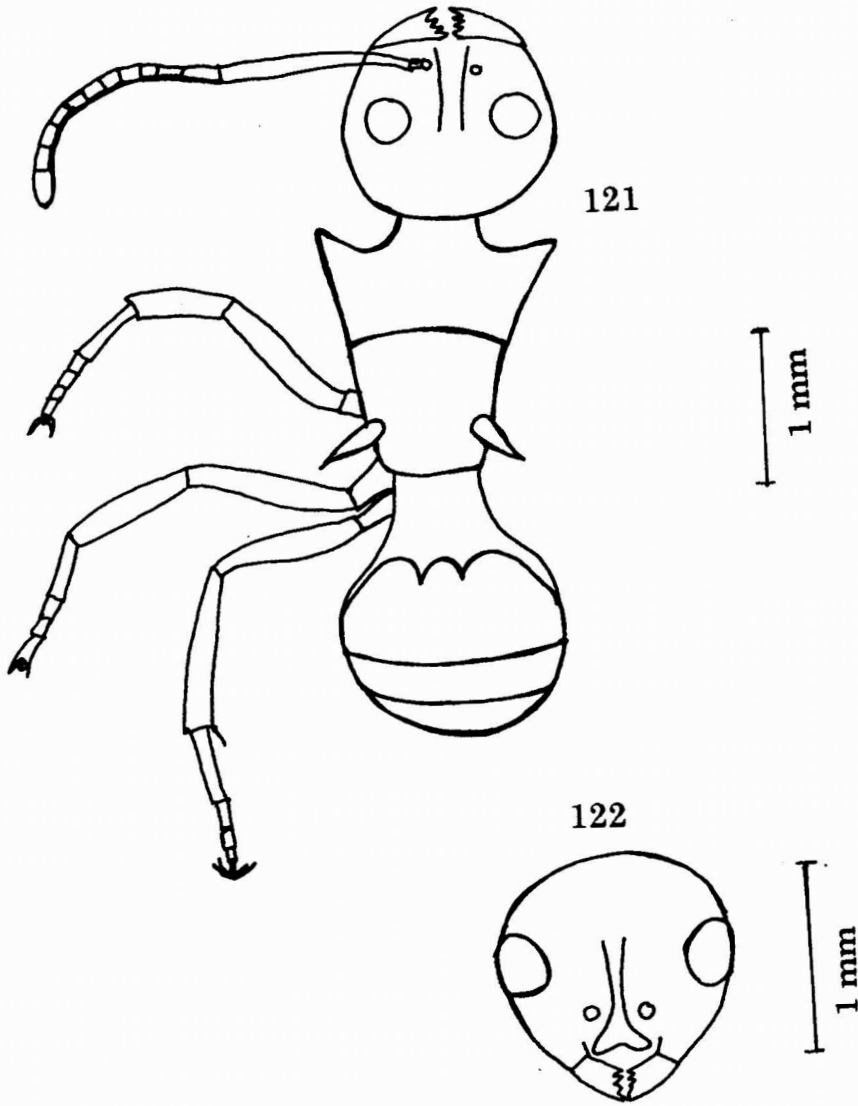
118. Body dorsal view



Figs. 119 - 120. *Polyrhachis travancoricus* sp. nov.

119. Body profile

120. Head front view

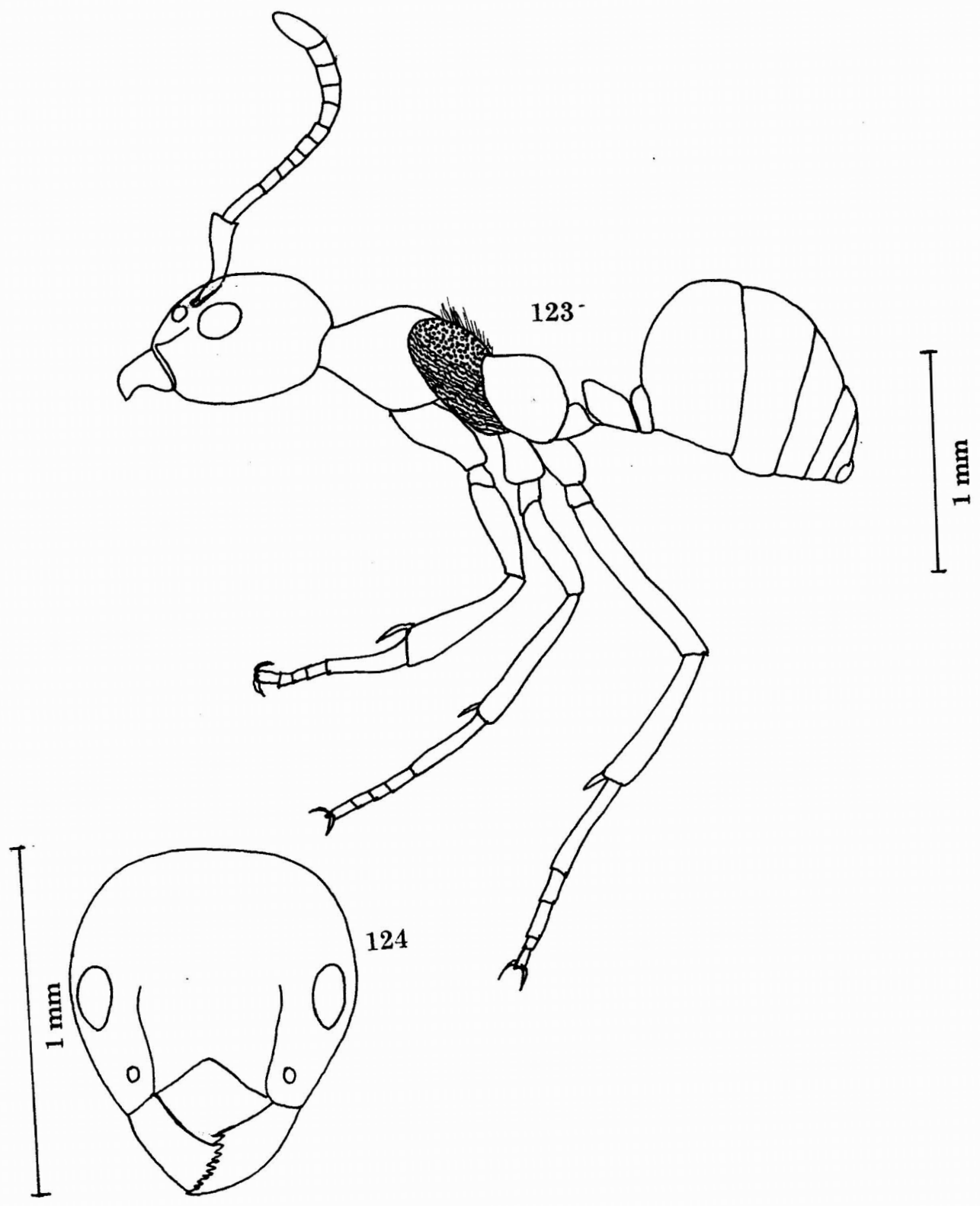


Figs. 121 - 122. *Polyrhachis wroughtonii* Forel

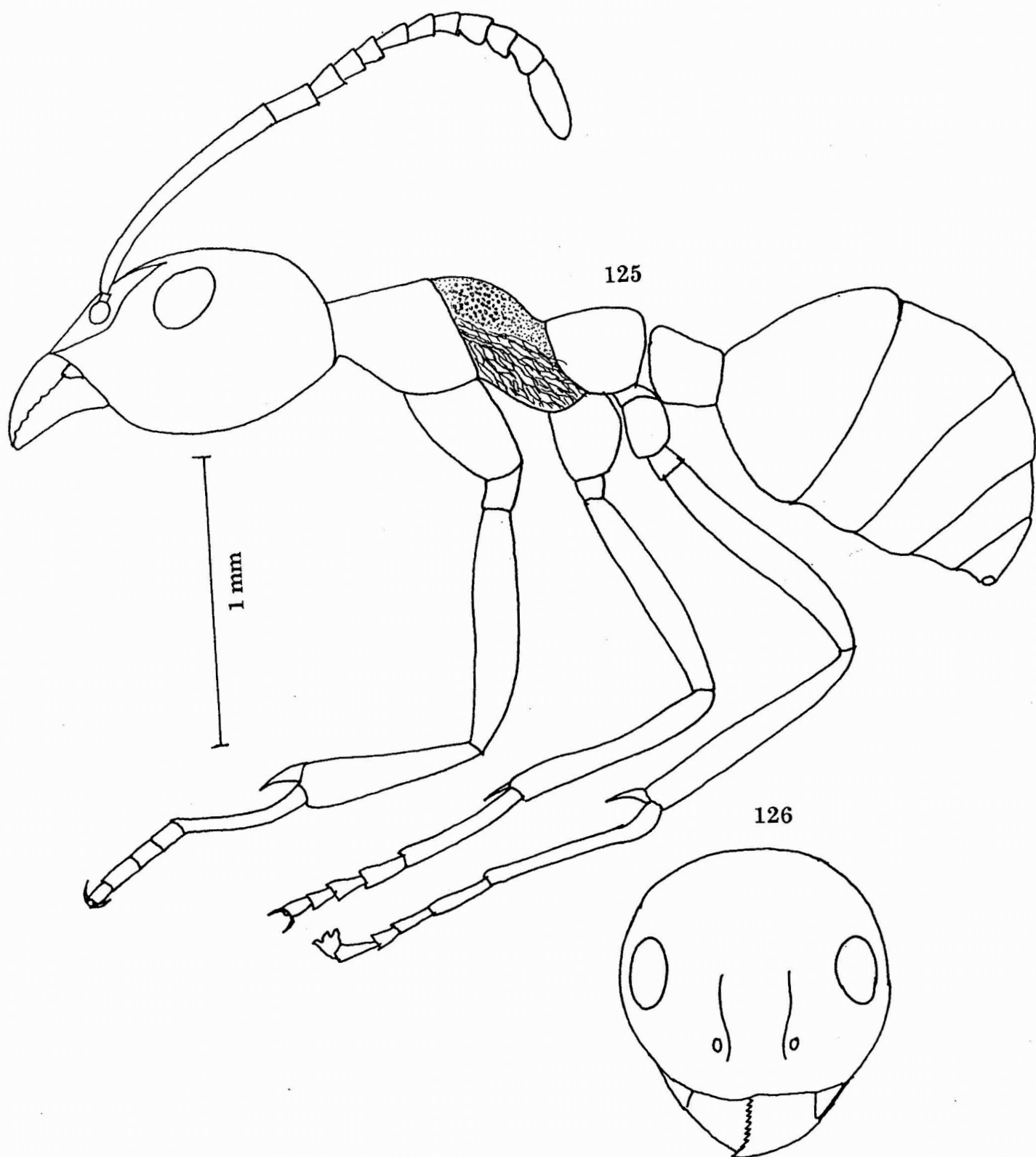
121. Body dorsal view

122. Head front view

936



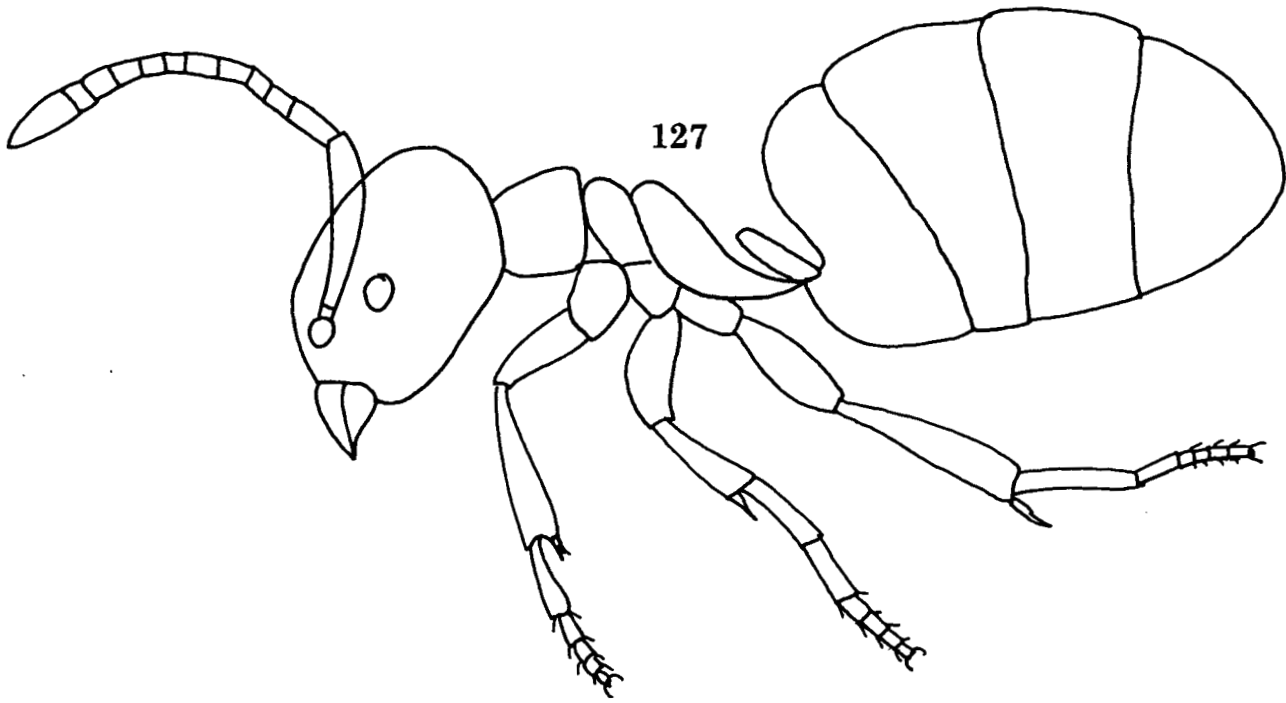
Figs. 123 - 124. *Dolichoderus bituberculatus* [Mayr]  
123. Body profile  
124. Head front view



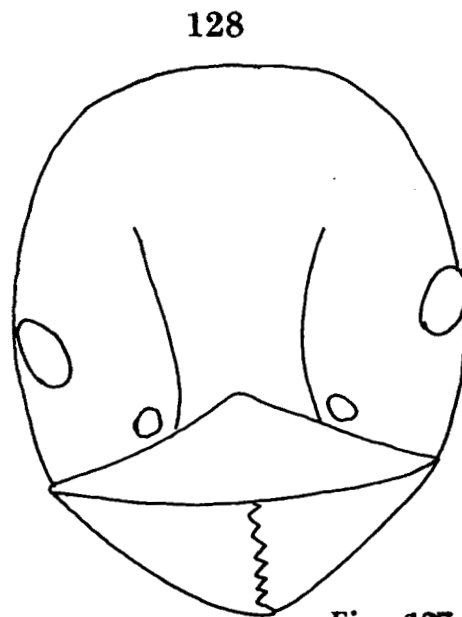
Figs. 125 - 126. *Dolichoderus burmanicus* Bingham

125. Body profile

126. Head front view



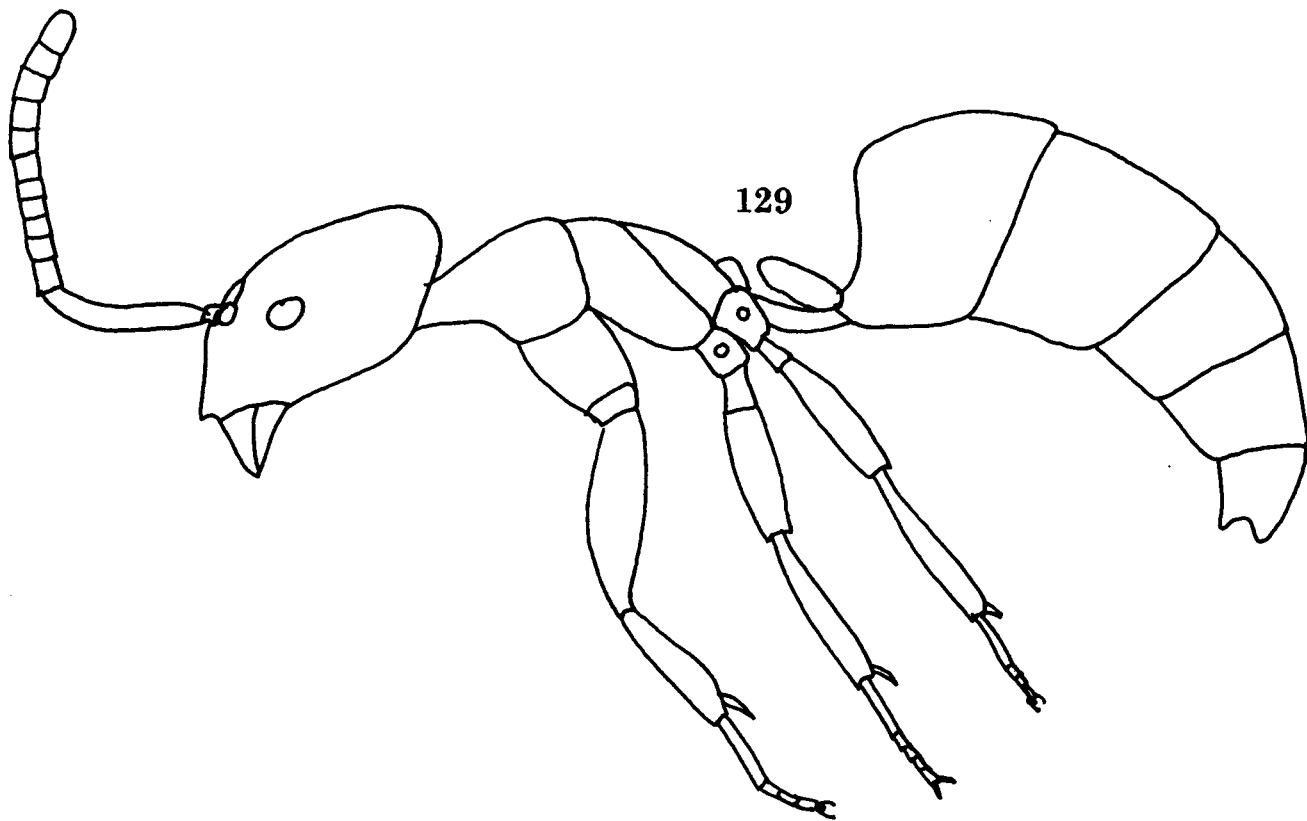
0.5 mm



Figs. 127 - 128. *Tapinoma indicum indicum* Forel

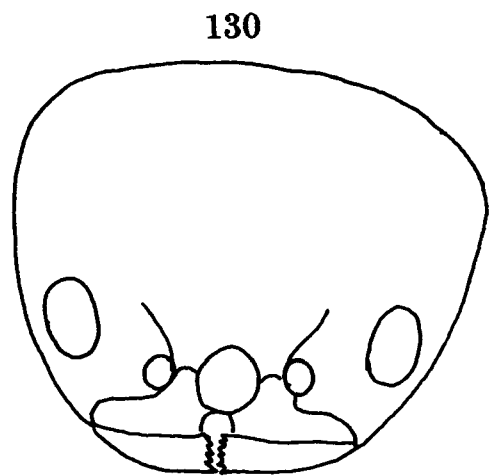
127. Body profile

128. Head front view



129

0.5 mm



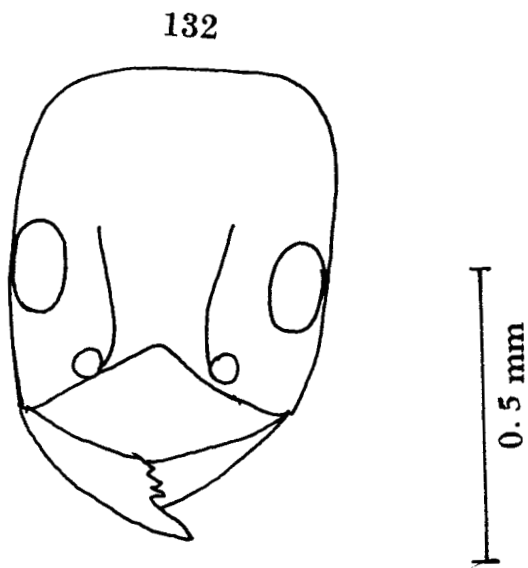
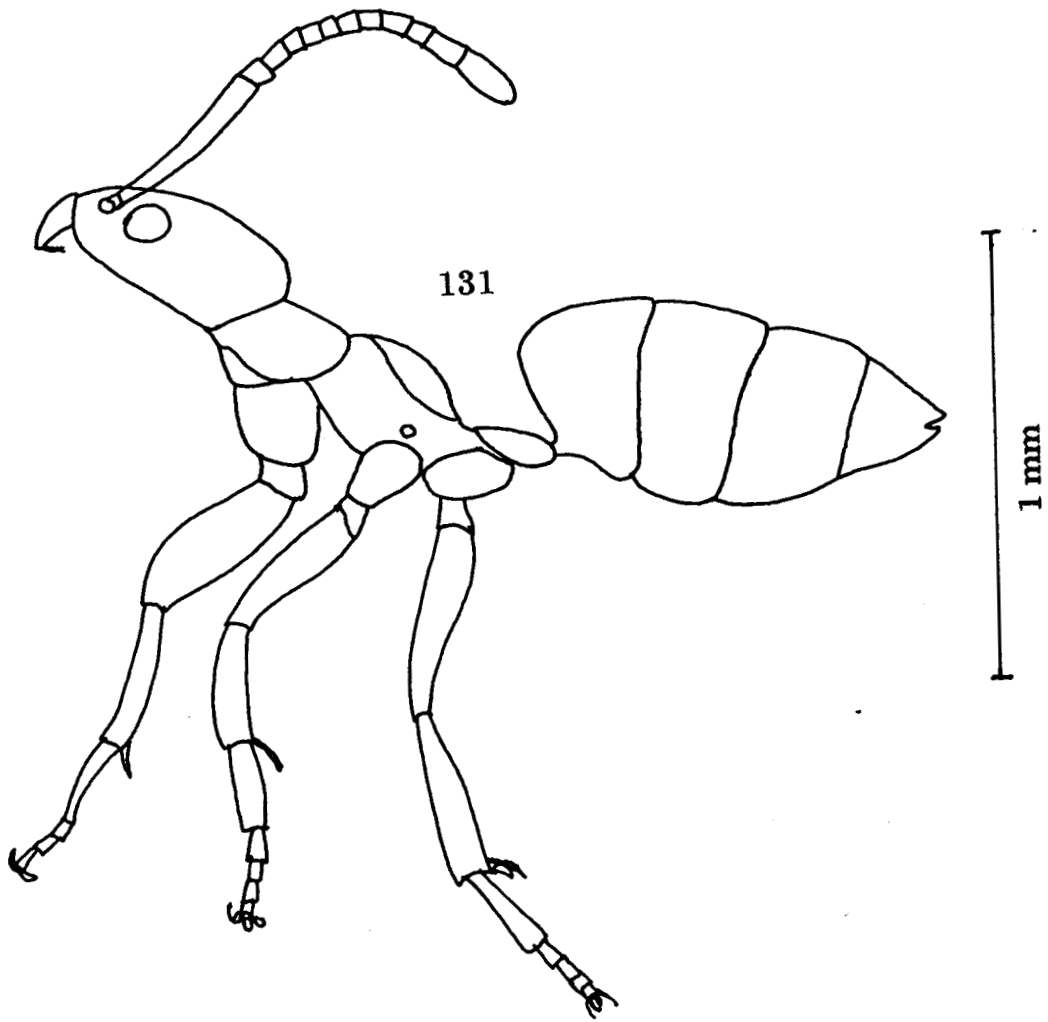
130

0.5 mm

Figs. 129 - 130. *Tapinoma melanocephalum melanocephalum* [Fabricius]

129. Body profile

130. Head front view

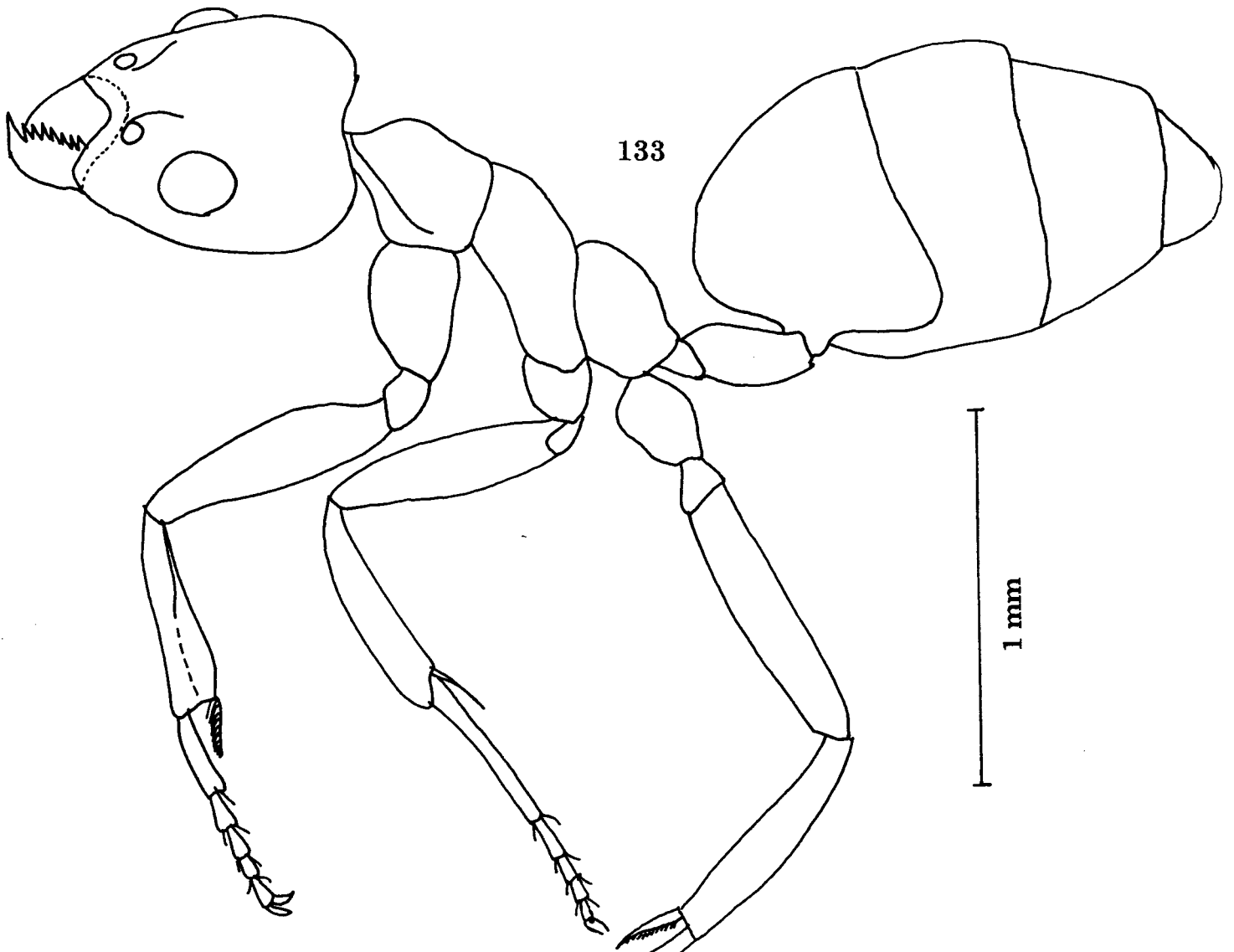


Figs. 131 - 132. *Technomyrmex albipes albipes* [Smith]

131. Body profile

132. Head front view

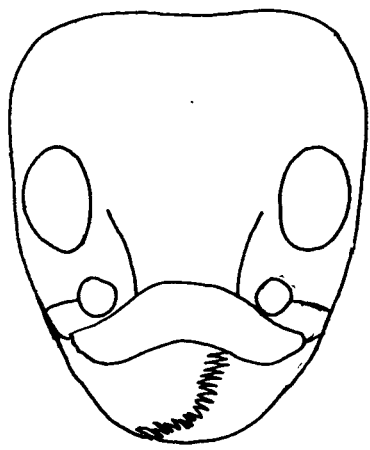
1341



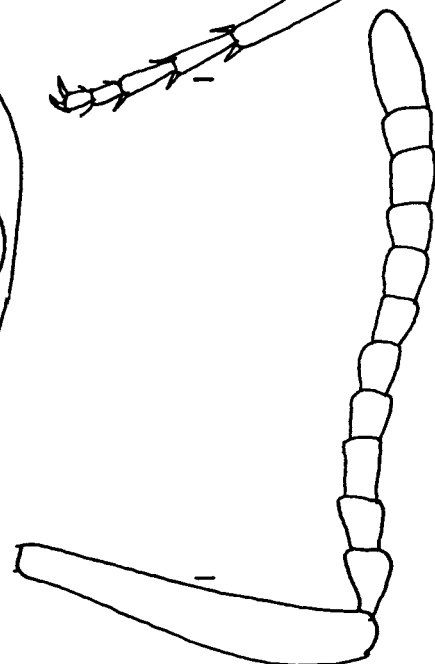
133

1 mm

135

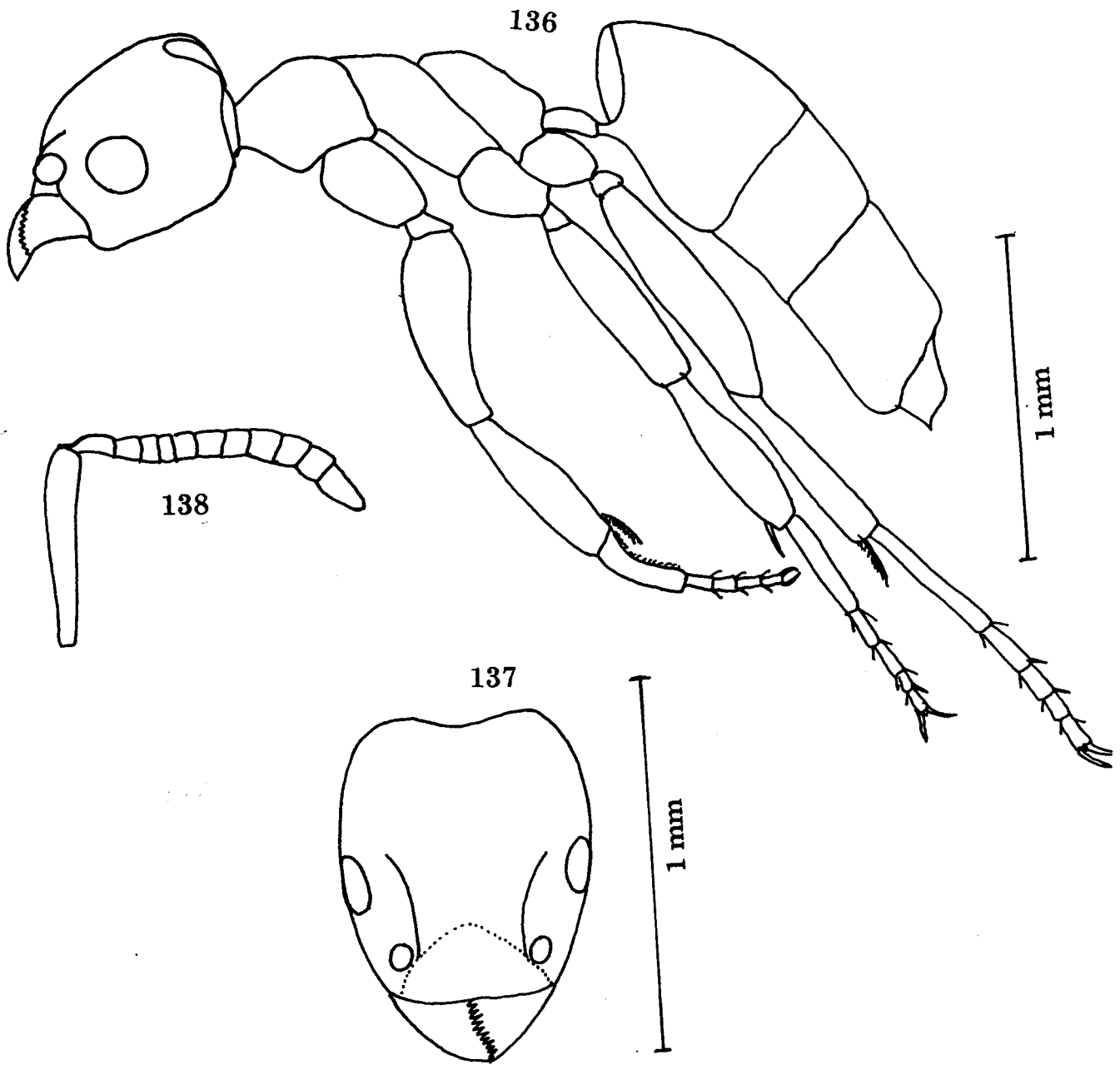


134



Figs. 133 - 135.  
*Technomyrmex bicolor bicolor* Emery

- 133. Body profile
- 134. Antenna
- 135. Head front view



Figs. 136 - 138. *Technomyrmex eliator* Forel

- 136. Body profile
- 137. Head front view
- 138. Antenna

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**Publications**

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**A NEW SPECIES OF *PARURIOS* GIRAULT (HYMENOPTERA :  
PTEROMALIDAE : DIPARINAE) FROM KERALA (INDIA)**

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**ABSTRACT**

A new species of *Parurios keralensis* Narendran sp. nov. is described from India and compared with its closest relatives.

**Keywords:** *Parurios*, New species, Pteromalidae

**INTRODUCTION**

The genus *Parurios* was erected by Girault (1913) with the type-species *Parurios australiana* Girault from New South Wales, Australia. Boucek (1988) synonymized *Uriolelaps* Girault and *Emersonia* Girault with *Parurios* Girault. Farooqui and Subba Rao (1986) catalogued the Pteromalidae of India and the adjacent countries but did not mention the genus *Parurios* Boucek (1988) stated that one Indian species (probably an undescribed species) reared from the curculionid *Anthesapeuta cyperi* Marshall feeding on roots of *Cyperus rotundus* Linnaeus. In this paper an undescribed species of *Parurios* from Kerala is described and its affinities are discussed. It is surprising that out of several specimens collected, only one single female (Holotype here) is obtained.

***Parurios keralensis* Narendran sp. nov.**  
(Figs. 1-3)

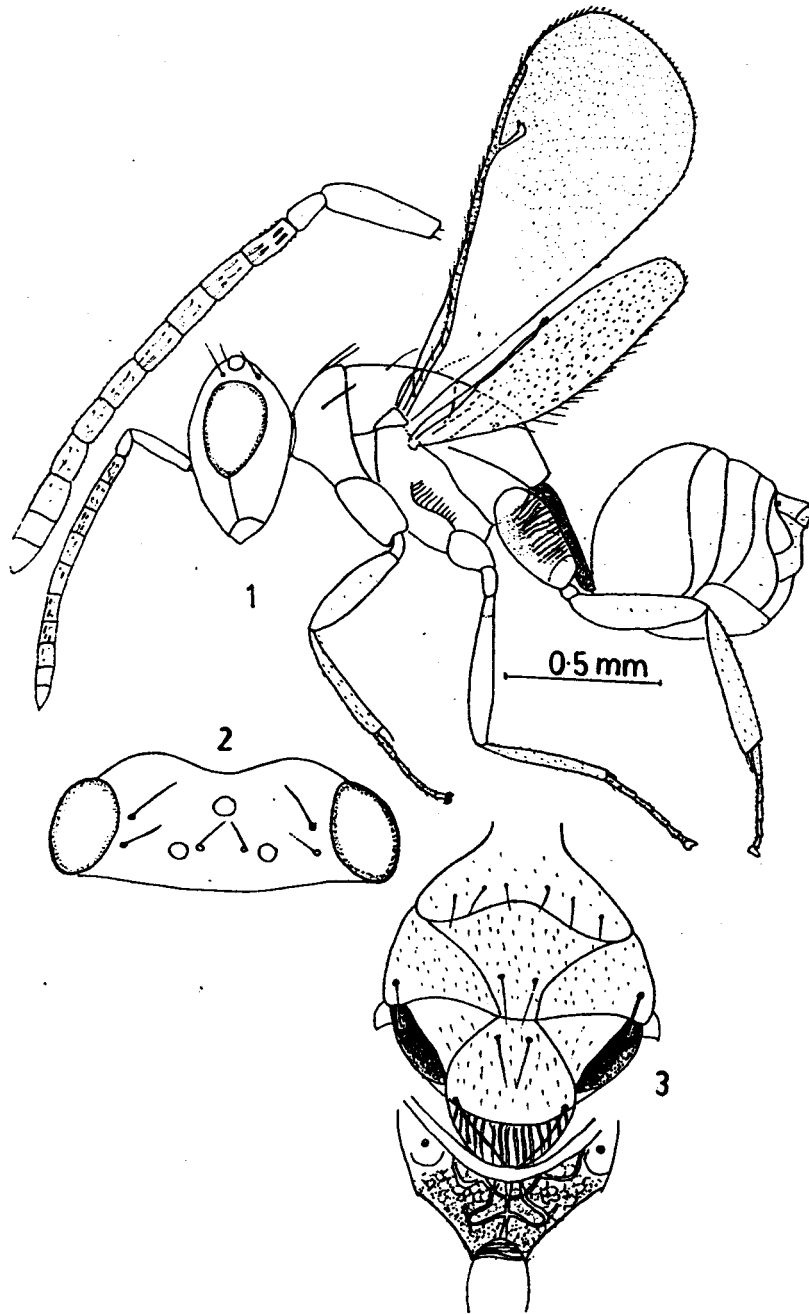
**Holotype :** Female length 2.07 mm. Head and mesosoma black with slight metallic bluish tinge; hind ocelli brown; front ocellus pale reflecting yellow; antenna dark brown with scape pale brown; eye grey; fore and mid coxae blackish brown; hind coxa black; remaining parts of legs pale yellow with

median part of femora darker; pretarsi dark brown; tegula pale brown; gaster brownish black with sternites pale brown. Wings hyaline with veins pale brownish yellow. Pubescence dirty white but longer setae brownish black.

**Head :** Width in front view 1.3x its length; width in dorsal view 3x its median length, frons, face and vertex reticulate; scrobe moderately deep on its lower half, upper half vague, margins not delimited, merging with frons; basal half of scrobe smooth with a median international carina; clypeus with anterior margin slightly arcuate; mandibles tridentate; maximum diameter of eye in profile about 1.8x length of malar sulcus in profile; POL a little more than 1.2x OOL; vertex with 3 pairs of bristles directed forward. Antenna inserted slightly above level of ventral margin of eyes; anellus indistinct; scape not reaching front ocellus. Relative measurement of Length : Width of antennal segments : Scape = 33:8; pedicel = 10.7; F1 = 13.5:7; F2 = 13:7; F3 = 13:7, F4 = 13:7; F5 = 13:7; F6 = 12:6.5; F7 = 11:7; Clava = 27:8.

**Mesosoma :** Pronotum with a row of long setae directed backwards; mesoscutum with a pair of long setae located mid-dorsally; scutellum with a pair of setae near base;

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**A new species of *parurios girault* (Hymenoptera : Pteromalidae : Diparinae) ...**

pronotum, mesoscutum and scutellum rugosoreticulate; frenum with several longitudinal carinae, notanli complete; prepectus rugulose; hind coxa strongly striate dorsally; propodeum with a median carina (Fig. 3), costula present, surface of propodeum strongly reticulo-punctate.

**Gaster :** length (including petiole) 1.3x length of mesosoma; petiole strongly microsculptured, distinctly longer than hind coxa (Fig.1), its base wider than its apex, 2.5x as long as broad (at its middle width); tergites smooth; T1 largest; epipygium rugulose.

**Male :** Length 2-2.3 mm. Similar to female except in having: bristles stronger; gastral petiole relatively longer than that of female; only T1 visible, other tergites retracted in most specimens (except one male from Aligarh and one male from Kasaragod district).

**Host :** Unknown.

**DISTRIBUTION**

India: Kerala: Moolamattom, Nilambur, Malampuzha, Calicut, Calicut University campus, Anappady (Near Parambikulam), Muthanga (S. batheri), Peravoor, Anakampoil, Amalagiri, Majeswaram; Uttar Pradesh : Aligarh.

**MATERIAL STUDIED**

**Holotype :** Female: INDIA, Kerala, Moolamattom, 30.xi.1989 T.C. Narendran (DZCU). **Paratypes :** 1 male of same data of holotype; 1 male: Kerala, Nilambur, 2.iv.1989, T.C. Narendran; 1 male: Kerala, Calicut Uni. Campus, 28. lii. 1990, T.C. Narendran, 1 male; Calicut Uni. Campus, 24.vii.1995.S.Sheela; 1 Male: Kerala, Malampuzha, 11.xii. 1987, T.C. Narendran & Party; 1 male: Kerala, Calicut, Tiruvannur, 23.11.1996. K. Mohana; 1 male: Calicut Uni. Campus. 25.iii.1990, T.C.

Narendran; 1 male: Kerala, Anappady (Nr. Parambikulam) (DST. Rs. tour), 6.v.1989, T.C. Narendran & Party; 1 male: Kerala, Anakampoil, 17.x.1995, T.V.Mini; 2 males, Kerala: Muthanga, 6.x.1995, T.V.Mini; 1 male, Kerala, Aralam, 17.xii.1995, T.V.Mini; 1 male: Kerala, Peravoor (Kannur), 25.11.1988, P.M. Sureshan; 1 male. Kerala, Kovalam, 28.11.1989, P.M. Sureshan; 1 male: Kerala, Manjeswaram (Kasaragod district), 23.iv.1985, T.C. Narendran; 2 male, Kerala, Amalagiri, 28.11.1988, T.C. Narendran & Party; 1 male: Uttar Pradesh, Aligarh, viii.1983, S.S. Islam. All types in DZCU.

**DISCUSSION**

*Parurios australiana* Girault (Girault, 1913) resembles this new species in having antenna with anellus indistinct or absent; in having similar pairs of long setae on head and mesosoma and in having most of tergites (except T1) retracted in male gaster in majority of specimens. However *P.australiana* Girault differs from *P.keralensis* in having :

1. Wings very small (wings well developed and normal in *keralensis* Narendran sp. nov).
2. STV and PMV subequal (in *keralensis* PMV distinctly longer than STV).
3. Disc of forewing with large fuscous cloud from the distal third of MV (in *keralensis* without such fuscous cloud)
4. Propodeum not punctate (in *keralensis* propodeum rugoso-punctate).
5. Gastral petiole longitudinally striate (in *keralensis* not striate but microsculptured)

*Parurios atriscutum* (Girault) (Girault, 1933) differs from *P.keralensis* in having:

- 1) with distinct anellus present (in *keralensis* anellus indistinct or absent);
- 2) second and third segments of clava white (in *keralensis* dark brown)
- 3) F1 length equal to pedicel (in *keralensis* F1 distinctly longer than pedicel).

**ACKNOWLEDGEMENTS**

We thank the authorities of the University of Calicut, for facilities and financial assistance.

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## TWO NEW SPECIES OF *BARYCONUS* FORSTER (HYMENOPTERA:SCELIONIDAE) WITH A KEY TO INDIAN SPECIES

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### ABSTRACT

*Baryconus keralensis* Narendran, sp. nov. comes near *Baryconus diversus* Saraswat in general appearance but differs from that species in having frons with a single median carina in front of front ocellus diverging and joining either side of scrobe margin and T6 without spines on posteriolateral corners. *B.unidentatus* Narendran sp. nov. comes near *B.dunensis* Mukerjee in general appearance but differs from that species in having prepectus indistinct and T6 with 3 spines. A key to Indian species of *Baryconus* is provided.

**Key words:** Scelionidae, *Baryconus*, New species, Key.

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### INTRODUCTION

The genus *Baryconus* was erected by Forster (1856) with the type species is *Baryconus floridanus* Ashmead 1887). Johnson (1992) listed the known synonyms of this genus and they are *Haplotelia* Ashmead, *Racotelia* Cameron, *Trichanteris* kieffer and *Apegusoneura* Camerron. Mani (1936; 1975) described two species viz. *Baryconus gravelyi* (Mani) and *Baryconus marattus* Mani from India. Since then Saraswat described *Baryconus bhāratius* Saraswat & *Baryconus diversus* Saraswat (Saraswat & Sharma 1978) from India. Later Mukerjee (1994) described *Baryconus dunensis* from Dehra Dun, India. In this paper we describe two new species from Kerala with a key to Indian species of *Baryconus* Forster.

### MATERIALS AND METHODS

The specimens were collected from the various localities in Kerala by using specially made sweep nets. They were studied in the laboratory by using Wild Stereozoom microscope (Switzerland ) and Leitz Wetzlar (Germany) microscopes. The drawings were made using the drawing tube of M3Z stereozoom. The specimens were card mounted and held on pins No.3 (size 38 mm x 0.53) made by Newey Goodman Ltd (England)

## RESULTS AND DISCUSSION

### I. *Baryconus keralensis* Narendran sp. nov. (Figs.1-5)

**Holotype Female:** Length 3mm. Head black; mesosomal notum black; rest of portions of mesosoma and gaster liver brownish black; scape, legs excepting pretarsus and tegulae brown; rest of antenna brownish black; teeth of mandible black; eyes yellowish black with reflecting yellow spots; hind ocelli blackish brown; front ocelli pale reflecting yellow; wings hyaline with fine dense pubescence; body clothed with silvery white pubescence.

**Head:** Vertex and occiput smooth with irregular longitudinal striations and minute pits behind POL and OOL area; occipital area with scarce setigerous pits, interstices rugulose; OOL and POL area granulate and rugulose; frons with a median carina in front of front ocellus, diverging and joining either side of scrobal margin, posteriorly diverging and joining either side of scrobal margin, posteriorly diverging on either side of front ocellus; scrobe very wide and deep, margins carinate, smooth with fine transverse striae on sides; median carina in between antennal toruli distinct and very prominent not 'y' shaped, reaching as far as middle of scrobe, giving short transverse branches on either side of apical part; two submedian carinae originating from inner antennal toruli extending towards upper side as in Fig. 2; parascrobal area with a single row of large shallow setigerous punctate; toruli close to clypeal border; clypeus short not projecting ventrolaterally; mandible tridentate; eyes bare; relative measurement of OOL =2; POL = 4; OD =3; occipital carina distinct posterior margin of gena distinctly carinate; interstices smooth and carinate; malar sulcus distinct and carinate with deep fovea at base; malar space with radiating carinae originating from base of mandible and going upwards towards direction of temples; head viewed in front median length to width 42:43; eye length to head length in front view 23:32; head viewed dorsally as wide as maximum width of mesosoma; median length to maximum width 23:45; head length to height in lateral view 12:10. Antenna 12 segmented. Length of antenna to that of body 40:21.5; relative measurement of length and width of antennal segments: scape =42.7; pedicel=10.5; F1=10:4; F2=8:4.5, F3=8:6; F4=6:7;F5=7:9, F6=9:10; F7=9:9.5; F8=8:8; F9=7.5:8; F10=9.5:7.5.

**Mesosma:** Pronotal shoulders narrowly visible laterally with large shallow

setigerous pits, margined by carina; posterodorsal corners in front of tegula produced into a pointed tooth; mesonotum medially with a longitudinal row of shallow setigerous pits; rest of mesonotum leathery with shallow, scattered setigerous punctate; notauli not very deep, with a row of foveolate depressions; posterior margin of mesoscutum distinctly carinated; scutellum semicircular with large deep setigerous punctae; interstices smooth, less than diameter of puncta; metanotum transverse with 2 large stout submedian teeth and a row of deep close pits; relative lengths of mesonotum 25; scutellum 12; metanotum 4; propodeum medially with two submedian carinae and a large sublateral foveola on either side; propodeum with moderately dense short pubescence all over; denser on callus region; propleura anteriorly reticulate and punctate, posteriorly rugose; prepectus with distinct deep close pits; mesopleura anteriorly reticulately punctate; median depression deep with transverse carinae, posterior margin with a row of deep pits, rest of mesopleura leathery; metapleura striate reticulate dorsally, rest of portions leathery and reticulate; wings hyaline with minute dense pubescence; fore wing length: width 112.38; fore wing to body 28:40; relative lengths of fore wing veins SMV =48; MV=8; PMV=25; STV =9. Length of fore wing to length of hind wing 112:82; hind femur 0.8x as long as hind tibia; hind metatarsus 0.8 x combined length of following tarsal segments; petiole distinct with a transverse row of deep pits between propodeum and T1. Width of petiole in dorsal view 3 x its median length.

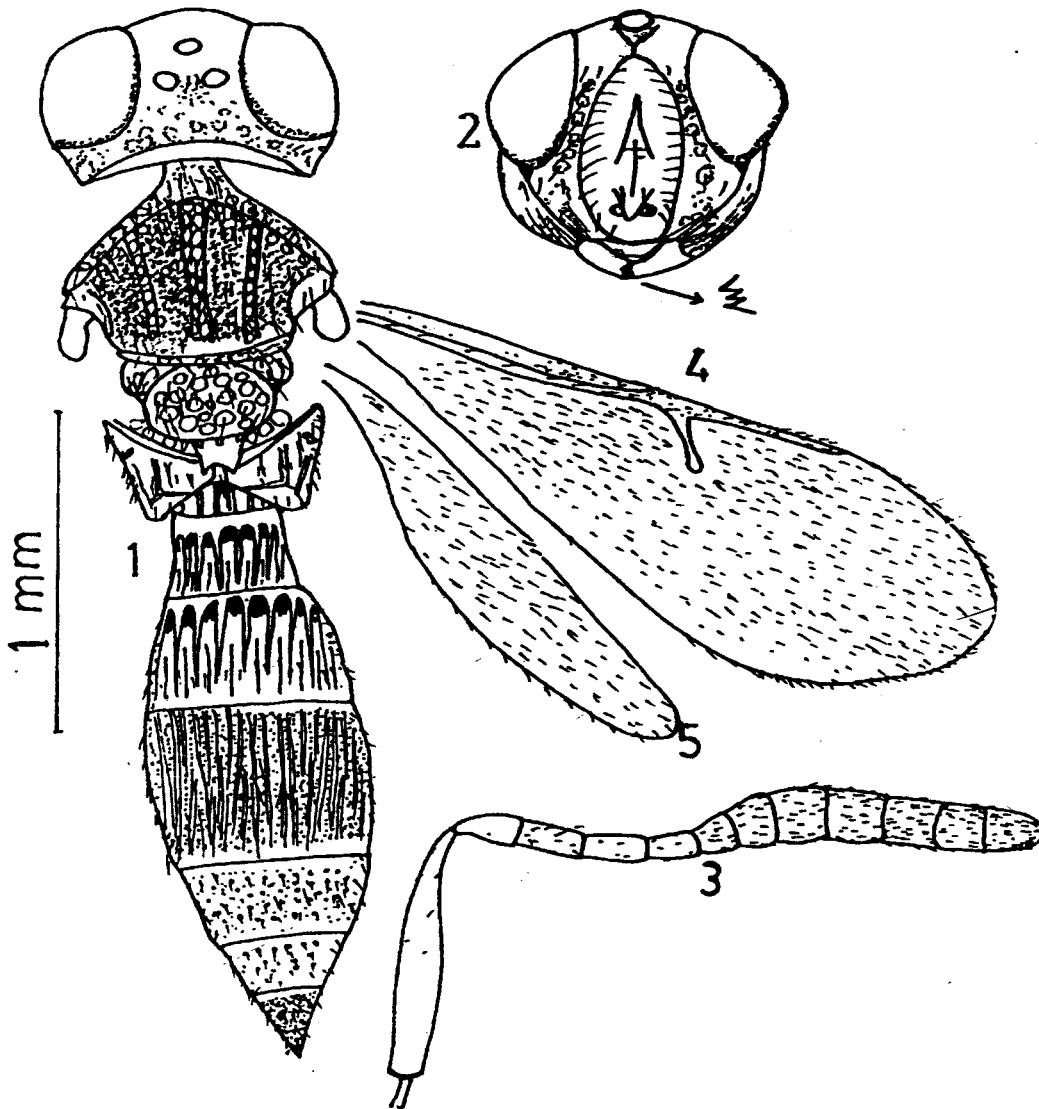
**Gaster:** Length to rest of body 82:86; 2.5x as long as wide; all tergites conspicuously wider than long; T1 and T2 with distinct longitudinal carinae extending throughout their length and deep pits in between carinae basally; T3 striate and interstices reticulate and microsculptured; T4 with minute pits; posterior borders of T4, T5 and T6 smooth; T5 minutely and sparsely punctate, each puncta with a seta arising from it; posterolateral corners of T6 not produced into spines. Relative length: width of tergites T1 =13:19; T2=19:29; T3=26:32; T4=12:27; T5=9:18; T6=7:10; relative length of gaster to vepositor sheath 80:4; sternites moderately pubescent.

Male: Unknown; Female: Unknown.

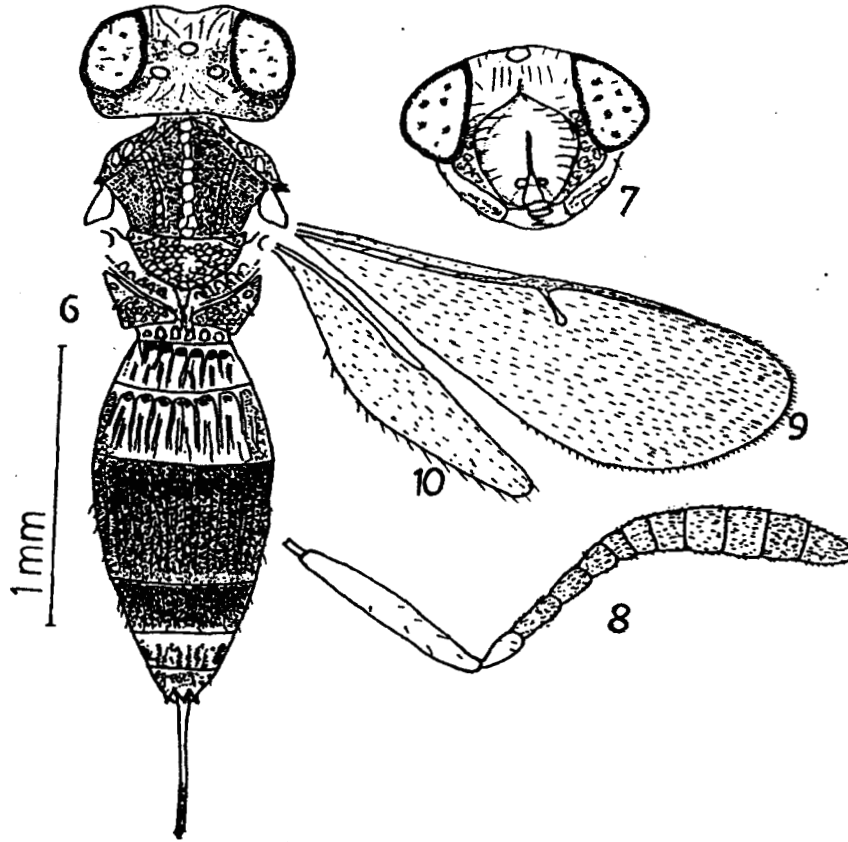
**Holotype:** Female, India, Keala, Attappady, Coll. T.C. Narendran & Party, 7. v.1989 (DZCU); **Paratype:** 1 Female, Kerala, Nilambur forest, T.C. Narendran & Party 24: i.1990 (DZCU).

Remarks: This new species can be separated from all other Indian species using the key given in this paper.

2. *Baryconus unidentatus* Narendran sp. nov. (Figs. 6-10)



Figs. 1-5 *Baryconus Keralensis* Narendran sp. nov. Female. 1. Dorsal view of head, mesosoma and gaster; 2. Head front view; 3. Antenna; 4. Forewing; 5. Hind wing.



Figs.6-10 *Baryconus unidentatus* Narendran sp.nov. Female:6. Head mesosoma and gaster dorsal view; 7. Head front view; 8. Antenna; 9. Forewing. 10. Hindwing.

**Holotype Female:** Length 2.57 mm, Black; scape, legs (except coxae and pretarsus) and ovipositor yellowish brown; funicle, mandible, coxa, pretarsus and tegula dark brown; rest of antenna blackish brown; eye pale reflecting yellow with blackish spots; ocelli pale yellow. Wing hyaline with fine dense pubescence; veins yellowish brown; body clothed with moderately long silvery white hairs.

**Head:** Vertex and occiput smooth with irregular striations and pits behind POL and OOL area; POL area more or less smooth sparse, setigerous pits and faint irregular striations on sides; frons in front of front ocellus with a few faint carinae, laterally finely striated; scrobe very wide, deep, margins carinate, surface smooth with fine parallel striae on either side; scrobe medially with a

distinct 'y' shaped carina, the two arms of 'y' extending into area between antennal toruli; median carina extends as far as upto middle of scrobe; parascrobal area with single row of round setigerous punctate; toruli close to clypeal border; mandibles tridentate; eye sparsely pubescent; lateral ocelli (hind ocelli) distinctly separated from eye border; OOL 1.8, POL 8.7; OD 4.3; occipital carina distinct; posterior margin of gena distinctly carinate; gena with irregular striae and leathery reticulation; gena sparsely pubescent; preorbital carina distinct; postorbital carina indistinct; malar space with a subtriangular shallow depression, transversely striated; clypeus short; not projecting ventrally; head width in front view to its length 42.75:38; eye length to head length in front view 27:42; head viewed dorsally wider slightly than maximum width of mesosoma, median length to width 21:38; head in lateral view length to height 9:13; antenna 12 segmented, antennal length to body length 19:36, Relative measurement of length: width of antennal segments:scape -38:6. Pedicel 9:4; F1=10:4; F2=7:4; F3=6:5; F4=6.5:6.5; F5=5:7; F6=7:9; F7=7:10; F8=7.10, F9=6.5:9; F10=9:8.

**Mesosoma:** Pronotal shoulders visible laterally with large, deep setigerous pits, margined by carinae; pronotum posterodorsally in front of tegula with a pointed tooth; mesonotum with a median longitudinal row of shallow pits; other areas of mesonotum rugose with small scattered setigerous pits, posteriorly pits larger and denser; scapula leathery, with sparse pubescence; scutellum semicircular with large deep close setigerous pits, interstices broad and smooth in median area, in rest of portions carinate; metanotum transverse with a row of deep close pits, armed medially with a pointed tooth; metanotum laterally unarmed; relative lengths of mesonotum 25; scutellum 10; metanotum 4; propodeum with two submedian and two sublateral carinae, laterally closely punctate and moderately pubescent with a tooth on either side. Mesosoma length to width in dorsal view 34:43; in lateral view length to height 18:12.5; skaphion absent; propleura striatopunctate; mesopleura striatoreticulate; mesopleural depression deep, rugose, with a row of shallow punctae at posterior border, transversely striated posteriorly; wings hyaline with minute dense pubescence; fore wing length to width 90:34; length of fore wing veins SMV=40; MV=5.5; PMV=22.5; STV=7. Relative length of fore wing to length of hind wing 90:66; hind femur 0.9x hind tibia; hind metatarsus 0.7x as long as following segments combined; petiole distinct between propodeum and T1, with a transverse row of deep pits; width of petiole about 4x its median length (visible part in dorsal view).

**Gaster:** Length a little more than 1.7 x length of mesosoma in dorsal view; a little more than 2x as long as wide in dorsal view; all tergites conspicuously wider than long; T1 and T2 with distinct longitudinal carinae and deep pits in between carinae basally, carinae extending throughout their length; T2 laterally with a leathery sculpture; T3 and T4 faintly striate, mostly granulate and leathery; posterior borders of T4, T5 and T6 smooth, minutely punctate with seta arising from each puncta; posterior border of T6 produced into three spines; ovipositor extruded; length of ovipositor 0.35x length of gaster; gaster dorsolaterally clothed with long silvery pubescence; sternites with dense silvery pubescence.

**Male:** Unknown

**Female:** Unknown.

**Holotype:** Female, India, Kerala Calicut University Campus, T.C. Narendran & Party, 23.xii.1989 (DZCU). **Paratypes:** 1 Female, Kerala, Cali. Uni. Campus, M.G. Ramesh Babu, 23.xi.1989; 1 Female, Kerala, Anakkatti, T.C. Narendran & Party 12.xii.1987; 3 Females, Cali. Uni. Camp. T.C. Narendran & Party 4.x.1988, 4.xii.1989; 2 Females, Kerala, Peravore, T.C. Narendran & Party 25.iv.1988; 2 Females, Kerala, Chindaki, T.C. Narendran & Party 13.xii.1987; 2 Females, Kerala, Nedumpoil, T.C. Narendran & Party, 25.ii.1988; 2 Females, Kerala, Nedumpoil, T.C. Narendran & Party 22.iv.1988 (All types in DZCU).

**Key to species of *Baryconus* Forster of India.**

1. Metanotum posteriorly unarmed .....2  
   =Metanotum posteriorly armed with a median tooth or with two  
   submedian teeth .....3
2. Gena, vertex and frons smooth; eyes densely pubescent; ocellular  
   space equal to ocellar diameter; .....*MARATTUS* Mani.  
   = Gena, vertex and frons punctate; eyes bare; lateral ocellus nearly  
   touching eye border .....*GRAVELYI* (Mani)
3. Metanotum with two submedian teeth posteriorly .....4  
   = Metanotum with a single tooth posteriorly (in *bharatus* the tip of tooth  
   slightly bilobed).....5

4. Frons with a median carina in front of front ocellus (Fig.2) diverging and joining either side of scrobe margin; posterolateral corners of T6 not produced into spines .....*KERALENSIS* Narendran sp. nov.  
 = Frons in front of front ocellus with 3 or 4 carinae medially; posterolateral corners of T6 produced into two very short spines .....*DIVERRSUS* Saraswat
5. Mesonotum medially with a median longitudinal ridge; the single median tooth of metanotum slightly bilobed at apex .....*BHARATUS* Saraswat.  
 =Mesonotum medially with a median longitudinal row of pits; median tooth of metanotum not bilobed at apex .....6
6. Antennal scape black; coxae black; eyes bare; prepectus distinct; posterior margin of T6 with two spines ..... *DUNENSIS* Mukerjee  
 =Antennal scape yellowish brown; coxae yellowish brown; eyes sparsely pubescent; prepectus indistinct; posterior margin of T6 with two lateral and one median spine ..... *UNIDENTATUS* Narendran sp.nov.

#### ACKNOWLEDGEMENTS

We are grateful to the authorities of the University of Calicut for facilities for this research.

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## A NEW SPECIES OF *ORMYRUS* WESTWOOD (HYMENOPTERA:CHALCIDOIDEA:ORMYRIDAE) FROM AUSTRALIA

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**ABSTRACT** : A new species of *Ormyrus marreebensis* Narendran sp. nov. is described and compared with its nearest relative.

### INTRODUCTION

After sending the typescript of Indo-Australian Ormyridae (Narendran, 1999) to the printers, the senior author received a set of Australian Ormyrids from Dr. Christopher Burwell of Queensland Museum, South Brisbane of Australia. On closer study it is found to be a new species which is described below. This forms the 12<sup>th</sup> species from Australia.

### MATERIALS AND METHODS

The material for this study was sent by Dr. Christopher Burwell of Australia. They were studied in the laboratory using M3Z WILD Sterozoom (Switzerland make) and Letiz Wetzlar (German make) microscopes. The figures were drawn using drawing tube of WILD M3Z Sterozoom and enlarged using KB enlarger of model B2M. The type is deposited in the Queensland museum, South Brisbane, Australia.

### Abbreviations used

EH = Eye height in side view, F - funicular segment MS = malar segment, MV = Marginal vein, MW = Mouth width in anterior view, OOL = Ocellocular line, PMV = Postmarginal vein, POL = Postocellar line SMV = Submarginal vein, T<sub>1</sub>-T<sub>5</sub> = Tergite 1 to Tergite 5.

*Ormyrus marreebensis* Narendran sp. nov.

(Figs. 1-3)

### Holotype Female

Length 1.6 mm. Metallic green. Eye reddish yellow; ocelli pale reflecting yellow; antenna

brownish black with basal one third, scape and radicle pale yellow; fore and hind coxae concolorous with body except their apices which are paler; all femora blackish brown with slight metallic reflections, their bases and apices paler; fore and mid tibiae pale yellow, with the middle portion slightly darker hind tibia pale brownish yellow; all tarsi whitish yellow, pretarsi brown; tegula pale yellowish brown; ventral side of gaster mostly pale brown; pubescence silvery; wings hyaline with veins pale brownish yellow; pubescence on wings pale yellowish brown; foveolae of gaster black with metallic tinge.

### Head

Width (Fig -1) slightly more than 1.5× distance between front ocellus and lower clypeal margin (90:60); head width in dorsal view 2.75× distance between front ocellus and occipital margin; POL Slightly more than 4.5×OOL; MW 1.09×MS in front view; and occiput cross striate, without any distinct pilosity. Scrobe with margin carinate; front ocellus; area between front ocellus and scrobe cross striate; parascrobal space longitudinally striate with sparse setae; upper clypeal margin hardly distinct; anterior tentorial pits indistinct; lower clypeal margin entire; eye bare; EH in profile a little more than 3×length of MS (30:10); gena striatoreticulate; antennal formula 11263; Relative measurements of L:W of antennal segments :Scape = 29 : 12.5; Pedicel-10.5:6, F<sub>1</sub> = 2.6, F<sub>2</sub> = 1:6, F<sub>3</sub> = 4.5:8, F<sub>4</sub> = 4.5:9, F<sub>5</sub> = 8:10, F<sub>6</sub> = 6:10.5, Clava = 31 : 11.

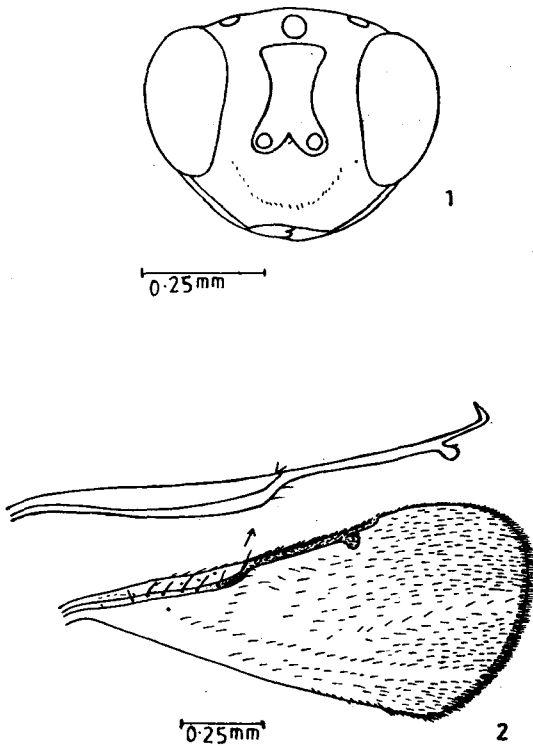


Fig. 1 : Head front view Fig. 2 : Forewing

### Mesonoma

Length in dorsal view a little more than  $1.25\times$  its maximum width; pronotum and mesonotum with cross striations consisting of fine strips; mesoscutum with moderately dense pilosity without any definite pairs of long setigerous setae; notauli slightly indicated in certain lighting. Scutellum longer than its maximum width (10.5 : 8); its apex rounded, anteriorly cross striate, posteriorly semi circularly striate, scutellum with uniformly arranged short pilosity, without distinct pairs of long setigerous setae; apex of scutellum extends a little beyond metanotum posteriorly. Propodeum with a pair of faint and short submedian carinae on the posterior margin not at all reaching middle of propodeum, (visible in certain lights) propodeum smooth with faint reticulations; callus densely pilose. Forewing length a little more than  $2.26\times$  (14.35 : 63.5) its maximum width (Fig : 2) ; speculum asetose,

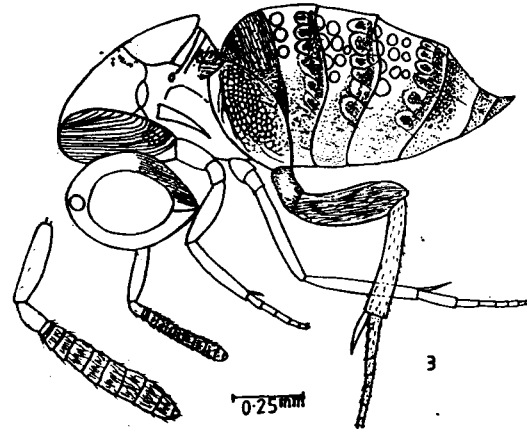


Fig. 3 : Body entire - side view

closed posteriorly by cubital line of setal which does not reach near the base of fore wing; basal line of setae distinct and complete; basal cell with one ventral setae; costal cell with single row of ventral setae. Relative measurements of lengths of forewing veins SMV = 84; MV = 50; PMV = 16; STV = 4. Lateral panel of pronotum obliquely cross striato-reticulate; hind coxa on outer dorsal side with relatively large reticulations (Fig : 3); longest spur of hind tibia as long as hind metatarsus.

### Gaster (Fig : 3)

Length a little more than  $1.7\times$  length of mesosoma (106:81), a little more than  $1.3\times$  combined length of head and mesosoma in side view; not compressed from side or from dorsal side; median longitudinal ridge present from posterior margin of  $T_1$  to  $T_5$  but not reaching  $T_6$ ;  $T_1$  with a median basal pit, remaining parts of  $T_1$  strongly reticulate;  $T_2$  not visible from dorsal side concealed by  $T_1$ ;  $T_3$  with a cross row of foveolae, followed by crenulate border and cusps space between cusps and portion posterior to cusps of  $T_3$  reticulate to faintly reticulate;  $T_4$  with two cross rows foveolae visible (anterior row partly concealed by posterior margin of  $T_3$ ), followed by crenulate border and cusps similar to  $T_3$ ;  $T_5$  with three cross rows of foveolae anterior row partly concealed by posterior margin of  $T_4$ ,

followed by crenulate border and cusps similar to  $T_4$ ;  $T_6$  coarsely reticulate and with scattered minute tubercles bearing setae. Length of epipygium almost half length of  $T_6$  in dorsal view, longer than ovipositor sheath in dorsal view.

Male : Unknown  
Host : Unknown  
Materials Examined

**Holotype** : Female; Australia, 3 KMs North East of Mareeba, Coll : C. J. Burwell; 25-28-xi-1997.

***Ormyrus mareebensis sp. nov***

1. Fore wing with one ventral seta.
2. Gena striato-reticulate.
3. Costal cell with single row of ventral seta.
4. Longest spur on hind tibia as long as hind metatarsus.
5.  $T_3$  with a cross row of foveaeolae.
6.  $T_4$  with two and  $T_5$  with three cross rows of foveaeolae.
7. Propodeum with a pair of very small submedian carinae.

***Ormyrus mareebensis sp. nov***

1. Fore wing with one ventral seta.
2. Gena striato-reticulate.
3. Longest spur on hind tibia as long as hind metatarsus.
4.  $T_3$  with a cross row of foveaeolae;  $T_4$  with two and  $T_5$  with three cross rows of foveaeolae.

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**Paratypes** : 1 female, Australia, Gordonvale, coll. E. C. Dahms and G. Sarens, 16-iv-1987 1 Female : Australia, Mount Mollay, Coll. C. J. Burwell, 22-v-1997.

**Remarks**:- This species does not fit to the key to the Indo-Australian species of *Ormyrus* by Narendran (1999). This species comes near *Ormyrus burwelli* Narendran and *O. tanus* Narendran in the key but differs from the following characters mentioned below :-

***Ormyrus burwelli***

1. Fore wing with two ventral setae.
2. Gena longitudinally Strait.
3. Costal cell with double row of ventral setae.
4. Longest spur on hind tibia shorter than hind metatarsus.
5.  $T_3$  without cross row of foveaeolae.
6.  $T_4$  and  $T_5$  with one cross row of foveaeolae.
7. Submedian carinae absent.

***Ormyrus tanus***

1. Fore wing with two ventral setae.
2. Gena longitudinally Straite.
3. Largest spur on hind tibia sub equal to length of hind metatarsus.
4.  $T_3$  without cross row of foveaeolae;  $T_4$  and  $T_5$  with single cross row of foveaeolae.

**REFERENCES**

1. Narendran, T. C. 1999. Indo-Australian Ormyridae (Hymenoptera : Chalcidoidea), Systematic Monograph. Systematic Entomology laboratory (Dept. of Zoology, University of Calicut publication 1-227).