INVESTIGATION ON THE ALPHA SYSTEMATICS OF VESPIDAE (HYMENOPTERA) OF KERALA STATE

THESIS
SUBMITTED TO THE UNIVERSITY OF CALICUT
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY
IN ZOOLOGY

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MARCH 2002

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CERTIFICATE

This is to certify that this thesis is an authentic record of the work carried out by **Mr. LAMBERT KISHORE**, from January 1999 to March 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 Ph.D. Qualifying examination of the University of Calicut held in 2000.

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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.

Lambert Kishore

Lambert Kishore

DEDICATED TO

My
Loving Parents

ACKNOWLEDGEMENTS

I wish to express my sincere thanks and gratitude to my venerable guide Dr. T.C. Narendran, Professor, Department of Zoology, University of Calicut, for his valuable guidance, suggestions, and constant encouragement throughout the course of this research work. He was the main inspiration behind my research work.

I am grateful to the Head of the Department of Zoology, University of Calicut for the facilities provided to carry out the study most conveniently. I would like to acknowledge the help rendered by the ZSI Calicut.

I wish to express my sincere thanks to the Director, Museo Civico di Storia; Naturale, S. Core 1730, 30135 Venezia Italy and Dr. Carpenter J.H., American Museum of Natural History, New York for providing necessary reprints for the work.

I am grateful to the Professor, Raghavendra Gadakar, Chairman, Centre for Ecological Science, Indian Institute of Science, Bangalore for permitting me to do reference work at the library of Indian Institute of Science.

I am extremely grateful to my colleagues, Dr. Rajmohana K., Mr. Jobiraj T., Sr. Karmaly K.A., Mrs. Vyjayanthi, M.C., Mrs. Madhavikutty M., Smt. Ushakumari, K., Mrs. Fousi, Mr. Sudheer, Mr.Divakaran and Mrs. Anitha P.V. for their help and affection.

I am grateful to the Manager and Principal of Malabar Christian College, Calicut for rendering valuable whole hearted support for completing the research work.

I am grateful to my parents, my wife Sushama and my sons Alok and Angadh without whose patience and encouragement I would not have been able to finish work in good time.

Lambert Kishore

CONTENTS

INTRODUCTION

Sound taxonomy is the foundation for all meaningful research in Biology. Before undertaking any research or studies on any aspect of any organism it is absolutely essential to know its status in systematics. Each species should have a name unique to itself. Once a name have been given to a species it becomes a functional label, using various information concerning that organism, including all the past work done on it, can be retrieved and stored ensuring easy reference (NARENDRAN 2000). Without studying systematics it is virtually impossible to study biodiversity of any group. Since it is not practicable to study the taxonomy of all the fauna all on a sudden, it is essential to choose groups of greatest importance, Hymenoptera is such a group. In this context it is worth to quote LA SALLE and GAULD (1992) "Having reached important conclusion it is necessary to preserve biodiversity, there are still several difficult decisions to be made. We do not have the resources to preserve, conserve, inventory and study all the world's species, so we must choose areas of greatest importance on which to concentrate our attention. If we wish to preserve diversity, we must focus our studies on groups which are important to maintaining diversity in other group. It is not just that some groups are more diverse than others; certain groups have a greater influence on diversity in other organisms. It is also imperative to discover which group have the greatest impact on maintaining diversity, and focus particular attention on them. Hymenoptera is such a group. It not only forms a

major component of diversity in itself, it is vital in sustaining diversity in other groups."

Members of the family Vespidae commonly known as potter wasps, paper wasps, hornets or yellow jackets are predators of many insect larvae. They play a vital role in the ecosystem by keeping excessive increase of many insects pests under check.

Some of vespids perform interesting social behaviour and some others are solitary wasps. Social wasps built their nest by using dead wood and vegetable fibre, they chew them into pulp to construct the first cell of the nest. Caste systems of the social wasps have not evolved as far as those of the other major groups of social insects. MARHAL (1896, 1897) postulated that physical divergence of the queen and worker casts of Vespinae is based on nutritional discrimination during larval growth. Worker caste can be identified due to their large size and the expanded conditions of the rear part of the head. The workers capture a wide variety of soft bodied insects to take back to the nest, favouring bees, flies, both larva and adult of lepidopterans and they also collect honey and nectar from flower. The queen is large sized (35 mm) in some species. She hibernates and becomes the foundresses (in northern India) of colony in next spring.

They can travel about 100 km per day in their foraging. Vespids are called "true wasps". The life cycle of Polistinae and Vespinae are very similar. Vespinae are highly poisonous and dangerous to human being.

Eumeninae are commonly called potter wasps. They are solitary wasps. They constructs nest by using mud in indoors. They feed and bring larvae of other insects to their nest. This type of feeding of their larvae is "mass provisioning". The wasps are skillful and intelligent organisms, hence the collection of wasp is a tedious task.

The taxonomy of Vespidae is improperly studied in the Indian subcontinent. The only comprehensive work available is BINGHAM's (1897) Fauna of British India volume on Vespidae, which is outdated. Since then several scattered papers appeared on wasps of the Oriental Region. VECHT (1935-79) ARCHER (1980-87), KOJIMA (1982-88), YAMANE and his collaborators (1974-87), WILLIAMS (1983-88) GUPTA and DAS (1977, 1983, 1989) contributed to the taxonomy of Vespidae of India. However nothing is known on vespid fauna of Kerala state which contain very interesting unexplored localities of hotspot areas of biodiversity. In view of the above facts it is envisaged to undertake a detailed systematic study of the Vespidae of Kerala at the alpha-level.

The objectives of present investigations are:

(1) to find out what all species and genera of Vespidae are present in Kerala.

(2) to provide workable key to identify them.

(3) to give detailed descriptions and illustrations of the new taxa found out.

(4) to provide redescriptions of little known taxa present in Kerala.

(5) to give a checklist and finally to review the past work done on taxonomy of Vespidae fauna.

The thesis is divided into three large chapters. First chapter deals with the review of literature, the second chapter contains systematic status and diagnosis of Vespidae, key to subfamilies of Vespidae and structure and terminology of adults; third chapter contains observations and results, keys to Indian genera, species and subspecies of Vespidae of India. Taxonomic descriptions and redescriptions are also provided. The third chapter is followed by a checklist of Indian fauna of Vespidae. Finally at the end of the thesis a summary of thesis and references are provided followed by plates and figures.

CHAPTER I

REVIEW OF LITERATURE

REVIEW OF LITERATURE

The study of Vespidae may be said to have began in 1758 when LINNAEUS described *Vespa coraba*, *Sphex tropica* (present *Vespa tropica*) and *Vespa vulgaris* (present *Vespula vulgaris*). Later in 1767 LINNAEUS described *Vespa gallicia*. LINNAEUS was followed by De GEER who contributed to the study of Vespidae in 1773. Later FABRICIUS (1787) described *Vespa cnicta*. The same author also studied taxonomy of Vespidae in 1793 and in 1798.

LATREILLE (1802) erected the Genus *Polistes*. FABRICIUS (1804) further contributed to the knowledge of taxonomy of Vespidae. SAUSSURE (1852) published a monograph on solitary wasps of Vespidae. In the same year SMITH described *Vespa ducalis* in the Transactions of Entomological society of London.

SAUSSURE (1853 - 58) continued his work on taxonomy of Vespidae and published monographs. In 1857 SMITH published a catalogue of Hymenoptera in which he dealt with Vespidae also. SMITH again published such a catalogue of Hymenopterous insects of some Islands of South East Asia. SAUSSURE (1862) studied taxonomy of Vespidae of Asia and Africa based on the collection of 'Leyden' museum. In 1867 again the same author published on Vespidae and in 1882 studied taxonomy of solitary Eumenidae.

BINGHAM (1888) published taxonomic notes on some bee and wasps of Burma in the Journal of National Society. In 1894 DALLA TORRE, published his classical work Catalogues Hymenopterorum in

which he treated Vespidae also. BINGHAM (1897) in his Fauna of British India including Ceylon and Burma dealt with Vespidae. This is a very important work to base later taxonomic studies of these wasps. In 1900 CAMERON described new taxa of Vespidae. In 1902 ASHMEAD gave a good classification of Vespidae. This was followed by BUYSSON (1903) who published a monograph on groups of *Vespa.*

In 1904 DALLA TORRE again dealt with Vespidae in his Genera Insectorum. He was followed by ASHMEAD (1904) who published descriptions of new genera and species of Hymenoptera including Vespidae from the Philippines.

In 1905 BUYSSON again published a monograph on the *Vespa* group in Annuals of Entomological society of France. In the same year BINGHAM reported the taxonomy of Vespidae. In 1907 CAMERON contributed to the knowledge of Vespidae in the Oriental Region. The same author again published on Vespidae in the next year (1908) BINGHAM (1908) published notes on Aculeate Hymenoptera of the Indian museum in which he treated taxonomy of Vespidae also.

In 1910 SCHULTHESS published a paper on the taxonomy of Eumenidae. In later BUYSSON (1911, 1913) contributed to knowledge of taxonomy of Vespidae. In 1914 SCHULTHESS published a paper on the taxonomy of Vespidae of Ceylon, Malaya, Java and Sumatra. Later RAMAKRISHNA IYER (1916-17) published a catalogue of wasps and bees described from Indian region in the Journal of Bombay Natural Society.

In 1918 BEQUAERT published a revision of the Vespidae of Belgian Congo, based on the collection of the American museum. In 1919 BORNER studied Vespidae. In the same year WILLIAMS and ROHWER published seperately several new species of Vespidae from Philippine islands. In 1921 BEQUAERT published on several species of Vespidae of Congo. In 1921 DOVER published a paper on wasps and bees of Barkuda island.

In 1922 BRADLEY published a paper on taxonomy of Masarid wasps. In the same year DOVER, RAO and SRINIVASA published note on "Diplopterous" wasps in the collection of the Indian museum. In 1925 DOVER again contributed on the taxonomy of Vespidae. Later SCHULTHESS (1927) studied Vespid fauna of Sumatra. BEQUAERT in 1928 studied certain types 'Diplopterous' of the collection of British museum. In 1928 WILLIAMS published a new species of Vespidae from Philippines. In the next year DOVER published on the wasps and bees of the Raffles museum of Singapore. In the next year BIRULA and BEQUAERT published separately on Vespidae. In 1931 DOVER published on Vespidae present in F.M.S. Museum, Singapore. In the next year BEQUAERT published a paper on *Ropalidia* Guérin.

In 1933 GIORDANI SOIKA published a paper on Eumenidae. In the next year CARL published a new species of *Ropalidia* Guérin. In 1934 SCHULTHESS studied *Odynerus* in China, Japan, Formosa and Philippines. Later BEQUAERT (1934-36) contributed to the knowledge of the taxonomy of *Vespa* Linnaeus and *Polistes* Latreille. In 1936 BELL described a new species of Vespidae from India in the Journal of Bombay Natural Society. Next year MAA published on taxonomy of

Vespa Linnaeus and *Vespula* Thomson of China. Simultaneously LIU (1936-37) published a Bibliographic and synonymic catalogue of Vespidae of China.

In 1938 BLÜTHGEN studied the systematics of Vespidae of Europe. In the next year GRIFFIN published on taxonomy of Vespidae. In the same year BEQUAERT published on Oriental *Vespa analis*. The same author in the next year (1940) published notes on Oriental *Polistes* Latreille in the Transactions of American Society.

In 1941 BEEST published an excellent taxonomic paper on Indo - Australian Genus of *Ropalidia* Guérin. In the next year GIORDANI SOIKA studied the solitary Vespidae.

In 1942 BERLAND studied taxonomy of *Polistes* Latreille. In the next year BLÜTHGEN published a paper on taxonomy of European Polistinae. Later BEQUAERT (1944) made the revision of *Protopolytia* Duke, a Genus of Geotropical social wasps of Vespidae. Since then MUESEBECK *et al.* (1951) published a catalogue of Hymenoptera (including Vespidae) of America, North of Mexico. RICHARDS (1956) published keys to families of order Hymenoptera including Vespidae. In the same year he published handbooks for identification of British insects including Hymenoptera.

In 1957 VAN DER VECHT made a studies on Vespinae of the Indo-Malayan and Papuan area. In the next year (1958) PAGDEN published some paper on Malayan social wasps. In the same year BRADLEY (1958) published a papers on phylogeny of the Hymenoptera including Vespidae.

VAN DER VECHT in 1959 studied some fabricious type of Indo-Australian Vespidae. Again in the same year he published notes on Oriental Vespinae including some species from China and Japan, and notes on *Eumenes archatus* (Fabricius) and some allied Indo-Australian wasps.

BLÜTHGEN in 1961 made studies on Diploptera including Vespidae. GIORDANI SOIKA in same year published revision of *Odynerus* Latreille of Australia and Tasmania. In this work he published ten new species and redescribed about seventy five species and he also provided key to species.

In 1961 again GIORDANI SOIKA published notes on some species of *Pachymenes* Saussure of Indo-Australian region. GIORDANI SOIKA in 1961-62 published a list of Eumenidae collected by the Noona Dan Expedition with description of new species viz., *Pavancistrocorus robertianus palavanensis* and *Stenodynerus multimaculatus.*

In 1962 PAGDEN made notes on *Stenogaster* of Malaya. In the same year (1962) VAN DER VECHT published an excellent taxonomic paper on Indo - Australian species of the Genus *Ropalidia* Guérin. In the next year the same author made studies on Indo -Australian and East asiatic Eumenidae. BOHART and STANGE (1965) published revision of the Genus *Zethus* Fabricius in the Western Hemisphere.

In 1966 GIORDANI SOIKA published taxonomy of Vespidae of Paleartic region in which he described ten new sub species and one new species. In the same year VAN DER VECHT published taxonomy of the East Asiatic and Indo - Australian species of *Polybioides* Buysson and

Parapolybia Saussure. In 1968 GIORDANI SOIKA published on the eumenid Genus *Cyrtolabus* Van der Vecht of Paleartic region. In this paper he described four new species and a key to species. He also commented on some known species also. In the next year (1969) IWATA published a paper on the identification of *Ropalidia (Anthereneida) taivana koshnnensis* Sonan.

Two year later GUIGLIA (1972) published on the history of systematics of Vespidae of the old world. RICHARDS (1973) studied subgenera of *Polistes* Latreille. In the same year GIORDANI SOIKA gave a list of designation of lectotype of several species of Vespidae described from 1934 to 1960. He also published description of new species in two different paper in 1973. In 1975 GIORDANI SOIKA again contributed to the taxonomy of Vespidae. He gave illustrated descriptions of new species.

BROTHERS (1975) studied phylogeny and classification of Aculeate Hymenoptera and published in Kansas University Science Bulletin. GIORDANI SOIKA (1976) studied Vespidae and Eumenidae collected in Mongolia. In the another paper in same year GIORDANI SOIKA revised *Leptomenes* Soika, *Stroudia* Grib and *Eumenidiopsis* Soika. In this paper he described new species and gave key to species. In another paper in 1976 GIORDANI SOIKA published notes on Vespidae and Eumenidae collected in Korea.

YAMANE (1976) made morphological and taxonomic studies on the larvae of Vespinae with reference to Phylogeny of subfamily. In the next year GIORDANI SOIKA published two paper on the taxonomy of

Eumenidae. In the first paper GIORDANI SOIKA dealt with Eumenidae of Cameroon. In the second paper he contributed to systematics of Australian Eumenidae and described new species and commented on known species of Australia. He also gave key to species of some genera of Australia.

GUPTA and DAS (1977) studied distributional pattern of Indian Vespidae with reference to altitude. In the next year KURZENKO published on solitary wasps of Eumenidae of USSR. WILLINK (1978) made a revision of Genus *Stenodynerus* Saussure in which he gave a good account of the Genus *Hypodynerus* Saussure and species. In the same year STANGE studied Eumenidae of Peruvian central desert. GIORDANI SOIKA (1978) gave an illustrated key to European family Eumenidae.

NELSON (1978) gave evidence for seperating Cryptic red Wasps *Polistes carolina* (Linneus) and *Polistes perplexus* Cresson. KROMBEIN *et al.* (1979) published excellent catalogue on Hymenoptera in America north of Mexico. In this book Vespidae is also included.

DAS in 1979 published excellent taxonomic review of Vespidae of Indian subregion. In the same year VAN DER VECHT published notes on Vespoidea from Nepal in which he described thirteen new subspecies of Eumenidae and fourteen new subspecies of Vespidae. YAMANE and YAMANE in 1979 published a paper on the taxonomy of *Polistes* Latreille from the same area. In 1980 BOHART published a paper on the middle American species of *Stenodynerus* Saussure. GIORDANI SOIKA in 1980 described and illustrated a new species *Sphaeromenes*

elizabethae from Argentina. ECK in same year described a new social wasp *Polichovespula loekenae* from Scandanavia. YAMANE *et al.* also published a tentative revision of the subgenus *Paravespula* Bluthgen of eastern Asia. In same paper he recognised and described eleven specimen belonging to seven species. In the same year ARCHER also described a new species of *Dolichovespula* Rohwer and subspecies of *Dolichovespula paciticai* from China. In the same paper he described and figured new subspecies.

GIORDANI SOIKA in 1981 published two taxonomic papers. In the first paper he described new species and subspecies viz., *Ropalidia unidentata, Ropalidia crassipunctata, Polistes marginalis meruensis, Polistes marginalis kindensis, Polistes tenelluo minutissimuss* and *Polistes tencellum labejensis.* In the second paper he commented on *Subancistrocerus* Saussure of Pacific region. VAN DER VECHT in same year studied Indo-Australian solitary wasps. In the same year ARCHER published a paper on Taxonomy of the *Sylvestris* group with the introduction of a new name and notes on distribution. YAMANE in the same year published notes on Eumenid wasps from Japan and its adjacent region. In the same paper the author described new species *Anterhynalium melanopterum* and a new subspecies from Korea and gave a key to the Japanese and Korean Eumenids. SNELLING in same year published notes on systematics of social Hymenoptera. AKRE *et al.*, published notes on yellow jackets of America North of Mexico in 1981.

GIORDANI SOIKA in 1982 revised the Genus *Antepipona* Saussure of Oriental Region. In the same paper he described eight new

species, eight new subspecies, redescribed thirteen species and provided a key to species. In the same year GUSENLEITNER erected *Monodynerus* as a new genus of Eumenidae and described *Monodynerus insimilis* sp. nov from Tadzhikistan. KOJIMA in the same year published taxonomic notes on Genus *Vespa* Linnaeus of the Philippines. KOJIMA in the same year made a taxonomic revision of the subgenus *Icarielia* of the Genus *Ropalidia* Guérin of the Philippines. In the same year CARPENTER published notes on the phylogenitic relationship and natural classification of the Vespoidea.

In 1983 GIORDANI SOIKA published an excellent taxonomic contribution to the knowledge of the Afrotropical Eumenidae, with descriptions of new genera, fourteen new species and four sub species and twentytwo new synonyms. DAS and GUPTA in the same year published a catalogue of the families Stenogastridae and Vespidae from Indian subregion. In the same year GUSENLEITNER published an interesting taxonomic notes on Vespidae from the highlands of Spain in which he described a new species of the Genus *Leptochilus* Saussure. SNELLING also dealt with taxonomic and nomenclatural studies of American *Polistes* Latreille in the same year. In 1984 KOJIMA published taxonomic notes on *Ropalidia* Guérin of the Philippines. In the same paper he provided key to seven species of the subgenus *Icarielia.* In another taxonomic paper KOJIMA *et al.* in 1984 described a new subspecies of *Vespa tropica* from Cebu Island, Philippines. In the same year GUSENLEITNER dealt with the description of new subspecies of Hymenoptera, viz., *Eudynerus (pavenodynerus)*

quadrifaciatum rufipes from Asia Minor and *Eudynerus (Parcuodynerus) quadrifasciatum rubrosignatus* from Cyrenaica.

GIORDANI SOIKA in 1985 published three taxonomic notes. In the first publication he revised the Genus *Antepipona* Saussure of the Afrotropical region. In this he erected two new genus of *Ovodynerus* and *Gioiella* and he described twenty new species, four new subspecies and eleven new synonyms. In the second paper he described a new genus *Leptomicrodynerus* and two new species *Leptomicrodunerus tieshengi* and *stenodynerus nepalensis* of Nepal. In the third paper he described *Acarepipona insdita* n. gen. n. sp. a solitary wasp. In the same year KOJIMA and TANO made taxonomic notes genus *Ropalidia* Guérin of the Philippines. In the same year GULCHARD dealt with family Eumenidae of the Arabian peninsula. GUSENLEITNER in same year published describtion of a new species of *Leptochilus* Saussure from the Mediterranean region and from Iran.

LEE in 1986 published two taxonomic papers. In first paper he dealt with notes on the genus *Dolichovespula* Rohwer from China and described a new species *Perisphinter chinensis*. In second paper he commented on Genus *Vespula* Thomson from China. He studied 26 species of *Vespula* in China, among them five new species described are *Vespula hainanensis, Vespula gracilia, Vespula yichunensis, Vespula hirbuta* and *Vespula obscura*. GIORDANI SOIKA in the same year studied Eumenidae of Paleartic region and Eumenidae of Indo-Malaysian region and published seperately. GUSENLEITER described three new species of *Alastor* Lepeltier, *Alastor (Alastor) dariun*, *Alastor (Alastor) xerxes* and *Alastor (Alastor) zoroaster* from Iran in the same

year. KOJIMA and REYES published taxonomic notes on Philippine Vespidae and KOJIMA with TANO in same year described a new subspecies of *Vespa luctuosa* from Negros Island.

GIORDANI SOIKA again in (1986) published a paper on taxonomy of Eumenidae of Philippines. JACOBSON in the same year (1986) published an excellent field key to identify hornet (*Vespa*) of India. CARPENTER published a synonymic checklist of the Eumenidae in which he commented on a synonymic checklist of the genus group names in the Eumenidae and 177 genera with 34 additional subgenera.

GIORDANI SOIKA in 1987 published five taxonomic papers. In first paper he described a new species *Leptochilus* (*Euleptochilus*) *somalicus* gathered in Central Somalia. In second paper he dealt with Eumenidae of Gambia and in the third paper he revised the genera *Stellepipona* Soika and described six species in which *Stellepinona lamellata, Stellepipona brevicornis, Stellepipona ochraccotineta* and *Stellepipona invida* are new species and he also provided a key to species of African region. In fourth paper the same author contributed to the knowledge of the Afrotropical Eumenidae with keys to species of the genera *Pseudochilus* Saussure and *Parachilus* Soika and description of new genera and subgenera in which he described five new genera, three new subgenera, twenty one new species, sixteen new subspecies and nine new synonyms. In the fifth paper he dealt with Eumenidae of Borneo.

CARPENTER in the same year (1987) published three taxonomic paper. In the first paper he dealt with phylogenetic relationship and

classification of the Vespinae; in second paper he commented on 'the evolutionary genetics of social wasps' and the phylogeny of the Vespinae. In third paper he made a review of the subspecies in Eumeninae genus *Zeta* Saussure. YAMANE in the same year described a new paper wasp species *Polistes (Polistes) riparius* from Japan. Then in the same year he made studies on Japanese Eumenidae and described eight new species from Ryukyu Island. In same year he published a paper on the Vespinae of the Ryukyu islands, Japan in which he described three new subspecies and presented a distribution maps of the Vespinae within the region. PETERSON in the same year (1987) dealt with the subspecies of the Indo-Australian *Polistes stigma* Fabricius and recognised 19 subspecies. ARCHER in the same year described three new species of *Dolichovespula* Rohwer from China.

GIORDANI SOIKA in 1988 published a taxonomic paper on Eumenidae from Indonesia in which he described new species *Labus sumatrensis* and redescribed nine species. GIORDANI SOIKA and KOJIMA studied Eumeninae wasps collected in Papua and New Guinea by J. Kojima and described two new species, and two new subspecies. CARPENTER in the same year published nomenclatural notes on Polistinae in Entomological society of Washington. GUSENLEITER and in the same year described a new species *Leptochilus (Linotulus) longipilis* Bohart. KOJIMA and KOJIMA described three new species of *Polistes* Latreille from Papua New Guinea, with notes on the taxonomic status of the subgenus *Stenopolistes* Vander Vecht.

GIORDANI SOIKA (1989) published two papers and in first paper "Third contribution to the knowledge of the afrotropical Eumenidae" he

described seven new genera, 29 new species, 12 new subspecies and eight new synonyms. In the second paper he dealt with Eumenidae of African continent. NOZAWA in the same year commented on Biochemical-genetic differentiation among nine species of Polistine wasps from Japan. MAC DONALD in the same year dealt with social wasps of Indiana. DAS & GUPTA in same year published an excellent monograph 'The social wasp of India and the adjacent countries'.

GIORDANI SOIKA in 1990 revised Neotropical Eumenidae of the genera *Pachymenes* Saussure, *Brachymenes* Soika, *Pseudacaromenes* Soika, *Stenosigma* Soika and Gammazav with key to the genera, species and subspecies, and descriptions of new genus *Santamenes* (Type: *Eumenes santanna* Saussure), eight subspecies and two species. He was followed by YAMANE (1990) who published a revision of the Japanese Eumenidae. In the same year again GIORDANI SOIKA dealt with the genus *Katamenes* Meadewaldo of Africa and proposed new synonyms.

GUSENLEITNER (1991) delt with Eumenids of Indonesia. He was followed by WILLINK and F. LOBO who dealt with two mimetic species of higher mountain *Hypodynerus* Saussure. In the same year GIORDANI SOIKA published a paper 'Noutulae Vespidologicae XLVII, new *Alastor* Lepeltier from tropical Africa with description of a new subgenus.' In this paper he described new subgenus *Alastrocellus* of *Alastor* Lepeltier with a key to the species belonging to the new subgenus. Besides he also described the following taxa: *Alastor (Alastor) faustus gaudens* n. ssp. (F) (S. Africa); *A.* (*Alastrorellus*) *madecassus* n. sp. (F) (Madagascar); *A.* (*A.*) nigroflavus (F) (Kenya); *A.* (*A.*) *plicatus* n. sp. (F) (Keny). Again in the same year he published three

more taxonomic papers, in the first paper he dealt with the *Rhynchium* Spinola of the Middle East and adjacent countries in which he revised genus *Rhynchium* Spinola and provided key to species and subspecies. In the second paper he commented on Vespoidea collected in Madagascar by L.A. Wilson, with a key to *Ropalidia* Guérin species from Madagascar and described four new species, and he gave nine new synonyms. In the third paper he dealt with Eumenid wasps of Indonesia.

ARCHER (1992), published the taxonomy of *Vespa crabro* L. and *Vespa dybowki* Andre. He was followed by GIORDANI SOIKA who published taxonomic notes on some new or little known Eumenidae with description of five new genera, twelve new species, two subspecies, two new synonyms and three new combination. In the next year (1993) GIORDANI SOIKA published four taxonomic papers. In the first paper he dealt with collection of Noona Dan Expedition of 1961-62. In the second paper he studied the Eumenidae collected in Sulowesi by Dr. A. Van Achterberg, with description of: a new subspecies, *Parancistrocerus androceles sulawenses.* In this paper he downgraded *Rhynchium haemorrhoidale umeroatrum* (Gusenleitner) from *Rhynchium umeroater* Gusenleitner. In the third paper he described three new genera, nine new species and three new subspecies of Eumenidae from Australia and New Guinea. In the fourth paper he dealt with new Eumenidae from the Oriental Region in which he described three new genera and four new species and five new subspecies.

In 1994 KIM JEONG KYU, MOON TAE-YOUNG and YOON BYONG dealt with systematics of Vespinae wasps from Korea. In this

paper the authors revised *Vespa* Linnaeus and provided keys, diagnosis and figures. GIORDANI SOIKA (1994) published two papers. In the first excellent taxonomic paper on the Oriental species of the genus *Rhynchium* Spinola, he gave key to species of *Rhynchium* of Oriental region and also described new species viz., *Rhynchium claripenne* from Malaya, Nias and Borneo, subspecies *Rhynchium brunneum ceylonicum* n. ssp. from Sri Lanka, *Rhynchium rubropictum tenimberense* n. ssp. from Tenimber and *Rhynchium rubropictum nigriventre* n. ssp. from Ambon.

GIORDANI SOIKA in 1995 published four papers. In first one, he dealt with Vespoidea and provided a checklist of wasps in Italy and in the second paper he commented on new Eumenidae of Oriental Region (Papuasia). In the third paper he described two new species of Eumenidae from New Guinea and in the fourth paper he studied distribution of insects in the territory of Venezia.

GIORDANI SOIKA (1996) published two taxonomic papers and in the first paper he described two new Eumenid species *Ectopioglossa borsatoi* from Kenya and *Afreumenes melanosoma yemenensis* from Afrotropical Region. In second paper he dealt with Eumenidae of the Oriental Region. In 1997 ARCHER published paper on Taxonomy, distribution and nesting biology of *Vespa affinis* Linnaeus and *Vespa mocsaryana* Buysson. The same author in 1998 published another paper on taxonomy distribution and nesting biology of *Vespa orientalis* Linnaeus.

KOJIMA (1999) published two taxonomic notes on distribution of the Polistinae and a key to species of the genus *Ropalidia* Guérin. In his second paper he dealt with taxonomic notes on Australian *Ropalidia* Guérin. In the same year MAUSS commented on taxonomy, biogeography and phylogenetic position of the North American *Ceramius maroccanus* Complex. KOJIMA in the year 2000 published notes on "types" of the Australian species of the *Ropalidia interrupta* complex. In the same year RAW described a new species *Mischocyttarus (Kappa) santacrusi* from Eastern Brazilian wet forest.

CHAPTER II

MATERIALS AND METHODS

1. Collection Work

The adult specimens were collected alive from indoors and outdoors. Standard entomological collection techniques include using insect net (Fig. 1). The killing jar or tube with ethyl acetate is used. Adult insects were also collected from the nests.

a) Study area

Specimens were collected from almost all the districts of Kerala state (Fig. 3). Kerala the extreme south-western state in India, is located between 8°18' and 12°48' latitude, 74°52' and 77°22'E longitude. This narrow strip of land extends north-south between the Lakshadweep sea and the main peninsular Indian hill range, the western ghats. Although it is about 580 km in length North-South, its average width varies from 32 kms in the extreme north and south and to over 120 kms in the middle. The state of Tamil Nadu on the east and south and the state of Karnataka on the north and north-east form the state boundries. The area of the state is 38, 863 sq. kms. and works out to 1.18% of the total area of the country. Wasps not only collected from Kerala, but also from neibhouring states are also included in this study, since the wasp fauna of Kerala is not isolated from nearby places. The Calicut University campus provide diverse fauna of wasps.

According to the geographical features, Kerala can be divided into three regions. (1) The Highlands above 76 m (2) The midlands 7.6 to 76 m and (3) the low lands below 7.6 m.

With an average height of 900 m and a number of peaks well over 1800 m in height, the high land of western ghats includes large forested areas, with major hot spot areas of biodiversity.

The midlands consists of extensive hills and valleys, form an important cultivable area for cashew, coconut, arecanut, tapioca, banana, rice and different kinds of vegetables.

The lowlands includes the major coastal areas, mangroves and the major 44 rivers. This area also includes lagoons and backwaters.

b. Climate

Four alternate seasons cover the climate of Kerala. They are the hot season (March to May), south -west monsoon (June to September), postmonsoon (October to November) and north-east monsoon (December to February). The annual temperature range between a maximum of 35.9°C and a minimum of 23.8°C only. The main relative humidity value ranges from 60-90%. The total annual rainfall is excessive with over 3200 mm.

2. Methods of Collection

Collection of wasps can be by various methods. These methods are mentioned below.

a) Net sweeping

Wasps were usually collected by this method. The type of net most suitable for sweeping is of a particular design. The net used in the present investigation is a modified model of the one designed by NOYES (1982).

The sweep net essentially consists of a net bag attached on a triangular frame which in turn is connected to a cylindrical handle (Fig. 1). The triangular frame of the net is made up of aluminium with sides measuring 48 x 46 x 48 cm. The triangular shape increases the surface area of the net in contact with the ground while sweeping. The net handle is made up of 2.5 cm aluminium tube, about 1 m long. The frame fitted to one end of the handle, enables easy separation of the frame and can be used as far away from the body possible. The long handle makes possible sweeping even underneath long hanging bushes easier and extends the area of each individual sweep. The 60 cm net bag is made up of thin white cotton cloth or strong muslin which allow easy passage of air, the small pore size meshes preventing the escape of minute specimens. The rim of the bag is reinforced with a thick material, preferably, canvas.

For sweeping, it is important to choose an area where the vegetation is as diverse as possible. A grassland with a good variety of plants surrounded by several kinds of bushes and trees form an excellent location for collection. Sometimes indoors also form a good location for collection. The sweeping is done as described by NOYES (1982). Special attention should be given to the fact that, once the

insects are caught inside the net, their escape should be prevented by twisting the net sideways, so that the bag folds over the rim and thus retains the capture. The wasps caught into the net are transferred to killing jar or tubes with ethyl acetate or sucked into the aspirator.

b. Aspirator (Fig. 2)

Small vespids measuring upto 10 mm can be sucked into aspirator. It consists of a glass or plastic vial, fitted with a two-holed cork, holding two thin transparent glass or plastic tubes, acting as a sucker and an entry tube. One end of the entry tube is placed deep down the vial and other end extends well out to be placed against the desired insect. One end of the sucker inside the vial is covered with a piece of fine netting or screening to prevent the suction of insects and the other end is connected air tight to a moderately long rubber tube, to act as sucking device. By sucking, the vacuum created inside the vial draws the desired insect into it through the entry tube. The insects collected are killed by placing a piece of tissue containing a few drops of ethyl acetate in the entry tube. Large vespids measuring more than 10 mm collected in the net were taken to the laboratory by transferring directly to the killing bottle.

c. Small hand net

Wasps visiting on the plants were collected by using small hand nets. The small hand net consists of a circular mouth, a handle and a net bag. The circular mouth is made up of aluminium or iron wire with a diameter of 17 cm. The handle is also made up of aluminium and having a length of 30 cm. The netbag measures 35 cm in length and

made up of linen or thin cotton or muslin cloth, which allows the easy passage of air. After blowing, the collected specimens were transferred to killing jar or tube with ethyl acetate.

d. Malaise trap

A suitable design of Malaise trap has been well described by TOWNES (1972). This tent like device catches insects by chance as they fly into the sides of the trap, they crawl upwards on the cloth to the roof where they enter the killing bottle which contains 70% alcohol. There are several modifications of the original Malaise trap. The latest model of this net made by Messers. Marris House Net's, England is used in the present work. This net has two advantages, it needs to be visited only once a week for emptying and it can be serviced even by a non-entomologist.

e. Yellow-Pan or Moericke trap

This was not found useful for collecting vespids.

3. Storing and Preservation

a) Unmounted material

Wasps were put directly from the net into vials of alcohol. They can then be pinned whenever convenient. Long term preservation in alcohol can be improved by freezing. The alcohol was changed periodically so as the prevent the damage.

b) Relaxing

For relaxing, specimens were kept in an atmosphere of acetic acid for atleast 6-8 hours. This method was found very suitable for specimens which had been killed using ethyl acetate or other killing agents. Relaxing helped to prevent breakage of specimens when they were being card mounted. In order to achieve best results, a clear plastic sandwich box with a tight fitting lid was taken and covered the bottom with a thick layer of cotton wool. A few drops of glacial acetic acid added, followed by a second layer of cotton wool. Specimens to be relaxed were placed on top of a piece of tissue in a glass dish and the whole dish, kept in the box, which was then closed.

4. Mounting

Mounting of specimens needs special care in taxonomy. The specimens were mounted in such a way that all characters were visible easily.

a) Mounting on cards

The method followed in the present work is that adopted by BOUCEK and NOYES (NOYES, 1982). The well dried specimens was mounted on a rectangular card. The size of the card altered depending up on the size of the specimens. They were mounted in such a way that one side of their mesosoma was glued to the card. Thus the specimen was mounted on its right side touching the card. In another method, they were mounted on a triangular card in such a way that the ventral side of the mesosoma was glued to the tip of the pointed card, so that

the full details of the specimen can be observed thoroughly. But the specimens mounted on the tip of pointed card need special care because they are easily subjected to damage. In another method larger specimens were pinned by using standard entomological pins, passing through the mesosoma from dorsal side.

The materials used for card mounting were (1) Microscope (2) Rectangular or triangular pointed cards (3) Blotting paper (4) A fine zero point brush (5) Entomology pins (6) Water soluble glue and (7) Table lamp.

Before mounting, it was made sure that the glue was completely cold-water soluble. First of all, the specimens to be mounted is placed on a piece of blotting paper, so that the blotting paper absorbed the moisture content from the specimen. It was then dried under the table lamp. The specimen was placed under microscope, and looking through it, its antennae, labial and maxillary palpi, legs and wings were spread and properly positioned, by using brush and pins. The pins (No.3) used here is made by M/s Newey Goodman and Co's (England) Asta pins of size 38 mm x 0.55. Using the tip of a pin a small drop of glue was put on the card. The glue should be fine and water soluble. The tip of the brush was moistened with alcohol. The specimen was picked up using the brush and placed on the gum. Then the specimen was gently and firmly pressed down with the brush for good adhesion. Care was taken to keep antennae, legs, wings etc. free from glue. The wings were kept stretched out and flat on the card. The mounted specimens were held on Asta insect pins. Then the specimens were labelled.

b. Labelling and Registering

Temporary labels were written in the field at the time of collecting specimens. After mounting 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 registering of entries is as follows: (1) collection number (2) scientific name (3) name of locality (4) date of collection (5) name of the host (6) name of the collector (7) remarks. Serial numbers were also given to each specimen.

The mounted and labelled specimens were then kept in insect boxes, for detailed systematic studies. Naphthalene balls were placed in the boxes to protect the specimens from insect attacks. Thymol crystals were used as fungicides. 1,2-dichlorobenzene can also be used to prevent fungal growth.

C. Mounting on microslides

Microslides of important parts such as antennae, mouth parts, genitalia, legs, stings etc. of paratypes or other specimens were prepared to study the minute details of the specimens. For this purpose the necessary parts were removed from the specimens 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 for 24-48 hours. After clearing they were washed in glacial acetic acid followed by distilled water and then dehydrated by passing through graded series of alcohol. The dehydrated materials were then mounted on glass slides using DPX.

5. Observations

Sorting and mounting were done under Herter and Reuss Optik Kassel Sterezoom (W. Germany) microscope and card mounted specimens were observed under Olympus (Japan made) and M3Z WILD Stereozoom (Switzerland made) microscopes. Slide mounted specimens were observed under LEITZ WETZLAR (German made) microscope.

6. Measurements

All measurements of body parts were taken from the Leitz Wetzlar microscope by using micrometer.

7. Illustrations

The figures were drawn using drawing tube of WILD M3Z stereozoom microscope. Depending on the size of the specimens the figures thus obtained were kept as such and others were enlarged using KB enlarger of the model B2M.

STRUCTURES AND TERMINOLOGY OF ADULTS

The morphological terms used for describing different parts of the adult body are mainly based on the works of RICHARDS (1956, 1973), SEHGAL (1963), SPRADBERY (1973) and VAN DER VECHT (1941, 1975). The important terms may be defined as follows.

1. THE HEAD

Mandibles (Fig. 4): The paired, heavily sclerotized biting and chewing lateral appendage of mouth parts between the labrum and maxilla.

Maxillary palps (Fig.6): A pair of jointed appendages originating from the maxillae.

Labial palps (Fig. 6): A pair of jointed appendages originating from the labium.

Clypeus (Fig. 4): The medial sclerite of the head immediately above the labrum.

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. The rim of the socket is often strengthened by an internal submarginal ridge called antennal toruli. Subantennal sutures extends from each antennal socket down to anterior tentorial pit.

Antenna (Fig. 5): A paired, segmented sensory appendage of the head between the compound eyes.

Scape (Fig. 8): The first or proximal segment of an antenna called antennal scape.

Pedicel (Fig. 8): The second segment of the antenna, it articulates apically with the flagellum and basally with the scape.

Flagellum (Fig. 8): The third segment of the antenna, it is subdivided into flagellomeres.

Ocelli (Fig. 4): Simple eyes, bead-like eyes located in the central portion of the head, one median and two laterals.

Frons (Fig. 4): The area of the head between the ventral margin of the toruli and the anterior margin of the median ocellus.

Orbit (Fig. 4): The narrow border around the eyes. The inner orbit for the frontal or facial margin, and outer orbit for the genal margin.

Vertex (Fig. 6): The upper surface of the head between eyes, frons and occiput.

Occiput (Fig. 6). The hind parts of the dorsal surface of the head.

Malar space (Fig. 4): The space between the eyes and mandibles.

Supraclypeal area (Fig. 7): The space between clypeus and antennal socket.

Anterior tentorial pit (Fig. 4) a pair of small pits at the anterior margin of clypeus, below the antennal socket.

Ocular sinus (Fig. 4): a space formed on frons by the emargination of eyes.

Inner orbit (Fig. 4): inner margin of the eyes.

Temple (Fig. 6): a space between eye and occipital margin in profile view.

Occipital carina (Fig. 5): a carina at the posterior margin of occiput in profile view.

THE MESOSOMA

The wasp thorax is a compact structure consisting of sclerites of the pro, meso and metathoracic segments, which bear the legs and wings.

Pronotum (Fig. 9): The dorsal sclerites of the prothorax, which extends ventrally at each side as a process that meets or nearly meets its fellow behind the forecoxae. The propleura are the sides of the pronotum. The carina, ridge or elevated zone extends between the dorso-lateral angles along the posterior margin, called pronotal collar. Pronotum with posterolateral apex distinctly angulate or rectangular, extending slightly above and beyond anterior margin of tegulae and dorsolatral angle of the pronotum form the pronotal lobe.

Mesoscutum (Fig. 9): Large segment in between pronotum and scutellum in dorsal side.

Scutellum (Fig. 9): a medium sized segment in between mesoscutum and postscutellum in dorsal side.

Postscutellum (Fig. 9): a medium sized segment in between postscutellum and propodeum.

Propodeum (Fig. 9): Posterior segment of the mesosoma in which metasomal petiole is attached, the anterior side of the propodeum in some examples elevated, called propodeal dorsum. Its lateral sides provided with propodeal pit (Fig.ඉ).

Axilla (Fig. 9): The posterolateral portion of the mesoscutum lateral to the scutellum, usually trianglular.

Mesepisterum (Fig. 9): Laterally the mesothorax is represented by the mesepisternum, sometimes referred to as mesopleuron. Mesepisternum divided by episternal groove.

Epicnemium (Fig. 9): The anterior portion of the mesopleuron delimited posteriorly by the epicnemial carina.

Epicnemial carina (Fig.ඉ): The ridge on the mesopleuron that more or less parallels the anterior margin of the mesepisternum and that delimits the posterior margin of the epicnemium.

Metapleuron (Fig. 9): The lateral and ventral part of the postscutellum. Metapleuron divided into dorsal metapleuron and ventral metapleuron.

The wing (Fig. 11 & 12): The direction towards the costal margin is called anterior and towards wing apex called distal. The wing veins labelled in figure (Fig. 11 & 12).

Tegula (Fig. 9): A small, scale like sclerite covering the base of the forewing, basal to humeral plate.

Stigma (Fig. 11): In forewing a thickly sclerotized and usually darkly pigmented area seen on the apex of the costal vein.

Anal lobe (Fig. 12): A small lobe like structure at the base of the hindwing.

The legs (Fig. 10): Forelegs, midlegs and hindlegs present.

Coxa (Fig. 10): First segment of the leg which articulates legs to mesosoma.

Femur (Fig. 10): Second segment of the leg.

Tibia (Fig. 10): Third segment of the leg.

Tarsus (Fig. 10): Usually five with apical claw.

Tibial spines (Fig. 10): They are movable inferior apical spines on the tibiae. Some species with one spine but majority with two spines.

Arolium (Fig. 10): A pad like structure profoundling between the tarsal claw.

Trochanter (Fig. 10): An angle like segment in between coxa and femur.

3. THE METASOMA (Fig. 16)

Metasomal tergum (Fig. 16): The dorsal sclerites of the body which may be subdivided into tergite and usually referred to as Tergum one, Tergum two ... etc.

Metasomal sternum (Fig. 16): The ventral sclerites of the body, which may be subdivided into sternite and usually referred to as sternum one, sternum two . . etc.

Fasciae (Fig. 16): The terga often provided with coloured transverse bands. These are seen on different parts of the terga. These bands are called fasciae.

Ovipositor (Fig. 16): In females, a slender, paired and interlocking, saw - like or tubular structure used for laying the eggs or for stinging.

Aedeagus (Fig. 15): Middle rod-like structure in the male genital plate.

SYSTEMATIC STATUS AND DIAGNOSIS OF THE SUPERFAMILY VESPOIDEA

Antenna with ten flagellomeres in female and eleven in male; pronotum with posterolateral apex reaching or exceeding tegula, the posterodorsal margin shallowly to very deeply concave but seldom broadly U-shaped, with lobe covering spiracle scarcely developed or only weakly convex and with lateroventral extremities broadly seperated; metanotum short, transverse, fused with propodeum and sometimes exposed but not posteriorly expanded in middle; wing venation well developed, usually ten or nine closed cells in forewing and two closed cells in hindwing (sometimes fewer); hindwing usually with jugal lobe; first and second metasomal sterna often separated by a constriction; female without an articulation within gonocoxite two; ovipositor concealed at rest and modified as sting; plumose setae usually absent. Sexual dimorphism slight to extreme; male macropterous but very rarely brachypterous or apterous; female usually macropterous but sometimes brachypterous or apterous.

Remarks: According to latest classification by CARPENTER (1993) Superfamily Vespoidea includes ten families: Bradynobaenidae, Formicidae, Mutillidae, Pompilidae, Rhopalosomatidae, Sapygidae, Scoliidae, Sierolomorphidae, Tiphiidae and Vespidae.

Vespoidea includes two of the most frequently encountered groups of Aculeata viz., wasps and ants, both highly social. In addition, several groups of solitary predators or parasitoids comprise the vast majority of the wasps component of the superfamily. Vespoidea is mainly tropical, with perhaps 48,000 species around the world, about half undescribed (CARPENTER, 1993).

SYSTEMATIC STATUS AND DIAGNOSIS OF THE FAMILY VESPIDAE

It was perhaps SAUSSURE (1853) who provided a higher classification of Vespoidea. According to him "Vespoidea" (often called diplopterus wasps) can be divided into three types, viz., "Masarien" "Eumenienes" and "Vespiens". In 1857 SMITH divided Diploptera into three families "Masaridae, Eumenidae and Vespidae." DALLA TORRE (1894, 1904) also considered Vespidae as a family of Diploptera. BINGHAM (1897) classified Diploptera as one of the five "tribes" of Aculeata and recognised two families under it, viz., Eumenidae and Vespidae. ASHMEAD (1902) considered Vespoidea as one of the five "tribes" of Aculeata and recognized two families under it, Eumenidae and Vespidae. ASHMEAD (1902) considered Vespoidea as one of the eight superfamilies of Suborder Heterophaga of Order Hymenoptera and placed Vespidae as one of the sixteen families of the Superfamily Vespoidea. BORNER (1919) changed the name Diploptera to "Vespina" and divided it into two families, Masaridae and Vespidae. The family Vespidae was again divided into two subfamilies, the Vespinae and Eumeninae. Later BRADLEY (1922) and RICHARDS (1962) based their classification on the work of BEQUAERT (1918). Since then SPARDBERY (1973) and CARPENTER (1982, 1987) classified Vespoidea.

In this classification, family Vespidae is divided in two six subfamilies viz., Eumeninae, Euparagiinae, Masarinae, Polistinae, Stenogastrinae, and Vespinae (Except subfamily Euparagiinae which is

found only in Nearctic region) all the remaining five subfamilies are found represented in India. In Kerala only Eumeninae, Vespinae, Polistinae and Stenogastrinae are present. The subfamily Masarinae has not been not so far recorded from India.

Diagnostic characters

Eye with inner margin deeply emarginate; dorsal rim of torulus simple; Pronotum with posterodorsal margin V-shaped, and with posterolateral apex acute and strongly produced above anterior margin of tegula; mesocoxae and metacoxae contiguous; forewing usually longitudinally folded but sometimes not folded; hindwing without distinct claval lobe, and usually with distinct jugal lobe but sometimes without; posterior (inner) spur of metatibia weakly modified as a calcar. Metasoma sessile or petiolate; metasomal segment one without a true node although sometimes approaching it; metasomal sternum one separated from sternum two by a deep constriction; male metasomal sternum eight (hypopyrigum) simple not concealed. Usually no sterile worker caste. Sexual dimorphism slight: both sexes macropterous.

CHAPTER III

OBSERVATIONS AND RESULTS

KEY TO THE SUBFAMILIES OF VESPIDAE

1. Anal lobe of hindwing long, about 0.5x as long as submedian cell; forewing with postnervulus wavy, first brachial cell pointed apically; recurrent veins received in different cubital cells; nervulus curved and about as long as brachius vein (extralimital) ..... Euparagiinae

– Anal lobe of hindwing short, 0.3x or less than the submedian cell; forewing with postnervulus straight or slanting (Fig.26) not wavy, first brachial cell not pointed apically (Fig.26); recurrent veins received in the same or different cubital cells (Fig. 26); nervulus straight and much shorter than brachius vein 2

2. Antenna usually clubbed; eyes hardly emarginate; wings not folded longitudinally when at rest; metacarp of forewing curved away from wing margin so that radial cell rounded apically, mesoscutum without any carina opposite tegula; fore and middle femora without any suture demarcating a basal ring (extralimital) ..... Masarinae

– Antenna not clubbed; eye emarginate; wings folded longitudinally when at rest (except in stenogastrinae); metacarp of forewing and radius meeting at wing margin (Fig. 26); radial cell usually pointed apically; mesoscutum either with a carina opposite to tegula or with projecting lobe from posterolateral corner; middle femur, and often forefemur also, with a suture demarcating a basal ring 3

3. Claws bifid (Fig. 98); middle tibia with one or two spurs; inner side of tegula usually emarginate (Fig. 98) to receive a process of mesoscutum (parategula); mandibles long and usually crossing when at rest (Fig.98); hind wingwith an anal lobe. India .... Eumeninae

– Claw simple. Middle tibia with two spurs; tegula not emarginate; parategula absent mandibles short 4

4. Wings not folded longitudinally when at rest; tarsal claws with one tooth; mandible elongate; Glossa and paraglossa of labium without sclerotized pads; occipital carina either joining with or almost near to hypostomal carina; nevulus distinct (Fig. 26) arising almost from the joint between basal vein and discoideus; second cubital cell rectangular (Fig.26); mesosoma rather short globular; first (Fig. 28) gastral segment petiolate, much longer than rest of the gaster. India ..... Stenogastrinae

– Wings folded longitudinally when at rest; tarsal claws simple, without tooth; mandible of normal shape; glossa and paraglossa of labium with sclerotized pads; occipital carina joining (Fig. 5) with or running towards the base of mandible; nervulus short (Fig. 11) arising from discoideus, first cubital cell larger than second (Fig. 11) cubital cell; mesosoma normal; first gastral segment petiolate or subpetiolate or sessile, not much longer than rest of the gaster 5

5. Hindwing usually with an anal lobe (Fig. 12); hindcoxa without a dorsal carina; mesepimeron not completely or not at all separated

from mesepistenum; dorsal episternal groove and epicnemial carina present or absent; gaster petiolate or subpetiolate without pubescence; first tergite gradually curving from base to apex; occipital carina always present behind vertex; male antenna with a hook-like bend (Fig. 254) at apex. India ..... Polistinae

– Hinwing without anal lobe (Fig. 300): hind coxa with a dorsal carina (Fig. 31) on posterior surface; mesepimeron completely separated (Fig. 31) from mesepisterum; dorsal episternal groove and epicnemial carina always absent. Gaster sessile, appearing conical, usually with sparse or dense long pubescence; first tergite anteriorly truncate (Fig. 34) occipital carina absent dorsally behind vertex, usually present laterally but may or may not reach base of mandible; male antenna straight apically ..... Vespinae

Subfamily EUMENINAE

Diagnostic characters

Inner side of tegule usually emarginate to receive parategula; claws bifid; middle tibia with one spur; hind wing with an anal lobe; propodeal spiracles circular, mandibles long and usually crossing when at rest (with some exceptions).

Distribution: INDIA (Throughout India); all over the world except New Zealand.

Biology: Several species are solitary or subsocial.

Distribution: World wide except New Zealand.

Remark: They are commonly known as Potter wasps, making earthen pot-like cells, predatory, storing up caterpillars or sometimes larvae of sawflies or beetles. Some make nest in burrows or in wood cavities. Eumeninae is the largest and most widespread subfamily of Vespidae.

KEY TO THE INDIAN GENERA OF EUMENINAE

1. Metasoma petiolate (Fig. 172); first abdominal segment in dorsal view with width half or less than that of second abdominal segment, and at least twice as long as wide, usually longer 2

-- Metasoma not petiolate (Fig. 92); first metasomal segment with width more than half that of second abdominal segment, much less than twice as long as wide 4

2. Propodeal valvula elongate, rectangular; propodeal dorsum below plane of metanotum, sloping posteriorly; metanotum dentiform mesally (Fig. 172); tegula not exceeding parategula posteriorly; metasomal petiole abruptly swollen apically (Fig. 172) .... *Labus* Saussure

-- Propodeal valvula short, rounded; propodeal dorsum nearly horizontal; metanotum not dentiform (Fig. 168); tegula exceeding parategula posteriorly; metasomal petiole not conspicously swollen (Fig. 168) 3

3. Pronotum with pretegular carina absent; mesepisternum without epicnemial carina; male antennae not hooked apically .... *Eumenes* Latreille

-- Pronotum without pretegular carina; mesepisternum with or without epicnemial carina; male antennae hooked apically (Fig. 155) ..... *Delta* Saussure

4. Metanotum smooth (Fig. 193) 5

– – Metanotum bidentate (Fig. 92) ..... *Antepipona* Saussure

5. Anterior face of pronotum with two close coalesced foveae; propodeum with submarginal carina produced into pointed lamella apically (Fig. 189); valvula enlarged and free posteriorly from submarginal carina; first metasomal segment subsessile, narrower than second metasomal segment (Fig. 189) .... *Paraleptomenes* Gordani Soika

– – Anterior face of pronotum without foveae; submarginal carina and valvula usually not produced; first metasomal segment usually sessile and as equal as second metasomal segment (Fig. 193) 6

6. First metasomal tergum carinate (Fig. 86); axillary fossa broader than long; forewing with prestigma less than half as long as pterostigma (Fig. 86) ..... *Ancistrocerus* Wesmael

– – First metasomal tergum not carinate (Fig. 178); axillary fossa slit like; prestigma about more than half as long as pterostigma (Fig. 178) 7

7. Tegula (Fig. 178) not emarginate adjoining parategula and usually reaching apex of latter; propodeum with lateral carinae weak or absent (Fig. 178); female with cephalic foveae; vertex not rugose; male sterna without fringe; temples and mesosoma with long hairs .....*Odynerus* Latreille

– – Tegula emarginate (Fig. 134) adjoining parategula and often reaching or surpassing apex of latter; propodeum with or without carinae (Fig. 134); female without cephalic fovea; in male, third to

seventh abdominal sternite usually with conspicuous hairs; temples and mesosoma with fine pubescence 8

8. Tegula shorter than parategula posteriorly (Fig. 193); forewing with prestigma half or more the length of the pterostigma, measured along posterior part, axillary fossa narrowed slite like 9

-- Tegula equalling or exceeding parategula posteriorly; forewing with prestigma less than half the length of the pterostigma, measured along posterior part; axillary fossa wider than long ... . *Antodynerus* Saussure

9. Scutum and scutellum punctate; metanotum not compressed medially (Fig. 129); male midfemur not basally emarginate 10

-- Scutum posteriorly and scutellum impunctate; metanotum somewhat compressed medially (Fig. 193); male midfemur basally emarginate ..... *Rhynchium* Spinola

10. Metanotum not projecting over propodeum; propodeum not carinate, without apical projection (Fig. 129) .... *Anterhynchium* Saussure

-- Metanotum projecting over propodeum; propodeum with concavity delimited by carinae with sclerotized apical projection (Fig. 199) .... *Xenorhynchium* Van der Vecht

Genus *ALLORHYNCHIUM* Van der Vecht

Allorhynchium Van der Vecht, 1963, *Zool. Verh* (Leiden) 60: 57, 58. Type species *Vespa argentata* Fabricius, 1804. Original designation.

Diagnostic characters

Metanotum flat, not compressed medially; propodeal dorsum raised shelf like to same level; forewing with third submarginal cell separated from apex of marginal cell by about half its length; in male midfemur not basally emarginate and seventh sternum with one or two tubercles; first metasomal segment sessile, about as wide as second metasomal segment; tegula shorter than parategula.

Distribution: India (Kerala, Tamil Nadu, Sikkim), Burma.

Biology: Unknown.

Remarks: Solitary wasps; widely distributed in study area.

Allorhynchium argentatum(Fabricius)comb. nov.

Vespa argentata Fabricius 1804. *Syst. Piez.* p. 260.

Rhynchium argentatum Saussure. 1852. *Mon. Guip. Sol.* p. 115, FM.

Rhynchium argentatum Smith, 1857. *Cat. V*, p.25.

Female: Length 14-15 mm; black, without any markings; silvery pubescence completely absent; wings dark fuscous with a purple effulgence, not fusco hyaline on posterior half; veins dark brown.

Head: Strongly punctate; clypeus pyriform, apex emarginate and truncate.

Mesosoma: Strongly punctate; scutellum and postscutellum slightly sloped, not oblique; postscutellum not glabrous; propodeum slightly rounded posteriorly.

Metasoma: Smooth with fine shallow punctures.

Male: Similar to female except clypeus and scape in front yellow.

Biology: Unknown.

Habitat: Unknown.

Distribution: India: (Kerala, Tamil Nadu).

Remark: Since no specimen of this species has been encountered in the present investigation, the above description is based on the description of the species by Bingham (1903).

Genus *ANCISTROCERUS* Wesmael

Ancistrocerus Wesmael, 1836, *Bull. Acad. Sci. Bruxelles* 3: 45 (as subgenus of *Odynerus* Latreille). Type species *Vespa parietum* L. 1758. Designated by Girard, 1879, *Traite E'lem. Ent.* 2(2): 900.

Aucistrocerus (!) Rudow, 1876, *Arch. Ver. Freunde Naturgesh Mecklenb.* 30: 197.

Ancystrocerus (!) Dalla Torre, 1894. *Cat. Hym.* 9: 50 ff.

Euancistrocerus Dalla Torre, 1904. *Gen. Ins.* 19: 36. Newname.

Diagnostic characters

Axillary fossa broader than long; tegula exceeding parategula; first metasomal tergum transversely carinate; metasoma not petiolate; first metasomal segment with width more than half that of second metasomal segment; forewing with prestigma less than half as long as pterostigma.

Distribution: India: (Kerala, Calicut), Sri Lanka.

Biology: Unknown.

Remark: Not widely distributed in Kerala.

Ancistrocerus tinctipennis (Walker)

(Fig. 85-89)

Odynerus tinctipennis Walker, 1860. *A.M.N.H.* 3(5) 304.

Ancistrocerus tictipennis Motschulsky 1863: *Bull. Soc. Nat. Mus.* p.23.

Female: Length 11.7. Black with yellow markings. Yellow markings as follows: a spot between antennae, a line underneath antennal scape, a spot on ocular sinus, clypeus except an irregular black band on centre, a line on temple, pronotum broadly, tegula except a central brown spot, a spot on mesopleuron, postscutellum almost, a band on first tergite and second tergite, legs except upper part of femurs. Wings hyaline; radial cell almost cloudy; veins dark brown.

Head: Closely and densely punctate; width in anterior view (81:77) as long as distance between front ocellus and lower labral margin (Fig. 87); width in dorsal view 5x distance between front ocellus and posterior occipital margin; slightly wider than mesosoma (40:38); clypeus as wide as long (28:28) (Fig. 87), apex with two distinct short teeth; sparsely punctate, upper margin not emarginate; mandible smooth; vertex, frons, supraclypeal area, interantennal space, inner orbit and ocular sinus closely and densely punctate; interocellar distance (13:13) as long as ocellocular distance and 1.3x diameter of posterior ocellus; interocular distance more on vertex (45:28) than at clypeus; temple distinctly narrower than eye in profile (8:27) (Fig. 89); antenna farther from each other than from eyes (10:4); scape length 5x length of first flagellar segment; second flagellar segment 1.8x as long as first flagellar segment and 1.1x (9:8) as long as wide at apex (Fig. 88);

apical antennal segment as wide as long (7:7); all other segments subequal to each other.

Mesosoma: Closely and densely punctate; parategula longer than tegula posteriorly; postscutellum raised; propodeal concavity with acarinarium (usually with full of mites) and with two sharp teeth.

Metasoma: First tergite and second tergite closely and densely punctate; third, fourth, and fifth smoothly punctate and covered with silvery white pubescence; first tergite raised and forming an acarinarium usually with full of mites; first tergite wider than long (28:17); second tergite wider than long (Fig. 85) (33:25), smaller than hind femur (17:28) and 1.9 x as long as first tergite.

Male: Unknown.

Distribution: India: (Kerala, Calicut).

Biology: Unknown.

Habitat: Disturbed.

Materials examined: ***Plesiotype***: Female, INDIA: Kerala, Kozhikode, 9.ix.2000, Vyjayanthi.

Discussion: Since no other species of this genus is so far recorded from India, a comparison is not attempted here.

Genus *ANTEPIPONA* Saussure

Antepipona Saussure, 1855, *Et. Fam. Vesp.* 3: 244 (as division of subgenus of genus *Odynerus* Latreille; validated by ICZN, opinion 893, 1970: 187). Type species *Odynerus silaos* Saussure, 1853. Designated by ICZN, Opinon 893, 1970: 187. *Antepipona* Saussure, 1875, Smiths. *Misc. Coll.* 254: XXXX, 361. Emendation.

Antepipona (!) Dalla Torre, 1894, *Cat. Hym.* 9: 50: 96.

Mehelyella Moczar, 1937, *Folia Ent. Hung.* 3: 16. Invalid, no type designated. Made available by Bohart, 1951, in Muesebeck *et al.*, *Cat. Hym.* N. Am. : 888; with type species *Odynerus parvulus* Lepeletier 1841.

Odontodynerus Bluethgen, 1938 (1937), *Konowia* 16: 280 (as subgenus of "*Euodynerus* Bluethgen"). Type species *Odynerus orbitalis* Herrich - Schaefter, 1841. Orginal designation (as "*Lionots vagus* Radoszkowsi (= *Vagabundus* Dalla Torre nom. nov.)"

Metastenancistrocerus Bluethgen, 1938, *Dts Entomol* Z.: 460. Error for *Dichodynerus*; of Bluethgen, 1939, Veroeff. Dts Kolon. *Vebersee. Mus. Bremen* 2: 246.

Diagnostic Characters

Metanotum bidentate; midtibia with one spur; metasoma not petiolate; first metasomal segment with width more than half that of second metasomal segment, much less than twice as long as wide.

Small wasps (body length varies from 6 to 10 mm). Most species are black with yellow marks.

Distribution: India (Kerala, Tamil Nadu, Karnataka, Uttar Pradesh, Orissa, Kashmir, Punjab, Bengal, Maharashtra, Chattisgarh). Thailand, Vietnam, Malacca, Sumatra, Java, Sri Lanka, Burma and China.

Remarks: They are not recorded from North America and New Zealand widely distributed in Oriental Region.

KEY TO THE ORIENTAL SPECIES AND SUBSPECIES OF THE GENUS *ANTEPIPONA* SAUSSURE

(Modified from Giordani soika 1982)

1. Frons subopaque, smoothly punctate, punctures sparse and very superficial, almost indistinguishable in centre, brown (Fig. 102) 2

\- Frons glossy, moderately punctate, punctures different size; black (except one brown species) (Fig. 96) 3

2. Postscutellar teeth closer to lateral postscutellar margins than between themselves; propodeum moderately punctate on posterior side; second sternite bulged at base, where it is extremely convex, without longitudinal groove ..... *A. intricata* (Smith)

– Postscutellar teeth closer to each other than to lateral postscutellar margins (Fig. 101); propodeum smooth and glossy; second sternite regularly convex, with a longitudinal groove at base ..... *A. frontalis* G. Soika

3. Pronotum with anterior carina well developed on lateral sides, does not reach dorsal side, it bends inwards before reaching centre, completely rounded, with an additional carina, thin, in the shape of an arch, often not well distinguishable (Fig. 95) 4

– Pronotum with regular carina, often very small or absent on the posterior side (Fig. 125) 5

4. Apex of clypeus deeply emarginate; interocular distance 1.25x of ocellocular distance; fifth and sixth tergites with median yellow spot; jointed yellow markings at apex of clypeus .... *A. malabarica* sp. nov.

– Apex of clypeus not deeply emarginate; interocular distance 0.66x of ocellocular distance; fifth and sixth tergite without median yellow spot (Fig. 95); free yellow markings at apex of the clypeus (Fig. 96) .... *A. ceylonica* (Saussure)

5. Pronotum with large or medium sized punctures on middle third of anterior side, larger ones on middle, close to each other and separated by thin carinae 6

– Pronotum without punctures on anterior side 7

6. Clypeus, in female and male, wider than long, without longitudinal carinae (Fig. 126); postscutellar teeth very small and very close to postscutellar margin; distance between postscutellar teeth twice as much distance between each tooth and lateral postscutellar margin (Fig. 125); head and mesosoma closely and heavily punctate ..... *A. sibilans* (Cameron)

– Clypeus as wide as long, with two longitudinal carinae orginating from middle of clypeus; postscutellar teeth bigger, distance between teeth as equal as distance between each tooth and lateral postscutellar margin (Fig. 92); head and mesosoma moderately punctate ..... *A. biguttata* (Fabricius).a

a. Both scutellum and post scutellum with two yellow spots each (Fig. 92) ..... ssp. *biguttata* (Fabricius)

– Both scutellum and post scutellum with a yellow band each ..... ssp. *takaoensis* G. Soika

7. Black species with spots of dark red colour 8

– Species with different colour 9

8. Posterior side of propodeum opaque, with visible and numerous bands, some punctures not clear on bands; postscutellar teeth closer to lateral margins; base of second sternite more bulging ..... *A. tytides* Cameron

– Posterior side of propodeum glossy, with very superficial bands and small punctures; postscutellar teeth more distant from lateral margins; base of second sternite less bulging .... *A. bhutanensis* G. Soika

9. Second sternite very bulging at base, forms well distinguishable anterior side, separated from ventral side by means of a fold in the shape of a carina 10

– Second sternite not bulging or bulging very little at base 11

10. Reddish brown; lower margin of clypeus not emarginate; clypeus completely yellow (Fig. 120); mesopleuron with two yellow spots .... *A. sasidharani* sp. nov.

– Black; lower margin of clypeus deeply emarginate; clypeus with a yellow band at base (Fig. 99); mesopleuron with one yellow spot ..... *A. exelsa* G. Soika.a

a. Frons with two hexagonal yellow markings; two separate yellow spots on postscutellum (Fig. 98) ..... ssp *malabariensis* ssp. nov.

– Frons with single yellow spot; postscutellum without spots .... ssp *excelsa*

11. Propodeum with two short horizontal carinae at posterior side 12

– Posterior side of propodeum without carinae 14

12. Anterior carina of pronotum present not only on centre, but also on lateral thirds of posterior side; carina thin, distinguishable; clypeus in male with deep apical margin. Philippines .... *A. lyzonensis* (Rohw)

– Anterior carina present only on lateral side and not on centre; clypeus of male with less deep apical margin. India and Malaysian Islands 13

13. Female unknown; male : clypeus with deeper margin, with shape of a half circle; last segment of antennae almost straight, very short, its top barely reaches half of ninth segment; third tergite with few punctures, much larger in size; fifth and sixth sternites (sometimes on fourth) with several long hairs of brown-yellow colour. India ..... *A. pruthii* G. Soika

– Clypeus with less deep margin, in the shape of a part of a circle; last antennal segment strongly arched, long; its top goes well beyond base of ninth segment; the punctures of third tergite not larger than in alternate; punctures of two subsequent tergites are similar to those of third tergite; fifth sternite and sixth sternite without long hair ..... *A. brunnipes* (Fabricius)..a

a. Body entirely black ..... ssp. *atratulus* (Van der Vecht)

– Body with spots ..... b

b. All spots pale yellow colour ..... ssp. *brunnipes* (Fabricius)

– Body with spots of bright yellow colour or reddish yellow colour, in one species with both yellow and reddish spots c

c. Mesosoma with reddish spots ..... ssp. *pocillum* (Saussure)

– Mesosoma with yellow spots which turn to reddish in some parts ..... ssp. *ignobilis* (Smith)

14. Mesopleuron closely punctate, interspaces carinate 15

– Mesopleuron moderately punctate, interspaces between punctae, at least half of diameter of punctures 16

15. Second sternite aburptly lowered at base; clypeus in female (Fig. 123) wider than long with weak margins at top, with little sparse punctures and longitudinal carina soft and superficial; black with pale yellow spots ..... *A. siamensis* G. Soika

– Second sternite not lowered at base, sides slightly convex; clypeus of female slightly wider than long with deep margin at top, with large punctures, with large longitudinal carina; black with bright yellow spots. India, Malaysia ..... *A. rufescens* (Smith)

16. Postscutellum with very small teeth, close to lateral postscutellar margin; clypeus of female wider than long; two large yellow spots at base of second sternite (Fig. 113) ..... *A. ovalis* (Saussure)

– Postscutellum with teeth of normal size, less close to lateral postscutellar margin; clypeus of female as wide as long or slightly wider than long; base of second sternite without yellow spots 17

17. Fundamental colour brown ..... *A. aurantiaca* G. Soika

– Fundamental colour black 18

18. Second sternite almost regularly convex from bottom to top (Fig. 104) 19

– Second sternite convex at base, where it creates a fold followed by a slight depression (Fig. 92) 21

19. Clypeus in female with narrower and deep margin, teeth rounded (Fig. 105) 20

– Clypeus in female wider and not deeply emarginate margin, teeth not rounded ..... *A. censors* G. Soika

20. Anterior carina of pronotum not enlarged into sharp teeth (Fig. 104); cephalic groove absent; clypeus (Fig. 105) not entirely yellow; postscutellum without yellow marking ..... *A. keralensis* sp. nov.

– Anterior carina of pronotum enlarged into sharp teeth; cephalic groove present; clypeus yellow; postscutellum with yellow markings ..... *A. guttata* (Smith) ... a

a. First tergite black and yellow ..... ssp. *guttata* (Smith)

– First tergite black, rusty and yellow ..... ssp. *diffinis* (Saussure)

21. External margin of posterior lobes of tegulae emarginate; bends towards bottom, becoming almost vertical, smaller than parategula; parategulae straight ..... *A. exaltata* G. Soika

– External margin of posterior lobes of tegulae not emarginate (Fig. 92), bends slightly towards bottom, and almost equal to parategulae; parategulae arched ..... *A. bipustulata* (Saussure)

***Antepinona biguttata biguttata* (Fabricius)**

(Figs. 89a-91)

Vespa biguttata Fabricus, 1787, *Mant. Ins.*, 1: 291-Schulz, 1912, *Berl. ent zta.* 57: 83, 100.

Odynerus biguttatus, Schulz, 1912, *Berl. e. zta* 57: 100, LIU, 1939, *Pek. nat Hist*: Bull, 11: 106.

Odontodynerus biguttatus Van der Vecht, 1959 *Arch. Necleri Zool.*, suppl., 1 (1958): 241 Fig.3 (F). 1Wata, 1964, *Nature and life in SE Asia*, 3: 344 (Biol.).

Antepipona injucunda Soika, 1973 *Bol. Mus. Civ. st Nat. Venezia* 24: 104 (M F).

Female: Length 10 mm. Black with yellow markings as follows: ocular sinus, broad rectangular shaped mark just above the antennae, clypeus except a triangular mark on the middle, scape of antenna, broad band on temple, pronotum major part, tegula (except a brown spot on middle), parategula, a band on scutellum, two separate spots on postscutellum, a spot on metapleuron, a medially broad band on first

tergite and second tergite, apical bands on third and fourth normal, a yellow spot on fifth and sixth tergites, yellow spot on side of first tergite united to apical band, spot on side of second tergite free, two large oval shaped yellow markings on sides of propodeum; legs completely but dorsal side of first femora and last femora entirely black; all tarsi brown, veins dark brown and wings with a brownish tint.

Head: Width in anterior view 1.2 x as long as 3x distance between front ocellus and lower labral margin (Fig. 90); head width in dorsal view 4.8 x distance between front ocellus and posterior occipital margin, slightly narrower than mesosoma (60:64) clypeus width longer than 1.3 x it length (24:20) (Fig. 90); clypeus with shallow punctures and silvery pubescence; supraclypeal area, inter antennal space, occular sinus, gena, temple, vertex, occiput with deep close punctures; interocular distance 0.7x ocellocular distance; antenna with scape length 5.6x length of first flagellar segment (Fig. 91). The last flagellar segment 1.5x length of eleventh segment.

Mesosoma: Stout; Anterior carina of pronotum well developed on side, not touching centre on dorsal side, with an additional thin arched carina, some times not well distinguishable, Middle third of anterior face of pronotum with a horizondal series of more or less regular dots, of large or medium size, but very close to each other, Mesosoma with distinct close punctures, interstices narrow and rugose on mesoscutum; interstices smooth on yellow area; mesopleuron similarly punctuate; interstices smooth, postscutellum with two distinct teeth directed upwards, the distance between postscutellar teeth 2x as much distance between each tooth and lateral postscutellar margin (4:8), propodeum

with a median carina; propodeal cavity without carinae on sides; propodeum with two sharp teeth directed posteriorly.

Metasoma: With shallow scattered small punctures; smaller than mesoma, first tergite 0.9x as wide as its length (Fig. 89); second tergite a little more than 1.18x as wide as its length.

Distribution: India (Kerala; Calicut; Tamilnadu, Nilgiri Hills, Gudalur, Assam, Manipur), Vitenam, China, Burma.

Male: Unknown.

Biology: Unknown.

Habitat: Disturbed.

Materials examined: ***Plesiotype:*** Female, INDIA: Kerala, Calicut University Campus, Girish, 2.iii.2001 (DZCU).

Discussion: This subspecies can be separated from *Antepipona biguttata takaoensis* Soika in the following ways: 1. In *Antepipona biguttata biguttata* both scutellum and postscutellum with two yellow spots (In *A. biguttata takaeoensis* two yellow bands are present on scutellum and postscutellum). 2. In *Antepipona biguttata biguttata* the first femur, second femur and third femur with black markings (In *A. bigutta takaeonsis* markings present in hind femur only).

Antepipona bipustulata (Saussure)

(Figs.92-94)

Odynerus bipustulatus Saussure, 1955, Et. fam. Vesp., 111: 277. Smith, 1857, *Cat. Hym. Br. Mus.* 5: 85 – Saussure, 1863, *Mem. Soc. phys. Hist. nat Geneve*, 17, 1:226 – Bingham, 1896, *Faunc Br. India*, 1:362 e 369, fig 108 – Rothney, 1903, *Trans, ent. soc., London*, 1903: 107-Annuandate, 1912, *Rec. Ind. Mus.* 7: 39 – Schulthess, 1914, 2001. *Jahr. Syst* 37:266; 1927, *Suppl. Entom.*, 16:82 – Dover 1929, *Bull. Raggles Mus.*, 2:45:1931, *J. Fed Malay St. Mus.* 16; 255 - Bischott, 1932, *Arch, Hydrob. suppl.*, 9: 739.

Male: Length 8.5 mm. Black; with yellow marking as follows: ocular sinus, clypeus, a spot between antennae connected to clypeus, lower side of mandible, antennal scape, a band on temple, pronotum major part, tegula (except a spot on middle), parategula, two sports on metanotum, two spots on postscutellum, a spot on mesopleuron, a vertical band on side of propedeum, a small band on first tergite, a medially broaded band on second tergite, a separate spot on lateral side of second tergite, third segment without band, fourth and fifth with apical bands, tibia and tarsi completely. Wings with brownish tint; veins dark brown.

Head: Width in anterior view 1.25x as long as distance between front ocellus and lower labral margin (Fig. 93), head width in dorsal view 5.5x distance between front ocellus and posterior occipital margin; slightly smoother than mesosoma (39:42); clypeus width larger than its length (20:16), upper margin of clypeus not straight, lower margin of

clypeus as in (figure 93) with slight emargination, clypeus with shallow scattered punctures; supraclypeal area, inter antennal space, occular sinus, frons, gena, temple, vertex and occiput with deep close punctures, Interoccular distance in dorsal veiw subequal to interoccular distance in front view, inter occellar distance equal to ocellocular distance (9:9), Antanna with scape length 4.7x length of first flagellar segment; second flagellar segment 2.5x as long as first flagellar segment (Fig. 94), third, fourth, fifth and upto tenth subequal, thirteenth hook like, hook longer and reaching tenth segment.

Mesosoma: Stout with distinct close punctures; interstices narrow and rugose on mesoscutum; interstices smooth on yellow area, punctures of mesepisternum less numerous, separated by space, which on average at least half of the diameter of dots, often larger in bottom posterior side; postscutellum with two distinct teeth directed upwards and less close to lateral postscutellar margin, propodeum without median carina; propodeal concavity with fine carina on sides; porpodeum with two sharp teeth directed posteriorly.

Metasoma: With shallow scattered small punctures, smaller than mesosoma first tergite 2.6x as wide as it length; second tergite width longer to its length (38.30) (Fig. 92); second sternite convex at base where it creates a sort of step followed by a slight depression.

Biology: Unknown.

Habitat: Disturbed.

Distribution: India: Midnapur, Mecheda, Nilgiri Hills,

Cherangode, Orissa Brahinagiri, Nimapura, Pipli. China: 2 M Loc. Indecifrabile (Ist 2001 Peking); Thailand: Faktaka, 1M; Burma: Bhamo, Palon, Pegu, Punkatung, Rangoon; Malaya: Kanching, Kuala Langat, Kuala Lumpur, Penang; Singapore: Kimkiat, Sumatra : Medan; Java: Bandoeng, Djasinga Toge, Dungas Iwul, Preanger, Soekaboemi, Semarang, Djatingalih, Sindanglaia, Tjikadjang, Bandjarwangi, Tjisinga.

***Material examined*: *Plesiotype*:** Male, INDIA, Kerala, Kerala Forest Research Institute Campus. 3-iv-2000. Female, Unknown.

***Discussion*:** This species comes near to *Antepipoma guttata* Smith in the key to species of *Antepipona* of Oriental Region of Soika (1982). However it differes from *A. guttata* in having: 1. Clypeus apex normal (In *Antepipover guttata* clypeus apex with emargination). 2. Second sternite very convex at the base, it creates a carnia followed by a slight depression. (In *Antepipone guttata,* second sternite normal and carina absent). 3. Side of the propodeum with two lateral yellow bands vertically (In *Anterpipona guttata* side of porpodeum with yellow oval markings). 4) Anterior carina of pronotum normal and not developed into enlarged sharp teeth. (*In Anterpipone guttata* anterior carina of pronotum developed into enlarged sharp teeth).

Antepipona ceylonica (Saussure)

(Fig. 95-97)

Odynerus ceylonicus Saussure, 1867, *Reised Novara, Zool,* 2(1) : 12 – Bingham, 1896, *Proceed. Zool. Soc.* London, 1896: 449; 1897 *Fauna Br. India, Hym.* 1.362e 369-Paiva, 1907, *Rec Ind. Mus.* 1:15.

Odynerus ornaticaudis Cameron, 1909, *J. Bombay Nat. Hist. Soc.* 19:37 (M). Giordani Soika, 1941, *Soc. Veneziana St. Nat.* 2:264.

Female: Length 10.1 mm. Black with yellow marking as follows: ocular sinus, a spot between antennae, upper part of clypeus, two irregular marking on base of clypeus, lower sides of mandibles, scape of antannae, broad band on temple, pronotum major part, tegula (except a spot on middle), parategular, two spots on metanotum, a spot on mesopleuron, a band on first tergite and second tergite, a broad round spot on side of second tergite; first and second femora and first, second and third tibiae yellow. Wings with a brownish tint, veins brown.

Head: Width in anterior view 1.3x as long as distance between front ocellus and lower labral margin (Fig. 96); head width in dorsal view 3.12x distance between front ocellus and posterior occipital margin, slightly narrower than mesosoma (56:58); clypeus width a little longer than 1.1x its length (24:22); upper margin of clypeus almost straight (Fig. 96), clypeus with silvery pubescence and shallow scattered punctures; supraclypeal area, interantennal space, ocular sinus, frons, gena, temple, vertex and occiput with deep close punctures, interocular distance in dorsal view subequal to interocular distance in front view;

interocellar distance 0.66x ocellocular distance; antenna with scape length 4.12x length of first flagellar segment; second flagellar segment (Fig. 97) 1.9x as long as first flagellar segment; third and fourth segments subequal in length, rest of the segments shorter than fourth segment but subequal.

Mesosoma: Stout; anterior carina of pronotum well developed on sides, not touching at center on dorsal side, interstices narrow and rugose on mesoscutum, interstices smooth on yellow areas; mesopleura similarly punctuate, but interstices smooth; postscutellum with two distinct teeth directed upwards; propodeum without median carina, propodeal cavity with fine carinae on sides, propodeum with sharp two teeth directed posterioly.

Metasoma: With shallow scattered small punctures, smaller than mesosoma (Fig. 95); first tergite 1.4 x as wide as its length; second sternite a little more than 1.48x as wide as its length.

Male: Unknown.

Distribution: India: (Uttar Pradesh, Benares, Tamil Nadu, Anamalai Hill, Madras state, Coimbatore, Madurai, Nilgiri Devak, Alagar Kovil, Kerala State, Walayar forest, Karnataka, Mysore, Nandy Hills, Orissa), Sri Lanka: Kandy, Deyannevelu Kandy Hantana, Kandyu, Pitakanda, Kegatta, Polonnaruwa, Teldeniya.

Biology: Unknown.

Habitat: Disturbed.

Material examined: ***Plesiotype:*** Female, INDIA: Kerala, Calicut, 3.iv.2000 Coll. L. Kishore (DZCU).

Discussion: This species comes near to *Antepipona biguttata* (Fabricius) in the key to species of *Antepipona* of Oriental Region of Soika (1982). However it differs from *Antepipona biguttata* (Fabricius) in following characters: (1) In *Antepipona ceylonica* pronotum with a additional carina (It is absent in*Antepipona biguttata*). 2. In *Antepipona ceylonica* anterior side of pronotum with a median fovea (it is absent in *Antepipona biguttata*). 3. In female *Antepipona ceylonica* clypeus with yellow band on base and two irregular spots on apex (In *Antepipona biguttata* such markings are absent). 4. .In *Antepipona ceylonica* postscutellum black with large teeth (In *Antepipona biguttata* postscutellum with yellow markings and small teeth). 5. In *Antepipona ceylonica* pronotum with strong carina (In *Antepipona biguttata* it is very weak).

Antepipona excelsa malabariensis subsp. nov.

(Figs. 98-100)

Female: Length 7.6 mm. Black with dark yellow. Semiorange marking as follows: ocular sinus, two fused hexagonal spots between antennae, irregular mark on the base of clypeus, lower sides of mandible, scape of antennae, band on temple, a line on anterior margin of the pronotum (except a spot of middle), two semi oral spots on metanotum, two oval spots on postmetanotum, a spot on mesopleuron, two large oval spots on sides of propodeum, a band on first tergite and

second tergite, a separate spot on side of second tergite, thin fasciae on third tergite but not jointed medially, relatively large fasciae on fourth tergite almost complete tergite; tarsi, tegulae. Wings brown, radial cell with apical brown cloud.

Head: Width in anterior view 1.15x as long as distance between front ocellus and lower labral margin (Fig. 99); head width in dorsal view 4x distance between front ocellus and posterior occiptal margin, as broad as mesosoma; clypeus width larger than (19:15) its length (Fig.99); upper and lower margin of clypeus not straight, clypeus with silvery pubescence and shallow scattered punctures; supraclypeal area, inter antennal space, ocular sinus from gena, temple, vertex and occiput with deep close punctures; interocular distance in dorsal view subequal to interocular distance in front view; interocellar distance slightly smaller than ocellocular distance (3:4); antenna with scape length 4.3x length of first flagellar segment (Fig. 100); second flagellar segment 1.8x as long as first flagellar segment, third and all other segments subequal in length.

Mesosoma: Stout with distinct close punctures; interstices narrow and rugose on mesoscutum; interstices smooth on yellow area; punctures of mesepisternum are numerous; pronotum with regular carina; postscutellum with two distinct teeth directed upwards, teeth are close to the lateral postscutellar margin; posterior side of the propodeum rugose, striation not clear, but thickly punctuated, two sharp teeth directed posteriorly.

Metasoma: With shallow scattered small punctures, smaller than mesosoma; first tergite 2.4x as wide as its length; second tergite width little longer than its length (42:36) (Fig. 98); second sternite very bulging at its base, anterior side differentiated from posterior side by a fleshy fold (carina), followed by a large depression.

Distribution: India: Kerala, Elathur, Parambikulam, Calicut University Campus.

Biology: Unknown.

Habitat: Disturbed.

Material examined: ***Holotype:*** Female. INDIA: Kerala, Parambikulam, 8.iv.1996, George Mathew. ***Other materials examined:*** 2 Females, INDIA: Kerala, Elathur, 22.viii-2000, L. Kishore, INDIA: Calicut University Campus, 10-x-1990, T.C. Narendran (DZCU).

Discussion: This subspecies comes near to *Antepipona excelsa excelsa* Soika in the key to species of *Antepipona* of Oriental Region of Soika (1982). However it differes from *Antepipona excelsa excelsa* in having: 1. In *Antepipona excelsa malabariensis* sp. nov. two hexagonal mark on frons (In *Antepipona excelsa excelsa* it is a single spot). 2. In *Antepipona excelsa malabariensis* sp. nov. two separate spots present on postscutellum (it is absent in *Antepipona excelsa excelsa).* 3. In *Antepipona excelsa malabariensis* sp. nov. wings with brownish tint (It is violet tint in *Antepipona excelsa excelsa*). 4. In *Antepipona excelsa malabariensis* sp. nov. third tergite with apical band only on side (Third tergite with complete apical band in *Anatepipona excelsa excelsa*).

Antepipona frontalis Soika

(Figs. 101-103)

Antepipona frontais Soika 1982. *Boll. Mus. Civ. Sto. Nat. Ven.* Vol. 32, p.255.

Male: Length 10 mm. Ferrugineous with yellow and black markings. Yellow marking as follows: Ocular sinus broadly, an irregular mark between antennae, clypéus entirely, lower sides of mandible, scape of antennae, only centre of pronotum, tegulae only at posterior ends, parategula entirely, faint fasciae at poterior margin of pronotum, two faint spots on lateral margins of metanotum and postscutellum, a thin band on first tergite, a medially broad band on second tergite, a spot on side of second tergite, apical fasciae on all other segments except last, The black marking as follows: antennal socket, a line from socket to frons, irregular mark on frons encircling the ocelli, joints of segments, an irregular band just above yellow band on first tergite and second tergite; upper parts of all femora, tarsi ferruginous; anterior regions (very lighty) of scutellum and post scutellum yellow, Wings hyaline, veins dark brown, radial cell with apical cloud, stigma hyaline.

Head: width in anterior view 1.41x as long as distance between front ocellus and lower labral margin (Fig. 102), head width in dorsal view 3x distance between front ocellus and posterior occipital margin, slightly narrower than mesosoma (45:52); occiput and temple glossy; clypeus width longer than 1.25x its length (20:15); upper margin of clypeus normal (Fig. 102); clypeus without silvary pubescence, with

shallow punctures, supraclypeal area, interentannal space, vertex and occiput with deep close punctures; interocular distance in dorsal view subequal to interocular distance in front view; interocular distance 7x ocellocular distance; antenna with scape length 4.5x length of first flagellar segment (Fig. 103), second flagellar segment 1.5x as long as first flagellar segment, third, fourth, fifth and sixth subequal; last segment hooked, end of hook does not reach to middle of eleventh segment.

Mesosoma: Stout, with distinct close punctures; interstices narrow and rugose on mesoscutum; interstices smooth on yellow area; mesopleuron with close punctures; anterior pronotal carina absent, posterior side of propodeum without carina, propodeal cavity almost smooth, glossy; propodeum with two sharp teeth directed posteriorly; postscutellum with two sharp teeth, post scutellar teeth closer between themselves than to lateral postscutellar margin.

Metasoma: With shallow scattered small punctures, width smaller than (42:53) mesosoma; first tergite 1.8x as wide as its length, second tergite 1.25x as wide as its lengths (44:35) (Fig. 101); second sternite regularly convex with a longitudinal shallow channel.

Distribution: India: Tamil Nadu, Tirunelvelly, Kerala, Nilambur, Sri Lanka: Ham Dist., Palatupana tank, Wilpetty Nat. Park, Mannay District, Silavatturai, Kondachch.

Biology: Unknown.

Habitat: Undisturbed.

Material examined*: *Plesiotype: Male, India: Kerala, Nilambur 15-ix-2000 L. Kishore and Sridharan.

Discussion: This species comes near to *Antepipona intricata* (Smith) in the key to species *Antepipona* of Oriental Region of Soika (1982). However it differes from *Antepipona intricata* in having: (1) Postscutellar teeth closer between themselves than to lateral postscutellar margin, (in *Antepipona intricata* postscutellar teeth closer to lateral postscuttellar margin than between themselves). (2) Posterior side of the propodeum smooth and glossy (in *Antepipona intricata* posterior side of the propodeum with little dots). (3) Second sternite almost regularly convex from base to upper margin (In *Antepipona intricata* second sternite extreamly convex). (4) Second sternite with longtitudinal shallow channel (trough) at base (In *Antepipona intricata* it is absent).

Antepipona keralensis sp. nov.

(Figs. 104-106)

Female: Length 8 mm. Black with brownish yellow marking as follows: ocular sinus, a spot between antennae, upper past of clypeus, two jointed irregular marks on apex of clypeus, lower sides of mandible, scapes of antannae, broad band on temple, pronotum major part, tegulae (except a spot on middle), para tegula, two spots on metanotum, a spot on mesopleuron, a spot on side of propodeum, a band on first tergite and on second tergite, a separate spot on side of second tergite, all other segments without bands, first femur half, second and third complete black, tarsi yellow wings with a brownish tint, veins dark brown.

Head: Width in anterior view 1.2x as long as distance between front ocellus and lower labral margin (Fig. 105); head width in dorsal view 3.6 x distance between front ocellus and posterior occipital margin, slightly smaller than mesosoma (50:52) clypeus width smaller than (19:23) its length upper margin of clypeus not straight; lower margin of clypeus (Fig. 105) with narrower and deeper margin; clypeus with silvery pubescence and shallow scattered punctures; supra clypeal area, inter antennal space; ocular sinus, frons, gena, temple, vertex and occiput with deep close punctures; interocular distance in dorsal view subequal to interocular distance in front view; inter occullar distance as equal as ocellocular distance (8:9); Antenna with scape length 4.5x length of first flagellar segment; second flagellar segment 2.2x as long as first flagellar segment (Fig. 106), Third and fourth segments subequal in length, rest of the segments shorter than fourth segment but subequal.

Mesosoma: Stout, with distinct close punctures; interstices narrow and rugose on mesoscutum; interstices smooth on yellow area; punctures of mesepisternum are less numerous, seperated by space which are, on average, at least half of diameter of dots, often larger in bottom posterior side; postscutellum with two distinct teeth directed upwards, teeth are not close to lateral postscutellar margin; propodeum without median carina; propodeal concavity without fine carinae on sides, propodeum with two sharp teeth directed posteriorly.

Metasoma: With shallow scattered small punctures smaller than mesosoma; first tergite 1.7x as wide as its length (Fig. 104), second tergite width subequal to its length (37:36).

Biology: Unknown.

Habitat: Disturbed and undisturbed.

Distribution: India: Kerala, Wayanad, Kangangad, Calicut.

Etymology: Named after area of collection.

Material examined: ***Holotype:*** Female. INDIA: Kerala. S. Bathery, 1.vii.1999, L. Kishore. ***Other materials examined:*** 1 Female. INDIA: Kerala, Calicut University Campus, 4.vi.1998, Jobiraj. 1 Female. INDIA: Kerala, Kangagad, 26.i.1999, K. Gopi. 2 Males, India: Kerala, Calicut, 28.vii.1999, L. Kishore; 1 Male, India: Kerala, Calicut University Campus, 10.iv.2001, Jobiraj (DZCU).

Discussion: This new species comes near *Antepipona guttata* Smith in the key to species of *Antepipona* of Oriental Region of Soika (1982). However, it differs from *Antepipona guttata* in following features. 1. In *Antepipona keralensis* sp. nov. clypeus with two irregular markings at apex (in *Antepipona guttata* clypeus is yellow). 2. In *Antepipona keralensis* sp. nov. above the ocelli a groove is absent (In *Antepipona guttata*, above the ocelli a groove covered with brown hairs is present). 3. In *Antepipona keralensis* sp. nov. anterior carina of pronotum normal and not developed into enlarged sharp teeth (In *Antepipona guttata* anterior carina of pronotum present only at shoulder and it is well developed into enlarged sharp teeth). 4. In *Antepipona keralensis* sp. nov between the postscutellar teeth concave depression is absent (in *Antepipona guttata* between the postscutellar teeth concave depression is present). 5. In *Antepipona karalensis* sp. nov. First

tergite 1.7x as wide as its length (In *Antepipona guttata* first tergite 2x as wide as its length). 6. In *Antepipona keralensis* sp. nov. postscutellum without yellow marking (In *Antepipona guttata* postscutellum with yellow markings).

Antepipona malabarica sp. nov.

(Figs. 107-109)

Female: Length 9.5 mm. Black with yellow marking as follows: Ocular sinus narrowly, an oval mark between antennae, base of clypeus and two jointed irregular marks on apex, lower sides of mandible, scape of antennae, a thin small band on temple, upper one third of pronotum, outer margin of tegula, parategula, one joined band on metanotum (almost entirely) a spot on metapteuron, an oval shaped mark on side of propodeum, a thin band on first tergite, a medially brodent band on second tergite, two separate spots on sides of second tergite, a median oval spots on fifth and sixth tegites; basal half of first, second and third femora black, tarsi brownish yellow. Wings with brownish tint; veins dark brown; radial cell almost dark brown.

Head: width in anterior view 1.14x as long as distance between front ocellus and lower labral margin (Fig. 108); width in dorsal view 3.4x distance between front ocellus and posterior occipital margin, slightly narrower than mesosoma (423:44), clypeus width shorter than .83x its length (19:23) (Fig. 108), upper margin of clypeus normal and oval, clypeus without silvery pubescence, with shallow punctures; supraclypeal area, internantennal space, vertex and occiput with deep

close punctures, interocular distance in dorsal view subequal to interocular distance in front view, interocular distance 1.25x ocellocular distance; Antenna with scape length 4.25 x length of first flagellar segment (Fig. 109), second flagellar segment 1.75x as long as first flagellar segment; third, fourth, fifth subequal, last segment 1.5x longer than third segment.

Mesosoma: Stout, with distinct close punctures, interstices narrow and rugose on mesoscutum, interstices smooth on yellow areas; mesopleuron without punctures, separated by a space which on average, atleast half of the diameter of the a pit; anterior pronotal carina present; and not reaching first femora; posterior side of the propodeum without carina propodeal concavity with fine lateral carinae; propodeum with two sharp teeth directed posteriorly; postscutellum with two distinct upwardly directed teeth.

Metasoma: With shallow scattered small punctures, width smaller than (47:54) mesosoma; first tergite 1.3x as wide as its length (Fig. 108); second tergite as wide as its length.

Male: Unknown.

Etymology: Named after collection locality.

Distribution: India: Kerala, Calicut University Campus.

Biology : Unknown.

Habitat: Disturbed.

Material Examined: ***Holotype:*** Female, INDIA: Kerala, Calicut University Campus, 4.v.2001, L. Kishore. ***Other materials examined***: Female, INDIA: Kerala, Calicut University Campus, 4.v.2001, L. Kishore (DZCU).

Discussion: This new species comes near *Antepipona ceylonica* (Saussure) in the key to species of *Antepipona* of Oriental Region of Soika (1982). However it differs from *Antepipona ceylonica* in having: (1) In *Antepipona malabarica* sp. nov. yellow markings at the apex of the clypeus are jointed, and larger in size (yellow markings free at apex in *Antepipona ceylonica.* (2) Apex of the clypeus deeply emarginate in *Antepipona malabarica* sp. nov. (It is normal in *Antepipona ceylonica*). (3) In *Antepipona malabarica* sp. nov. oval shaped spot on interantannal space (It is round in *Antepipona ceylonica*). (4) In *Antepipona malabarica* sp. nov. fifth and six tergite with median yellow spot (It is absent in *Antepipona ceylonica*). (5) Radial cell almost dark brown in *Antepipona malabarica* sp. nov. (It is with only brownish tint in *Antepipona ceylonica*). (6) Interocular distance 1.25x ocellocular distance (Interoccular distance 0.66x of ocellar distance in *Antepipona ceyonica*). (7) In *Antepipona malabarica* sp. nov. antennal scape length 4.25x length of the first segment (Antennal scape length 4.12x length of the first segment in *Antepipona ceylonica*).

Antepipona minutissima Soika

(Figs. 110-112)

Antepipona minutissima Soika 1982. *Boll. Mus. Civi. Stor. Nat. Ven.* Vol. XXXII, p.239.

Male: Length 6.5 mm. Black with yellow mark between ocular sinus, irregular mark between antennae, clypeus entire, mandible almost, scape of antenna, broad brand on temple, pronotum major part, tegula (except a spot on middle), parategula, two sports on meatnotum, postscutellar teeth, a spot on mesopleuron, a band on first tergite and second tergite, a spot on side first tergite united with apical band; free spot on side of first tergite united with apical band, free spot on side of second tergite, lateral margins of third and fourth tergites, apical margins of and all legs entirely. Wings with a brownish tint, veins dark brown.

Head: Width in anterior view 1.1x as long as distance between front ocellus and lower labral margin (Fig. 111); head width in dorsal view 3.75 x distance between front ocellus and posterior occipital margin, slightly narrower than mesosoma (59:64); clypeus width a little longer than 1.08x its length (26:24) (Fig. 111), upper margin of clypeus almost straight; clypeus without silvery pubescence and shallow scatted punctures; supraclypeal area, interantennal space, ocular sinus, frons, gena, temple, vertex, and occiput with deep close punctures interocellar distance 1.2x ocellocular distance; antenna with scape length 4.6x length of first flagellar segment, second flagellar segment 1.8x as long as first flagellar segment (Fig. 112); third and fourth segment subequal in

length; fifth slightly longer than sixth (1.25x); rest of segments subequal; last segment very small and hooked but hook not reaching to half of eleventh segment, last segments fifth to ninth bulged.

Mesosoma: Anterior carina of pronotum not well developed, with distinct close punctures; interstices narrow and rugose on mesoscutum; interstices smooth on yellow areas; punctuate on mesopleuron less numerous, inter space between punctures, atleast half of diameter of pits; postscutellum with two large teeth directed upwards; propodeum without median carina; propodeal concavity without carinae on sides; propodeum with sharp two teeth directed posteriorly.

Metasoma: With shallow scattered small punctures, as broad as mesosoma; first tergite 2.2x as wide as long (Fig. 110); second tergite little more than 1.18x as wide as its length.

Distribution: India: Kerala, Walayar forest, Sri Lanka: Mannar.

Female : Unknown.

Biology : Unknown.

Habitat : Undisturbed.

Material excamined: ***Plesiotype***: Male, INDIA: Kerala, Calicut University Campus, 3.iii. 2000, T. C. Narendran and party (DZCU).

Discussion: This species comes near to *Antepipona bipustulata* (Saussure) in the key to species of *Antepipona* of Oriental Region of Soika (1982). However it differs from *Antepipona bipustulata* in following characters: (1) In male *Antepipona minutissima* last article

of the antennae very small, with its tip reacting just the half of the ninth article (In *Antepipona bipustulata* last article of antenna is large, reaching, beyond ninth segment). (2) In *Antepipona minutissima* parategula straight (It is arched in *Antepipona bipustulata*). (3) In *Antepipona minutissima* postscutellar teeth large in size (In *Antepipona bipustulata* it is normal size). (4) In *Antepipona minutissima* second sternite normal at the base (In *Antepipona bipustulata* second sternite convex at the base with a slight depression).

***Antepipona ovalis* (Saussure)**

(Figs. 113-116)

Odynerus ovalis Saussure 1853, Et Fam., vesp., 1: 215. Tav.19 Fig. 4 (F) 1855, Et, Fam. vesp., 3,245. Smith, 1857, *Cat. Hyn. Br. Mus.* 5. 59. heasmarest inchenu, 1859, *Enc. Hist. nat.* Annele's 143, Fig 124 – Saussure, 1863, *Mem soc, Phys. Hist nat.* Geneve, 14: 57 – Wmith, 1871, *J. Linn. Soc. London*, 2001. 11: 376, - *LIu Pek. nat. Hist Bull* 11:112 Wain, 1956, *J. Bombay Nat Hist. Soc.* 54/32 (fig. 15 (boil).

Lionotus ovalis Schuthess, 1934, *Arb norhph, tax Enton.* Berlin Dablem 1:94 Iwata 1930. *Trans nat. His. soc.* Formosa; 19:68:69; 1941, tentrhredo, 4:71-71e 129 (Boil).

Antepipona ovalis van der Vecht. 1970. *Proce. K. neal Dakl. wet ser. c.*, 73:16. fig. 1,2 (M,F)

Vespa quadrupunctata Fabricus 1787, *Mant Ins.* 1:291 (M) Gmelin 1790 in Linne sypt Nat Ed XIII : 215. Oliver Insc. 6:190 Fabricus, 1893 *Enton supt.* 2:273. 1804 supt. Peiz. 268.

Odynerus hindostansus Cameron, 1900. *Ann Mag. nat. Hist.* (7)6: 504 (M,F) Rotheney, 1903. *Trans, ent. Soc London* 1903: 107.

Male : Length 8 mm. Black with yellow markings. Yellow marking as follows: Triangular marks on frons, ocular sinus, scape to antenna clypeus, gena, temple, medially connected two large spots on pronotum, a spot on mesopleuron, entire scutellum, postscutellum entire, two large patches on side of propodeum, medially broadent bands on first tergite and second tergite, a spot each side on first tergite spot inside of second tergite and second sternite on sides; apical band on all tergite and sternite (except last one), legs completely except tarsal segments, tarsal segments are brown, Wings hyaline with slight brown colour; veins, stigma, prestigma and antennae brown.

Head: Width in anterior view 1.21x as long as distance between front ocellus and lower labral margin (Fig. 114), head width in dorsal view 4x distance from front ocellus and posterior occipital margin, slightly wider than mesosoma (69:67); clypeus width a little longer than 1.5x its length (36:24) (Fig. 114); upper margin of clypeus arched; surface of clypeus with scattered shallow punctures; supraclypeal area, interantennal space, ocular sinus, frons, gena, temple, vertex, occiput with deep close punctures; interocular distance in dorsal view subequal to interocular distance in front view. Antenna with scape (Fig. 116) length 5.6x length of the first flagellar segment; first flagellar segment

1.6x as long as second flagellar segment (Fig. 116); third to sixth subequal in length, seventh, eighth, ninth shorter than sixth, but subequal; last segment hooked, tip of hook reaching middle of tenth segment.

Mesosoma: Stout; with distinct close punctures; postscutellum with two distinct teeth directed upwards; interstices narrow and rugose on mesoscutum; interstices smooth on yellow area; mesopleuron similarly punctuate but interstices smooth; propodeum without carinae; propodeal concavity without carinae on sides; sides of propodeum slightly bulged, with scattered shallow punctures; propodeum with two sharp teeth directed posteriorly.

Metasoma: With small punctures; posterior marginal area of tergites with deep punctures; first tergite 2.45x as wide as its length, sceond tergite a little more 1.33x (Fig. 113) as wide as its length.

Distribution: India: (Kerala, Palakkad, Trichur, Tamil Nadu, Coimbatore, Nedungadam Pondicheri state, Karikal, Orissa, Tirunelvelly, Donhavur, G. India). Sri Lanka (Amp Dist. Lahugala sanctuary, Anuraddapuva, Nochiyama, Elephant pass, Mannar, Tissamaharana.)

Female: Unknown.

Biology: Unknown.

Habitat : Disturbed.

Materials examind: ***Plesiotype:*** Male, INDIA: Kerala, Calicut University Campus, 3.ii.1998, Bivi.

Discussion: This species comes near to *Antepipona minutissima* Soika in the key to species of *Antepipona* of Oriental Region of Soika (1982). However it differs from *Antepipona minutissima* in having: (1) In male *Antepipona ovalis* last article of the antennae is bigger, its top reaching or going back base of the of the eleventh article (In male *Antepipona minutissima* last article of antennae is very small not reaching the eleventh article). (2) In *Antepipona ovalis* the second sternite with yellow spot (In *Antepipona minutissima* second sternite without yellow spot). (3) In *Antepipona ovalis* all apical abdominal segments with yellow band (In *Antepipona minutissima* all apical segments without yellow bands) . (4) In *Antepipona ovalis* postscutellar teeth very small (In *Antepipona minutissima* postscutellar teeth large). (5) In *Antepipona ovalis* postscutellum and scutellum with yellow band (In *Antepipona minutissima* postscutellum and scutellum without yellow bands). (6) In *Antepipona ovalis* propodeum bulged on sides and with yellow lateral bands (In *Antepipona mimutissima* propodeum not bulged and without yellow bands).

***Antepipona sasidharani* sp. nov.**

(Figs. 117-121)

Female: Length 7.6 mm. Reddish brown with yellow marking as follows: frons (except upper part above level of emargination of eye), clypeus and gena, temple, pronotum major part, mesopleura (Fig. 117), scutellum, postscutellum, two patches on sides of propodeum, a band on posterior margin of first tergite, two large spots on sides of second

tergite (Fig. 117), a band on posterior margin of second tergite, remaining tergites largely, forefemur and tibia, bases and apices of mid and hind femur, mid and hindtibia completely, lower part of hind tarsal segments and tegula (except middle brown part) yellow, Wings hyaline with brown patches of infuscations on marginal and median cells; veins and stigma brown.

Head: Width in anterior view 1.13x as long as distance between front ocellus and lower labral margin; head width in dorsal view 3.8x distance front ocellus and posterior occipital margin, slightly narrower than mesosoma (66:68); clypeus width a little longer than 1.36x its length (30:22); upper margin of clypeus arched, with scattered shallow punctures (Fig. 120); supraclypeal area, interantennal space, ocular sinus, frons, gena, temples, vertex and occiput with deep close punctures. Interocular distance in dorsal view subequal to interocular distance in front view; interocellar distance 0.57x ocellocular distance, Antenna (Fig. 121) with scape length 5.55x length of first flagellar segment; second flagellar segment 1.55x as long as first flagellar segment; segments third to sixth subequal in length. Seventh and eighth shorter than sixth but subequal to each other.

Mesosoma: Stout (Fig. 118), with distinct close punctures, interstices narrow and rugose on mesoscutum; interstices smooth on yellow areas; mesopleuron similarly punctate but interstices smooth; postscutellum with two distinct teeth directed upwards. Propodeum with a median carina which gives two side branches before reaching base; propodeal concavity not delimited by carinae on sides, surface with

widely scattered shallow punctures; propodeum with two sharp teeth directed posteriorly.

Metasoma: With small punctures, smaller than those of mesoscutum, interstices rugulose. First tergite 2.06x as wide as its length; second tergite a little more than 1.35x as wide as its length.

Male: Unknown.

Biology: Unknown.

Habitat: Disturbed.

Etymology: Named after K.R. Sasidharan, Institute of Forest Genetics & Tree Breeding, who collected the specimen.

Material examined: ***Holotype***: Female. INDIA: Tamil Nadu, Coimbatore, 4.viii.1997, Sasidharan (DZCU).

Discussion: This new species comes near *Antepipona exelsa* Soika in the key to species of *Antepipona* of Oriental Region of Soika (1982). However it differs from *Antepipona exelsa* in having: (1) Clypeus completely yellow but with a band at base in *exelsa*); (2) General body colour reddish brown (black in *exelsa*); (3) Lower margin of clypeus entire (deeply emarginate in *exelsa*); (4) Mesopleuron with two yellow spots (with only one yellow spot in *exelsa*); scutellum and postscutellum with yellow colour completely (with two distinct yellow spots in *exelsa*) and propodeum without distinct striae (with striae on posterior side of propodeum in *exelsa*).

Antepipona siamensis Soika

(Figs. 125-127)

Antepipona siimensis Soika, 1982, *Boll. Mus. Civ Sto Nat. Ven.* Vol. 32, 1982, p.242.

Female: Length 8 mm. Black with pale yellow markings as follows: Ocular sinus, a irregular fused barrel shaped mark between antenna, clypeus entirely except two irregular spots, lower sides of mandibles, scape of antenna, a broad band on temple, pronotum major part, tegulae except a spot on middle, parategula, two joined spots on metanotum, two spots on postmetanotum encircling spine, a spot on metapleuron, a broad band on first tergite joints, two large spots on sides, two separate yellow spots on sides of second tergite, a medially broad apical band, two separate spots on sides of the third tergite, a large spot on last segments; half of first, second and third femora black, tarsi brownish yellow; wings with brownish tint, veins dark brown.

Head: Width in anterior view 1.34 x as long as distance between front ocellus and lower labral margin (Fig. 126); head width in dorsal view 3.8x distance between front ocellus and posterior occiptal margin, slightly narrower than mesosoma (42:46); clypeus width longer than 1.3x its length (28:22) (Fig. 126); upper margin of clypeus very weak; clypeus without silvery pubescence, with shallow punctures. Supraclypeal area, interantennal space, vertex and occiput with deep close punctures; interocellar distance 0.7x ocellacular distance. Antenna with scape length 5.5 x length of the first flagellar segment (Fig. 127) 2.1x as long as first flagellar segment. Third, fourth, fifth subequal in

length, rest of all flagellomeres are smaller than third but, subequal to each other.

Mesosoma: Stout, with distinct close punctures, interstices narrow and rugose on mesoscutum; interstices smooth on yellow areas; mesopleuron with less numerous punctures, separated by space which are, on overage, at least half at diameter of dots, often larger in bottom posterior sides. Anterior carina of pronotum normal; posterior side of propodeum without carina, propodeal concavity without fine carinae on side, propodeum with two sharp teeth directed posteriorly. Postscutellum with two distinct teeth directed upwards.

Metasoma: with shallow scattered small punctures, as broad as mesosoma; second tergite abrupty lowered at the base; first tergite, 1.9x as wide as its length (Fig. 125), second tergite 1.32x as wide as its length.

Male: Unknown.

Distribution: India: Kerala, Palakkad

Biology: Unknown.

Habitat: Disturbed.

Material examined: Plesiotype: Female, INDIA: Kerala, Palakkad, 9-x1-1997, K. Gopi.

Discussion: This species come near to *Antepipona rufescens* (Smith) in the key to species of *Antepipona* of Oriental Region of Soika (1982). However it differs from *Antepipona rufescens* in having:

(1) Second sternite abruptly lowered at the base (it is normal in *Antepipona rufescens*); (2) Clypeus with weak upper margin (it is strong, clear margin in *Antepipona rufescens*); (3) Clypeus in male wider than longer (its slightly wider than longer in *Antepipona rufescens*); (4) Black with pale yellow spots (*Antepipona rufescens* dark yellow or with reddish spots).

Antepipona sibilans (Cameron)

(Figs. 125-127)

Odynerus sibilans Cameron, 1903, *Trans. ent. Soc. London*, 1903: 129 (F) - Rothney, 1903. *Trans. ent. Soc. London*, 1903: 107.

Odontodynerus diflendiformis Soika, 1961. *Atti Soc. Ital. Sc. nat.*, 100: 377, Fig. 2 (M).

Antepipona dettendiformis Soika, 1970, *Boll. Mus. Civ. St. nat. Venezia*, 20-21: 120 (FM) - Van der Vecht & Fischer, 1972, *Hym. Cat.*, 8: 73.

Female: Length 8.5 mm. Black with yellow marking as follows: ocular sinus, broad rectangular shaped mark just above antennae, except a triangular mark on middle of clypeus, mandible almost, scape of antenna, broad band on temple, pronotum major parts, tegula (except a brown spot on middle), parategula, a band on postscutellum and scutellum, a spot on metapleuron, a medially broad band on first tergite and second tergite, sides of first tergite with spots which are united to band, second tergite with a free yellow spot on sides, two large oval

shaped yellow markings on lateral sides of the propodeum, legs completely, dark brown. Wings with a brownish tint.

Head: Width in anterior view 1.2x as long as distance between front ocellus and lower labral margin (Fig. 126); head width in dorsal view 4.8x distance between front ocellus and posterior occipital margin, slightly narrower than mesosoma (60:64). Clypeus width 1.3x its length (24:20), clypeus (Fig. 126) with shallow punctures, without silvery pubescence; supraclypeal area, interantennal space, ocular sinus, frons, gena, temple, vertex and occiput with deep close punctures. Interocellar distance 0.7x ocellocular distance. Antenna with scape length 5.6x length of first flagellar segment; second flagellar segment 1.7x as long as first flagellar segment (Fig. 127); rest of segments subequal; last flagellar segment 1.5x, eleventh segment.

Mesosoma: Stout. Anterior carina of pronotum well developed on sides, not touching center on dorsal side, with an additional thin carina, in shape of an arch, sometimes not well distinguishable. Middle third of anterior face of pronotum with a horizontal series of dots, more or less regular, of large or medium size, very close to each other. Mesosoma with distinct close punctures, interstices narrow and rugose on mesoscutum, interstices smooth on yellow area; mesopleuron similarly punctate but interstices smooth; postscutellum with two distinct teeth elevated upwards; distance between postscutellar teeth twice as much distance between each tooth and lateral postscutellar margins (4:8); propodeum with median carina; propodeal concavity without carinae on sides; propodeum with two sharp teeth directed posteriorly.

Metasoma: With shallow scattered small punctures, smaller than mesosoma; first tergite 2.9x as wide as its length (Fig. 125); second sternite a little more than 1.18x as wide as its length.

Distribution: India: Kerala, Calicut, Tamil Nadu, Devala, Nilgiri Hills, Tirunelveli, Gudalur, Assam, Manipur.

Biology: Unknown.

Habitat: Disturbed and undisturbed.

Materials examined: ***Plesiotype:*** Female, INDIA: Kerala, Calicut University Campus, 1.iv.1985, T.C. Narendran and party. 2 Males, INDIA: Kerala, Calicut University Campus, 1.iv.1985, T.C. Narendran and party. Male, Tamil Nadu, INDIA: Tirunelveli, Tarasingh. Female, INDIA: Kerala, Calicut, 1.vi.2000, L. Kishore.

Discussion: This species comes near to *Antepipona ceylonica* (Saussure) in the key to species of *Antepipona* of Oriental Region of Soika. However it differs from *Antepipona ceylonica* in having: (1) Middle third of the anterior face of pronotum with a horizontal series of dots, regular and medium sized (it is absent in *Antepipona ceylonica.* (2) Anterior side of pronotum without a median fovea (it is present in *Antepipona ceylonica*). (3) Clypeus in female with a triangular mark in center (In *Antepipona ceylonica* two irregular spots on the apical margin). (4) Postscutellum with very small teeth and very close to post scutellar posterior margin (In *Antepipone ceylonica,* postscutellar teeth are very large). (5) The scutellum and postscutellum have yellow bands (it is not similar in *Antepipona ceylonica).* (6) First and second abdominal tergite with yellow spots. (It is absent in *A. ceylonica*).

Genus *ANTERHYNCHIUM* Saussure

Anterhynchium Saussure, 1863, *Mem. Soc. Phys. Hist. Nat. Geneve* 17: 205 (as division of *Rhynchium* Spinola). Type species *Rhynchium synagroides* Saussure, 1852. Designated by Vecht, 1963, *Zool. Verh* (Leiden) 60: 73.

Anterrhynchium (!) Dalla Torre, 1904. *Gen. Ins.* 19: 23.

Sub. *Dirhynchium* Vecht, 1963, Zool. *Verch* (Leiden) 60: 74, 77. Type species *Ancistrocerus flavopunctatus* Smith, 1852. Original designation.

Diagnostic characters

Palpal formula 6:4; metanotum angled and not projecting over propodeum; propodeal dorsum not at same level; propodeum not carinate, without apical projection; third submarginal cell separated from apex of marginal cell by about its own length; scutum and scutellum punctate; first metasomal segment sessile, about as wide as second metasomal segment.

Distribution: India (Kerala, Jammu Kashmir) and China.

Biology: Unknown.

Remarks: Solitary wasps. Widely distributed in Malabar area.

Anterhynchium flavomarginatum (Smith) comb. nov.

(Figs. 128-132)

Rhynchium flavomarginatum Smith, 1852. *Trans. Ent. Soc.* p.35, F, Saussure 1852. *Mon. Guep. Sol. Suppl.* p.177.

Odynerus nigrifrons Smith, 1857, *Cat. V.*, p.62.

Rhynchium basimacula Cameron, 1897, *Mem. Manch. L. Ph. Soc.* Xli.

Female: Length: 22 mm. Black with yellowish white markings. Yellowish white marking as follows: a spot between antennae, an interrupted line on pronotum and an interrupted narrow subapical line on posterior margin of first metasomal segment; apical joint of anterior tarsi fulvous; apices of femora more or less ferrugineous. Wings fusco-hyaline, iridescent in certain lights; veins dark brown.

Head: Covered with short silvery pubescence; closely and strongly punctated, width in anterior view about (85:95) as long as distance between front ocellus and lower labral margin (Fig. 130); width in dorsal view 3.8x distance between front ocellus and posterior occipital margin, smaller than mesosoma (35:43); clypeus longer than wide (36:34) (Fig. 130), convex, broadly pyriform, apex with a medial vertical short groove and ending in two prominent teeth, moderately punctate; upper side slightly emarginate; antennal carina short distinct; vertex, frons, supraclypeal area, interantennal space, inner orbit and ocular sinus strongly and closely punctate; interocellar distance 0.6x as long as ocellocular distance and 1.6x diameter of posterior ocellus; interocular distance as equal on vertex and at clypeus (35:36); temple distinctly

narrower than eye in profile (15:28) (Fig. 137); antennae farther from each other than from eyes(13:3); antennal scape length 5x length of first flagellar segment; second flagellar segment 2.2x as long as first flagellar segment and 1.4 x (11:7) as long as wide at apex (Fig. 136); apical antennal segment curved at apex and longer than wide (10:5); all other segments subequal.

Mesosoma: Covered with small silvery pubescence; strongly and closely punctate; mesonotum with longitudinal carina; pretegular carina distinct; parategula longer than tegula posteriorly; postscutellum gibbous, projecting posteriorly, margin roughened; propodeum vertical; concavo-truncate posteriorly with numerous carinae and dentate posteriorly.

Metasoma: Covered with fine silvery pubescence; finely and sparsely punctated; first abdominal segment sessile, wider than long (29:20) (Fig. 133); second gastral tergite wider than long (34:23) and 1.1 x as long as first tergite.

Male: Similar to female except in having greater part of clypeus and a line on anterior tibiae above yellowish white.

Variation: Yellow markings, vary in shape and size.

Distribution: India: (Kerala, Kozhikode, Sikkim, Mussorree, Himalayas) and China.

Biology: Unknown.

Habitat: Disturbed.

Material examined: ***Plesiotype:*** Female, INDIA: Kerala, Kozhikode, 5.v.2000, Alok Lambert. ***Other materials examined:*** Female, INDIA: Kerala, Calicut University Campus, 16.iv.1999, L. Kishore, Female, INDIA: Kerala, Kozhikode, 6.iv.2000, Beena, 1 Female, INDIA: Kerala, Kozhikode, 13.ix.2000, L. Kishore, 1 Female, INDIA: Kerala, Calicut University Campus, 19.ii.2000, Beena (DZCU).

Discussion: Since no other specimen of this genus is recorded so far from this region, comparison with related native species is not provided here. This species is transferred here from *Rhynchium* to *Anterhynchium* since it show the characterS of *Anterhynchium*.

Genus *ANTODYNERUS* Saussure

Antodynerus Saussure 1855, *Et. Fam. Vesp* 3: 242, 287 (as division of subgenus *Odynerus* of genus *Odynerus* Latreille; validated by ICZN, opinion 893, 1970: 187). Type species *Vespa flavescens* Fabricius 1775 ("*Odynerus punctatum* (Fabricius)" *sensu* Saussure, 1853). Designated by ICZN, opinion 893, 1970: 187.

Kalliepiponai Soika, 1952 (1951), *Riv. Biol. Colon* 11: 81 (as subgenus of *Pseudepipona* Saussure). Type species *Rhynchium radiale* Saussure, 1855 (as "*Odynerus radialis*). Original designation.

Pseudokalliepipona Soika, 1955, *Ann. Mus. R. Congo Belge Tervuven, Zool.* 36: 366. (as subgenus of *Pseudepipona* Saussure, 1853. Type species *Odynerus bellatulus* Saussure, 1853. Type species *Odynerus bellatulus* Saussure, 1853. Original designation.

Parepipona Soika, 1957. *Brit. Mus.* (*Nat. His.*) *Exped. S.W. Arabia* 1 (31): 477 (as subgenus of *Pseudepipona* Saussure). Type species *Rhynchium radiale* Saussure 1855 (as *Odynerus radialis*"). Original designation.

Diagnostic characters

Tegula exceeding parategula posteriorly; propodeum with submarginal carina not differentiated from valvula; forewing with prestigma less than half the length of pterostigma; medium sized (body length 1o to 16 mm); brown wasps with yellow marks.

Distribution: India: (Kerala, Sikkim, Maharashtra).

Remarks: They are solitary wasps and widely distributed in Kerala State.

KEY TO THE SPECIES OF GENUS *ANTODYNERUS* SAUSSURE OCCURING IN INDIA

(Partly modified from the fauna of British India Bingham 1897)

1. Head, thorax strongly punctate; second to fourth metasomal segments yellow (Fig. 139); clypeus wider than long India: Kerala, Tamil Nadu ..... *punctatipennis* Saussure

– Head, thorax moderatly punctate; apical margins of metasomal segments more or less yellowish (Fig. 134); clypeus longer than wide India: Kerala, Tamil Nadu ..... *ornatus* Smith

Antodynerus ornatus (Smith) comb. nov.

(Fig. 133-137)

Ancistrocerus ornatus Smith, 1852. *A.M.N.H.* (2) 9, p.49, M.

Female: Length: 12 mm. Reddish brown with yellow and black markings. Yellow markings as follows: Ocular sinus, temple, anterior margin of pronotum, scape of antenna in front and mandibles; apical margins of gastral tergites with yellow tinge. The black markings as follows: irregular mark on supraclypeal area, vertex enclosing ocelli, all impressed divisions of mesosoma, basal margin of first tergite and second tergite. Wings hyaline; marginal cell with dark fuscous spot; veins brown.

Head: Covered with short silvery pubescence; smoothly punctate; width in anterior view about (89:70) as long as distance between front ocellus and lower labral margin (Fig. 135); head width in dorsal view 3.8 x distance between front ocellus and posterior occipital margin; as wide as mesosoma (34:34); clypeus longer than wide (34:30) (Fig. 135), smooth, two longitudinal carina towards apex, apically dentate, upper side slightly emarginate; vertex, frons, supraclypeal area, interantennal space, inner orbit, ocular sinus smoothly punctate; interocellar distance 3.4x diameter of the posterior ocellus; interocular distance wider at vertex than at clypeus (40:30); temple wider than eye in profile (20:18) (Fig. 136); antennae farther from each other than from eyes (9:7); antennal scape length 5.4x length of first flagellar segment; second flagellar segment 2.6x as long as first flagellar segment and 4x (13.9) as long as wide at apex (Fig. 136); apical antennal segment as wide as long(10:10); all other segments subequal.

Mesosoma: Covered with small silvery pubescence; moderately punctate; parategula not reaching apex of tegula posteriorly; postscutellum very prominent and raised; propodeum bulging laterally, rounded posteriorly, with long pubescence on posterior margin, concavotruncate without carinae.

Metasoma: With silvery white small pubescence; smooth; first metasomal segment sessile, not petiolate; first tergite wider than long (26: 16) (Fig. 133); second metasomal tergite wider than long (30:21) and 1.3x as long as first tergite; metasoma narrower than mesosoma (30:34).

Male: similar to female except in having clypeus, mandible and tegula yellow; blackish markings reduced in impressed divisions of mesosoma; legs with yellowish tinge.

Variation: The yellow markings reduced or almost absent in some specimens irregular mark on interantennal space sometimes absent.

Distribution: India: (Maharashtra, Tamilnadu, Kerala, Kozhikode, Trichur).

Biology: Unknown.

Habitat: Disturbed.

Material examined: ***Plesiotype:*** Female. INDIA: Kerala, Trichur, 7.vi.1998, Usha, K. ***Other materials examined:*** 1 Female. INDIA: Kerala, Calicut University Campus 19.v.2001, L. Kishore. 2 Females: INDIA: Tamilnadu, Tirunelvelli, 3.iii.2000, Tharasingh, 1 Female: INDIA: Kerala, Calicut University Campus. 1.v.2001, L. Kishore, 1 Female: INDIA: Kerala, Calicut University Campus, 2.vii.1998, Jobiraj, 1 Female, INDIA: Kerala, Trichur, 6.vi.1998, Usha, K. (DZCU).

Discussion: This species comes near to *Antodynerus punctatipennis* Saussure in the key to species Genus *Odynerus* in the fauna of British India by Bingham, 1897. However it differs from *Antodynerus punctatipennis* in the following characters: 1. In *Antodynerus ornatus* the head is smooth (In *Antodynerus punctatipennis* head is strongly and closely punctate). 2. In *Antodynerus ornatus*

margins of all the metasomal segments more or less yellowish. (In *Antodynerus punctatipennis* second to fourth metasomal segments yellow). 3. (In *Antodynerus ornatus* clypeus is longer than wide (34:30) (In *Antodynerus punctatipennis* clypeus is wider than long (38:34). 4. 'Λ' shaped black mark on vertex is absent in *Antodynerus ornatus* ('Λ' shaped mark is present on vertex in *Antodynerus punctatipennis*) 5. In *Antodynerus ornatus* mesosoma is strongly punctate (In *Antodynerus punctatipennis* mesosoma is moderately punctate).

Remarks: This species is transferred from *Ancistrocerus* to *Antodynerus* since it is more fitting to the characters of the latter genus than to those of the former genus (*Ancistrocerus*).

***Antodynerus punctatipennis*(Saussure) comb. nov.**

(Fig. 138-141)

Odynerus punctatipennis Saussure, 1852. *Mon. Guip. Sol.* p.210, F; Smith, 1859, *Cat. V*, p.59.

Odynerus intricatus Smith, 1859, *Cat. V*, p.59, F.

Male: Length 10 mm; Ferrugineous brown with yellow and black markings. The yellow markings as follows: clypeus, interantennal space, temple narrowly, pronotum anteriorly, tegulae, postscutellum, legs except femora, first tergite medially interrupted band widening at angles and a band on at apex, second sternite completely, third tergite and sternite; head in front and antennae more or less orange yellow. Black markings as follows: 'Λ' shaped mark on vertex originating from

antennal socket, apex of first tergite, just below yellow marking, widest in middlc. Wings flavo-hyaline, with a large subapical fuscous cloud in forewing; veins brown.

Head: Strongly punctated; width in anterior view (95:102) as long as distance between front ocellus and lower lateral margin (Fig. 139); width in dorsal view 6.1x distance between front ocellus and posterior occipital margin, slightly smaller than mesosoma (43:49); clypeus wider than long (38:34) (Fig. 139), convex, broadly pyriform, emarginate at apex smoothly punctate; mandible smooth; vertex, frons, supraclypeal area, interantennal space, inner orbit, ocular sinus strongly and densely punctate; interocellar distance 0.86x as long as ocellocular distance and 2x diameter of posterior ocellus; interocular distance more on vertex (46:38) than at clypeus; temple distinctly narrower than eye in profile (14:28) (Fig. 141); antennae far from each other than from eyes (9:4); antennae with scape length 4.2x length of first flagellar segment; second flagellar segment 2.5 x as long as first flagellar segment and 1.6 (15:9) as long as wide at apex; apical antennal segment hooked; all other segments subequal to each other.

Mesosoma: Strongly and closely punctate; covered with minute hairs, hairs longer on propodeum; postscutellum very prominent and raised, tegula exceeding parategula posteriorly; propodeum bulging laterally, rounded posteriorly with a small median groove.

Metasoma: Covered with fine hairs; finely and smoothly punctate; first metasomal tergite wider than long (40:20) smaller than

hindfemur (20:26); second metasomal tergite wider than long (45:25) (Fig. 138); second metasomal tergite 1.25 x as long as metasomal petiole.

Female: similar to male except in having black mark on vertex smaller; last antennal segment not hooked; band on the second metasomal segment not enlarged.

Variation: The yellow markings much reduced or replaced with orange-brown in some specimens.

Distribution: INDIA: Kerala, Kozhikode, Allahabad; Delhi, Maharashtra.

Biology: Unknown.

Habitat: Disturbed.

Material examined: ***Plesiotype:*** Male, INDIA: Kerala, Kozhikode, 22.vii.2000, Vyjayanthi. ***Other materials examined:*** 1 Female, INDIA: Kerala, Kozhikode, 20.iv.1999, Vyjayanthi, 1 Male, INDIA: Kerala, Calicut University Campus, 1.vii.2001, Sudheer, 1 Male, INDIA: Kerala, Calicut University Campus, 10.x.2000, L. Kishore.

Discussion: This species comes near to *Antodynerus ornatus* Smith in the key to species of genus *Odynerus* in the Fauna of British India by Bingham (1897). However it differs from *Antodynerus ornatus* in the following characters: (1) In *Antodynerus punctatipennis* head and mesosoma strongly punctate (In *Antodynerus ornatus* head and mesosoma moderately punctate). (2) In *Antodynerus punctatipennis* second to fourth metasomal segments yellow. (In *Antodynerus ornatus* margin of all the metasomal segment more or less yellowish). (3) Black

'Λ' shaped mark present on vertex in *Antodynerus punctatipennis* (Black 'Λ' shapered mark absent on vertex in *Antodynerus ornatus*). 4. In *Antodynerus punctatipennis* clypeus wider than long (38: 34) (In *Antodynerus ornatus* clypeus longer than wide (34:30)).

Genus *DELTA* Saussure

Delta Saussure, 1855, *Et. Fam. Vesp.* 3: 130, 143 (as division of *Eumenes* Latreille). Type species *Vespa maxillosa* De Geer, 1773 (= *Vespa emarginata* L., 1758). Designated by Bequaert, 1925, *Bull. Brook. Entomol. Soc.* 20: 137 (as "*Spex maxillosus*").

Phi Saussure, 1855 *Et. Fam. Vesp.* 3: 132 (as division of *Eumenes* Latreille) *non phi* Saussure, 1854. Type species *Vespa arcuata* Fabricicius, 1775. Designated by Bequaert, 1926, *Ann. S. Afr. Mus* 23: 4-87.

Erinys Zirngiebl, 1953, *Mitt. Pollichia* (3): 1: 173 *non Erinys* Rye, 1876. Type species *Vespa unguicukta* Villers, 1789. Monotypic.

Diagnostic characters

Pronotum with pretegular carina; tegula convex and not equaling parategula posteriorly; axillary fossae broader than longer; metasoma petiolate; first segment with width more than half that of second, much less than twice as long as wide; tergum one shorter; male antenna hooked apically; Large sized (body length 20 mm to 30 mm); colour reddish brown, black with yellow marks.

Distribution: India (Throughout India) Burma, Sri Lanka, China, Malaysia.

Biology: Solitary wasps built nest in indoors with mud, commonly called potter wasps.

Remarks: Widely distributed in India and in Oriental Region.

KEY TO INDIAN SPECIES OF GENUS *DELTA* SAUSSURE

1. Black with yellow markings; mesonotum with two hook shaped yellow markings (Fig. 142); metasomal tergites with medially interrupted yellow bands (Fig. 142). India: Kerala .... *D. arcuata* Fabricius

– Reddish brown with black and yellow marking; mesonotum without hook shaped markings (Fig. 147); metasomal tergite without medially interrupted yellow markings (Fig. 147) 2

2. Metasomal tergites without yellow band; first metasomal tergite with medially interrupted black band (Fig. 147); apical margins of following segments red India: Kerala ..... *D. conoideus* Fabricius

– Metasomal tergites with yellow bands; first metasomal tergite without medially interrupted black band (Fig. 155); apical margins of following segments yellow 3

3. Length under 25 mm; clypeus convex (Fig.152); anterior half of mesonotum not yellow; petiole cylindrical with yellow bands and without median teeth (Fig. 151) on lateral sides (India: Kerala) ..... *D. esuriens* Fabricius

- Length above 25 mm; clypeus pyriform (Fig.156) anterior half of mesonotum yellow; petiole subcylindrical without yellow bands and with median teeth on (Fig. 155) lateral sides India: Kerala .... *D. petiolata* Fabricius

Delta arcuata (Fabricius) comb. nov.

(Fig. 142-145)

Vespa arcuata Fabricius, 1793. *Syst. Ent.* p.371; id. *Ent. Syst.* ii, p.276.

Eumenes arcuata Fabricius, 1804. *Syst. Piez.* p.287; Saussure, 1852. *Mon. Guep. Sol*, p.63, F; Smith, *Cat. V*, p.29.

Eumenes flavopicta Blanch, 1847. *Dict. Univ. Hist. Nat. Ins. Hym.*pl. ii. fig. 2. (Saussure, 1852). *Mon. Guep. Sol.* p.65) syn. nov.

Female: Length 23.5. Black with yellow markings. Yellow markings as follows: clypeus, interantennal space, a line behind eyes, ocular sinus, temple, basal half of pronotum, two hook like markings on mesonotum, tegulae completely except a single black spot on center, mesopleuron almost, scutellum, postscutellum, propodeum with a broad median mark in shape of a Maltese cross, petiole with two lateral spots at base, two spots about at middle, medially interrupted apical band, two large pyriform spots near base of second tergite and another two large medially interrupted band on subapical region, second sternite with two spot at base and all other segments with medially interrupted apical bands. Wings light brown or fuscohyaline.

Head: Width in anterior view 0.8x (82:102) as long as distance between front ocellus and lower labral margin (Fig. 143), head width in dorsal view 4.7x distance between front ocellus and posterior occipital margin, as equal as mesosoma (47:47); clypeus as long as wide (35:35) (Fig. 143), pyriform, apex sharply truncate, upper margin emarginate, smooth; supraclypeal area slightly elevated; interantennal space, inner

orbit, ocular sinus, vertex, temple with fine and shallow punctures; interocular distance as equal as on vertex (35:35) and clypeus; interocellar distance 1.25x as long as ocellocular distance and 1.6x diameter of posterior ocellus; temple distinctly narrower dorsally towards vertex (5:32) (Fig. 145); antennae farther from each other than from eyes (12:4); antennal scape length 5x length of first flagellar segment (Fig. 144); second flagellar segment 3.5x as long as flagellar segment; second flagellar segment 3x (7:21) as long as wide at apex, apical antennal segment as long as wide (7:7).

Mesosoma: Stout; covered with silvery pubescence; finely and shallowly punctate; pronotum anteriorly transverse; pretegular carina present; propodeum with an impressed medial vertical line; scutellum not parallel to postscutellum and propodeum.

Metasoma: Smooth; petiole very long and narrow, only slightly broadening towards apex, longer than hind femur (70:35) and sparsely punctate; second gastral tergite slightly longer than wide (50:48) (Fig.142); base of following metasomal segment constricted; second gastral tergite 0.7x (50:70) as long as petiole; petiole longer than thorax (70:65).

Male: Similar, but smaller and slighter, segment entirely black.

Variation: The depth of the yellow markings varies in different individuals.

Distribution: India: (Throughout India), Burma, Sri Lanka, Malaysia, and New Guinea.

Biology: Unknown.

Habitat: Disturbed.

Material examined: ***Plesiotype:*** Female, INDIA: Kerala, Kozhikode, 22.viii.2000, Vyjayanthi. ***Other materials examined:*** 1. Female, INDIA: Kerala, Kozhikode, 12.vii.1999, L. Kishore. 1. Female, INDIA: Kerala, Kannur, 3.ii.1997, Swaran, 2. Female, INDIA: Kerala, Calicut University Campus, 9.vi.1998. Biji, M. 1 Female, INDIA: Kerala, Wayanad, 15.vii.2000, Angudh Lambert, 1. Male, INDIA: Kerala, Kasargode, 6.x.1999, Vyjayanthi (DZCU).

Discussion: This species comes closer to the *Delta petiolata* Fabricius which is common in South India. However, it differs in following characters: 1. In *Delta arcuata* the mesonotum with two hook shaped yellow marks (In *Delta petiolata* the basal half of the mesonotum yellow). 2. In *Delta arcuata* the propodeum yellow with a Maltese cross black mark (In *Delta petiolata* the propodeum reddish brown). 3. In *Delta arcuata* the petiole is marked with yellow on base, middle, and apex (in *Delta petiolata* petiole not marked with yellow). 4. In *Delta arcuata* the metasomal segments marked with medially interrupted yellow bands (In *Delta petiolata* metasomal segments with yellow bands).

Remarks: Since several specimens showing intergrading characters between *Delta arcuata* and *Dalta flavopicta* the latter is placed as a junior synonym of the former (syn. nov.).

Delta conoideus (Gmelin)

(Figs. 146-150)

Vespa conica Fabricius, 1787. *Mant. Ins.* 1: p.293.

Vespa conoidea Gmelin, 1790. in Linne, Syst. Nat. Ed. B, Vol. 1. new name for *Vespa conica* (not of Fabricius 1775) preoccupied by *Vespa conica* (now *Delta*) Fabricius 1775.

Vespa conica Fabricius, 1793. *Ent. Syst.*. 11: p.278.

Eumeres conica Fabricius, 1804, *Syst. Piez.* p.285.

Delta conoideus (Gmelin), Soika, 1972. *Boll. Soc. Entomol. Ital.* 104 (6-7). 99-110.

Female: Length 30 mm. Dark reddish with yellow and black markings. Yellow marking as follows: clypeus, interantennal space, frons, temple, occipital margin and foretarsi. Black markings as follows: a broad band on vertex, a medial longitudinal line on mesonotum anteriorly, a transverse narrow line on its apex, base of second metasomal segment, and a short transverse medially interrupted band on its middle above. Wings dark flavo-or fuscohyaline, with a slight purplish effulgence; veins brown.

Head: Closely and finely punctate; width in anterior view 0.8x as long as (95:120) distance between front ocellus and lower labral margin (Fig. 148), width in dorsal view 7.5x distance between front ocellus and posterior occipital margin, slightly smaller than mesosoma (45:48); clypeus as long as wide (42:42) (Fig. 148), smooth, strongly convex,

anterior margin transversely truncate at apex, oblique at sides, upper end slightly emarginate, and pyriform; interantennal space raised and parting into two divergent carinae towards ocelli; frons, vertex, ocular sinus hairy; ocellar distance 1.55x as long as ocellocular distance and 2x diameter of posterior ocellus; interocellar distance equal on vertex and at clypeus; temple distinctly narrower than eye in profile (5:31) (Fig. __); antennae farther from each other than from eye (14:7); antenna with scape length 7x length of first flagellar segment; second flagellar segment 3.5x as long as first flagellar segment (7:25) (Fig. 149) and 2.2x as long as wide at apex; apical antennal segment as long as wide (10:11); all other segments subequal in size.

Mesosoma: Covered with small silvery pubescence; closely and sparsely punctate; tegular carina present; pronotum transverse anteriorly; propodeum with a medial vertically impressed line, widening at apex of segment into a deep hollow; propodeum hairy, hairs longer at apex.

Metasoma: Covered with fine silvery pubescence; smooth and shining, with surface minutely aciculate; metasomal petiole longer than hindfemur (53;30), subcylindrical, 3.5x as long as wide; considerably thickened towards apex; second metasomal segment constricted at base; wide, moderately deep channel present on second sternite; second gastral tergite as long as wide (53:53) (Fig. 146) and subequal to metasomal petiole (53:52).

Male: Similar to female, but smaller and slighter; apex of clypeus emarginate; scape of antennae in front yellow; last antennal segment

hooked; gena black with a narrow yellow line next to outer orbit; third to fifth metasomal sternites in middle black; anal segment black.

Distribution: India: (throughout South India), Burma, Sri Lanka, China and Malaysia.

Biology: Unknown.

Habitat: Disturbed.

Materials examined: ***Plesiotype***: Female, INDIA: Kerala, Calicut University Campus, 15.vi.1998. Jobiraj, T. ***Other materials examined:*** 1 Female, INDIA: Kerala, Calicut University Campus, 7.v.2000, Sathyan, K.M., 1 Male, INDIA: Kerala, Kozhikode, 1.xii.1999, L. Kishore, 1 Female, INDIA: Kerala, Alway, 1.vii.2000, Sr. Karmaly, 2 Female, INDIA: Kerala, Trichur, 9.xi.1998, Usha, K. (DZCU).

Discussion: This species comes closer to *Delta esuriens* Fabricius in the following characters: (1) In *Delta conoideus* second abdominal segment red at base, with a black transverse medial band. (2) Smaller slender usually length under 25 mm. (3) Colour usually brown. However it differs from *Delta esuriens* in following characters: (1) In *Delta conoideus* clypeus pyriform (In *Delta esuriens* clypeus not pyriform). (2) The pronotum in *Delta conoideus* transverse anteriorly and not yellow (In *Delta esuriens* pronotum normal and yellow). (3) In *Delta conoideus* apical half of the first tergite reddish brown (In *Delta esuriens* apical half of the first tergite yellow). (4) In *Delta conoideus* occipital margin yellow. (In *Delta esuriens* occipital margin black) and (5) In *Delta conoideus* petiole with two median spines and without

apical bands (In *Delta esuriens* the petiole without median spines and with apical band).

Remarks: Fabricius described *Vespa conica* in 1787. Since then the same author described another species under the same name *Vespa conica* in 1793 mistaking both the former and latter species are the same. Gelmin found out that *Vespa conica* Fabricius of 1793 is another species and not *Vespa conica* Fabricius of 1787. Hence Gmelin errected a replacement name for the second species of Fabricius (1787) as *Vespa conoidea* Gmelin which was later transformed to *Delta* by Soika (1972).

Delta esuriens (Fabricius) comb. nov.

(Figs. 151-154)

Vespa esuriens Fabricius, 1787. *Mant. Ins.* i, p.293.

Eumenes esuriens Fabricius, 1804. *Syst. Piez* p.283; Saussure, 1852. *Mon. Guep. Sol.* p.56, FM; Smith, 1857. *Cat. V*, p.22.

Female: Length 23.5 mm; reddish brown with yellow and black markings. Yellow markings as follow: clypeus, labrum, frons, temple, interclypeal area, occular sinus, occiput narrowly, pronotum completely, pro and mesopleural post scutellum, apex of propodeum, petiole narrowly at apex, apical half of second metasomal segment, apex of second sternum, forefemur and tibia and spot on apex of mid tibia and hind tibia. Black markings as follow: a broad band between top of the eye across, upper margin of mesoscutem, lower margin of scutellum, at lateral base of petiole, apex of petiole just in front of yellow band and

subapical band on second, segment. Wings hyaline, a narrow subapical spot on radial cell black, veins pale yellow and apical margin broadly pale yellow.

Head: Closely and finely punctate; width in anterior view 0.83x as long as (100:120) distance between front ocellus and lower labral margin (Fig. 152); width in dorsal view 6.2x distance between front ocellus and posterior occipital margin, slightly smaller than mesosoma (50:51); clypeus longer than wide (40:35) smooth (Fig. 152), strongly convex, flat at centre, anterior margin transversely truncate at apex, oblique at sides, upper end slightly emarginate; inter antennal space raised and prominent; frons and vertex smoothly punctate; supraclypeal area, interantennal space, ocular sinus, temple smoothly punctate, a carina present in between ocelli; ocellar distance 1.36x as long as ocellocular distance and 2x diameter of posterior ocellus; interoccellar distance more on vertex (45:35) than at clypeus; temple distinctly narrower than eye in profile (6:30) (Fig. 154); antennae farther from each other than from eyes (10:4); antenna with scape length 8x length of first flagellar segment; second flagellar segment 4.6x as long as first flagellar segment (5:23) (Fig. 153) and 2.8x (8:23) as long as wide at apex; apical antennal segment as long as wide (7:7); all other segments subequal.

Mesosoma: Covered with small silvery pubuscence; pronotum, scutellum, postscutellum, propodeum, meso and metapleuron smoothly and reticulately punctate; subtegular carina present; mesoscutum with carina; mesoscutum with an anterior median longitudinal carina; hairs

longer on apex of propodeum; propodeum with a medial furrow broadening and deepning at apex.

Metasoma: Covered with fine silvery pubescence; sparsely punctate; metasomal petiole with two small tubercles, in the middle and small depressions and grooves at apex, longer than hind femur (55:36) and 3.9x as long as wide (55:14) (Fig. 151); second metasomal tergite as long as wide (52:52) and 0.94x as long as metasomal petiole.

Male: Similar, but more slender; anal segment, two spots on second ventral segment, and hind legs black.

Variation: The head (except black transverse band on vertex) and mesonotum light red.

Distribution: India: (throughout India), Burma.

Biology: Unknown.

Habitat: Disturbed.

Materials examined: ***Plesiotype:***. Female, INDIA: Kerala, Calicut University Campus 3. iii.1999. L. Kishore. ***Other materials examined:*** 1 Female, INDIA: Kerala, Trichur 7.vii.1998. Usha, K. 1 Female, INDIA: Kerala, Calicut University Campus 22.v.2001. Uma 2 Female, INDIA: Kerala, Calicut University Campus, 25.vii.2001, L. Kishore (DZCU).

Discussion: This species comes closer to *Delta conoides* Fabricius in the following features: (1) Propodeum convex. (2) Mesosoma with pretegular carina. (3) Solitary forms. However it differs from *Delta*

conoides in the following characters: (1) In *Delta esuriens* clypeus convex (in *Delta conoides* clypeus pyriform). (2) In *Delta esuriens* a broad black band present on vertex (in *Delta conoides* the broad black band on vertex is absent). (3) The pronotum in *Delta esuriens* yellow (in *Delta conoides* pronotum not yellow). (4) In *Delta esuriens* petiole not as long as head and mesosoma united (in *Delta conoides* petiole as long as head and mesosoma united). (5) In *Delta esuriens* apical half of the second tergite yellow (In *Delta conoides* apical half of the second sternite red).

***Delta petiolata*(Fabricius) comb. nov.**

(Fig. 155-158)

Vespa petiolata Fabricius, 1793. *Sp. Ins.* i. p.467; *Ent. Syst.* ii. .278.

Eumenes petiolata Fabricius, 1804. *Syst., Piez.* p.284; Saussure, 1852. *Mon. Guep. Sol.* p.47, F M; Smith, 1857. *Cat. V*, p.26.

Male: Length 28.4 mm. Reddish brown with yellow and black markings. Yellow marking as follow: clypeus, interantennal space, frons, ocular sinus, scape of antennae, occiput, temple, pronotum, mesoscutum anteriorly, mesopleuron at upper side, apical half of first tergum, slightly on apex of first sternum, and apex of rest of all tergum, first femur, tibia and wings with yellowish tint. Black markings as follows: a band on vertex; sutures between scutellum, postscutellum, mesopleuron and metapleuron; median groove of propodeum, base of petiole, a band on apex, a band on middle of first tergum and base of all metasomal

segments; Veins brown; radial cell without apical cloud and stigma yellow.

Head: Closely and finely punctate; width in anterior view about 0.94x as long as (95:101) distance between front ocellus and lower labral margin (Fig. 156); width in dorsal view 8x distance between front ocellus and posterior occipital margin, slightly wider than long (56:54); clypeus longer than wide (42:35) (Fig. 156), smooth, pyriform, apex truncate, upper margin emarginate; interantennal space raised and prominent; frons, temple, vertex with close shallow punctures; ocellar distance 3x as long as ocellocular distance and 3x diameter of posterior ocellus; interocellar distance more on vertex (40:35); temple distinctly narrower than eye in profile (6:35); antennae farther from each other than from eyes (10:5); antenna with scape length 4.25x length of first flagellar segment; second flagellar segment 3x as long as first flagellar segment (8:24) (Fig. 157) and 3x (8:24) as long as wide at apex; last antennal segment hooked in male; all other segments subequal.

Mesosoma: With small silvery pubescence and shallow punctures; pronotum anteriorly transverse; propodeum with a long median furrow widening towards apex; apex of propodeum with longer hairs.

Metasoma: Covered with fine silvery pubescence; petiole smooth; metasoma finely and longitudinally aciculate; metasomal petiole longer than hindfemur (58:31) and 4.1x as long as wide (Fig. 155) (58:14); second metasomal segment longer than wide (70:46) and 1.2 x as long as metasomal petiole.

Female: Similar to male; slightly paler than male; fifth and sixth metasomal segments yellow.

Variation: Posterior portion of the mesonotum and flanks and legs reddish brown, with some black markings.

Distribution: India: (Kerala, throughout India), Sikkim, Burma; Tenasserim.

Habitat: Disturbed.

Biology: Unknown.

Material examined: ***Plesiotype:*** Male, INDIA: Kerala, Balussery 8.x.1999, Girish Kumar. ***Other materials examined:*** 1. Female, INDIA: Kerala, Balussery, 8.1.2000; Girish Kumar, 1 Female, INDIA: Kerala, Manjeri, 8.iv.2000, Jobiraj, 1 Female, INDIA: Kerala, Nilambur, 5.iii.1998, T.C. Narendran. 1 Female, INDIA: Kerala, Alway, 1.vii.2000, Sr. Karmaly, 1. Female, INDIA: Kerala, Calicut, 12.ix.1998, L. Kishore (DZCU).

Discussion: This species comes closerto *Delta esuriens* Fabricius in the key to species in the following features: (1) Propodeum convex. (2) Mesosoma with pretegular carina. (3) Solitary form. However it differs from *Delta esuriens* in the following characters: (1) In *Delta petiolata* clypeus pyriform (In *Delta esuriens* clypeus convex). (2) *Delta petiolata* measures above 25 mm in length (*Delta esuriens* measures below 25 mm in length). (3) In *Delta petiolata* anterior half of the mesoscutum yellow (In *Delta esuriens* anterior half of the mesonotum not yellow). (4) In *Delta petiolata* the petiole not marked with yellow

colour (In *Delta esuriens* the petiole marked with yellow colour). (5) In *Delta petiolata* petiole is semi-cylindrical and with middle teeth-like structure (In *Delta esuriens* petiole cylindrical and without middle teeth). (6) In *Delta petiolata* apex of all metasomal tergite yellow (In *Delta esuriens* only first metasomal tergite yellow).

Genus EUMENES Latreille

Eumenes Latreille, 1802. *Hist. Nat. Crust. Ins.* 3: 360. Type species *Vespa coaretata* L., 1758. Designated by Latreille, 1810 *Consid. Gen. Crust. Arach.* Ins.: 328.

Alpha Saussure, 1855, *Et. Fam. Vesp.* 3: 128, 137 (as division of *Eumenes*) *non Alpha* Saussure, 1854. Type species *Vespa coarctata* L., 1758. Designated by Bequaert, 1926, *Ann. S. Afr. Mus.* 23: 435.

Eumenis Kriechbaumer, 1879, *Entomol. Nachr.* 5: 57. Emendation.

Eumenidion Schuthess, 1913, *Soc. Entomol.* 28: 2 (as subgenus) Type species *Vespa coarctata* L., 1758. Original designation.

Eumenidium (!) Sharp, 1915, 2001. *Rec. Ins.* 1913: 275. Subg. *Zeteumenoides* Soika, 1972, *Boll. Soc. Entomol. Ital* 104: 110 (as genus). Type species *Eumenes filitormis* Sassure, 1855 (= *Eumenes versicolor filiformis*). Original designation.

Disgnostic characters

Metasoma petiolate; segment one in dorsal view with width half or less than that of second, and at least twice as long as wide; propodeal valvula short, rounded; propodeum without fovea or dentiform projection; axillary fossa broader than long; tegula convex and not equaling parategula posteriorly; pretegular carina absent; mesepisternum without epicnemial carina slender medium sized (body length 10 mm 17 mm).

Distribution: INDIA (Kerala, Maharashtra, Sikkim) Burma.

Biology: Unknown.

Remarks: Widely distributed in Kerala. They are solitary wasps.

KEY TO THE SPECIES OF GENUS *EUMENES* LATREILLE

1. Reddish brown; propodeum with well marked groove down middle widening at apex into a deep '∧' - shaped hollow; second abdominal tergite red at base, no black band, apical half yellow, following segments red (Fig. 164) India: Kerala, Maharashtra .... *E. edwardsi* Saussure

– Black; propodeum with small groove down middle and not widening at apex; second abdominal segments black with apical yellow narrow band (Fig. 168) 2

2. Clypeus convex; (Fig.160) metasoma finely and densely punctated; antennal carina absent; propodeum rounded posteriorly and bulging; second metasomal tergite without lateral yellow spot (Fig. 159) India: Kerala ..... *E. arctitectus* Smith

– Clypeus coffin shaped (Fig. 169); metasoma strongly, more densly punctated and granular; antennal carina present; propodeum roundly truncate with median sulcation; second metasomal tergite with lateral yellow spot (Fig. 168). India: Kerala .... *E. punctata* Saussure

Eumenes architectus Smith

(Figs. 159-162)

Eumenes architectus, Smith, 1859, *Jour. Linn. Soc.* iii. p.20, F M.

Female: Length 16.2 mm. Black with yellow markings. Yellow marking as follows: an obscure very short line on occular sinus starting from clypeus, a narrow irregular line on pronotum, a broad marking on mesopleuron just below tegula, a medially interrupted line on postscutellum, a narrow line on apical margin of petiole and legs variegated with yellow. Wings fusco-hyaline with coppery effulgence; veins brown.

Head: Covered with short silvery pubescence; finely and densely punctated; width in anterior view about (87:84) as long as distance between front ocellus and lower labral margin (Fig. 160); head width in dorsal view 13.2x distance between front ocellus and posterior occipital margin, slightly smaller than mesosoma (55:58); clypeus longer than wide (34:30), convex, sides slightly emarginate (Fig. 160), broader below than above, with small hairs and punctures; mandible with long hairs at inner edge, with scattered punctures; vertex, frons, supraclypeal area, interantennal space, inner orbit, and ocular sinus finely and densely punctate; interocellar distance 1.35x as long as ocellocular distance and 3x diameter of posterior ocellus; interoccular distance more on vertex than at clypeus (44:30), temple distinctly narrower dorsally towards vertex and smaller than eye in profile (5:32) (Fig. 162); antennae farther from each other than from eyes (5:1); scape length 5x length of first flagellar segment; second flagellar segment 3.6x as long as first flagellar

segment and 2.4x (17:7) as long as wide at apex (Fig. 161); apical antennal segment as long as wide (9:9); all other segment subequal in size.

Mesosoma: Covered with silvery pubuscence; finely and densely punctated; hairs longer on propodeum; propodeum convex, vertical, with a slight groove down the middle.

Metasoma: Covered with silvery pubuscence; finely and densely punctuated; last two segments smooth; gastral petiole longer than hind femur (40:70) and 3.8 x as long as wide (70:18); second metasomal tergite longer than wide (58:48) (Fig. 159); second metasomal tergite 0.68 x as long as metasomal petiole.

Male: Similar to female except clypeus yellow; two spots on propodeum yellow; second metasomal segment with apical yellow band.

Variation: The yellow markings entirely absent.

Distribution: India: (Kerala), Tenasserim: Celebes.

Biology: Unknown.

Material examined: ***Plesiotype:*** 1 Female, INDIA: Kerala, Nilambur, 23.ix.2000, L. Kishore. ***Other material examined:*** 1 Male, INDIA: Kerala, Trichur, 2.iv.2001, L. Kishore, 1. Female, INDIA: Kerala, Kozhikode, 8.vii.2000, Alok Lambert (DZCU).

Discussion: This species comes closer to *Eumenes punctata* in the key to species of *Eumenes* by Bingham (1897). However it differs from *Eumenes punctata* in the following characters: (1) In *Eumenes*

architectus metasoma finely and densely punctuate (In *Eumenes punctata* metasoma more densely punctate and granular. (2) In *Eumenes architectus* clypeus convex and not coffin shaped (In *Eumenes punctata* clypeus not convex, coffin shaped). (3) In *Eumenes architectus* second metasomal segment without lateral yellow spots (In *Eumenes punctata* second metasomal segment with lateral yellow spots. (4) In *Eumenes architectus* antennal carina absent *Eumenes punctata* antennal carina present) and (5) In *Eumenes architectus* propodeum rounded posteriorly and bulging (In *Eumenes punctata* propodeum roundly truncate with median sulcation.

Eumenes edwardsii **Saussure**

(Figs. 163-167)

Eumens edwardsii Saussure, 1852. *Mon. Guep. Sol.* p.60, F; Smith, 1857. *Cat. V*, p.22.

Female: Length 19 mm. Brownish red with yellow and black markings. Yellow marking as follows: clypeus, ocular sinus narrowly, inter-antennal space, a small line on temple, a short line on middle of pronotum, apex of postscutellum, a streak on each side on the middle of petiole, two subapical spots on posterior margin and a small band at apex of petiole; a broad band on second tergite at apex, broad band on metasomal segments both on tergite and sternite of third, fourth and fifth, fore tibia completely hind tibia and middle tibia partially and tarsi with yellowish tint. Black marking as follows: dorsal side of petiole and

middle of second tergite. Wings hyaline; radial cell with apical cloud; veins brownish.

Head: Covered with short silvery pubescence; width in anterior view about as long as (93:90) distance between front ocellus and lower labral margin (Fig. 165); head width in dorsal view 6.2x distance between front ocellus and posterior occipital margin, slightly smaller than mesosoma (48:45); clypeus longer than wide (40:35) (Fig. 165), convex, with a small tooth on each side, apex not pointed upper end slightly emarginate, with small hairs and scattered punctures; mandible with long hairs at inner edge; vertex and frons flat; supraclypeal area, interantennal space, inner orbit, ocular sinus vertex and temple, closely punctate; interocellar distance 1.75x as long as ocellocular distance and 2x diameter of posterior ocellus; interocular distance more on vertex than at clypeus (45:30); temple distinctly narrower dorsally towards vertex and smaller than eye in profile (Fig. 167) (25:7); antennae farther from each other than from eyes (12:4); antenna with scape length 6.75 x length of first flagellar segment; second flagellar segment 5x as long as the first flagellar segment (4:20) (Fig. 166); second flagellar segment 2.5x (8:20) as long as wide at apex; apical antennal segment longer than wide (10:8); all other segments subequal in size.

Mesosoma: Covered with silvery pubescence; pronotum, scutellum and postscutellum more sparsely punctate; propodeum smooth with long hairs on apex; mesopleuron and metapleuron sparsely punctate.

Metasoma: Covered with fine silvery pubescence; smooth; metasomal petiole longer than hind femur (55:24) and 5x as long as wide (55:11) (Fig. 164); second metasomal tergite longer than wide (48:37); second metasomal tergite 0.8x as long as metasomal petiole.

Male: Similar to female except the sinus of eye yellow and mesonotum entirely black.

Distribution: India: Maharashtra, Kerala, Burma.

Biology: Unknown.

Habitat: Disturbed.

Material examined: ***Plesiotype:*** Female, INDIA: Kerala, Trichur, 20.xi.1998, Usha, K. ***Other materials examined:*** 1 Female, INDIA: Kerala, Trichur, 5.v.1999, Usha, K. (DZCU).

Discussion: This species comes closer to *Eumenes elegans* Saussure in the key to species of *Eumenes* by Bingham (1897). However it differs from *Eumenes elegans* in the following characters: (1) In *Eumenes edwardsii* clypeus convex and not shiny (In *Eumenes elegans* clypeus not convex and shiny). (2) In *Eumenes edwardsii* second tergite with black band (In *Eumenes elegans* second tergite without black band). 3. In *Eumenes edwardsii* apical half of the second tergite yellow (In *Eumenes elegans* a small apical band only yellow of second tergite) and 4. In *Eumenes edwardsii* a small area of occular sinus yellow (In *Eumenes elegans* ocular sinus black).

Eumenes punctata Saussure

(Figs. 168-171)

Eumenes punctata Saussure, 1852. *Mon. Guep. Sol.* p.37, F M; Smith.

Female: Length 14.4 mm. Black with yellow markings. Yellow marking as follows: two spots at base of clypeus, narrow line on temple, anterior margin of pronotum broadly, postscutellum, legs almost, posterior margin of petiole and second metasomal segment, two spots at sides of petiole, two spots at sides of second segment, a band on petiole and another deeply emarginate band anteriorly on second segment. Wings hyaline suffused with brown; stigma dark brown; veins dark brown; mandible, tegulae and tarsi pale brown.

Head: Covered with short pubescence; closely punctate; width in anterior view about (75:75) as long as distance between front ocellus and lower labral margin (Fig. 169), head within dorsal view 8x distance between front ocellus and posterior occipital margin, smaller than mesosoma (40:45); clypeus as long as wide (28:28) (Fig. 169), convex, sparsely punctate, sides slightly emarginate, mandible sparsely punctate with hairs; antennal carina short, clavate; vertex, temple, frons, supraclypeal area, interantennal space, inner orbit and ocular sinus strongly punctate; interocellar distance 1.1x as long as ocellocular distance and 2.2x diameter of posterior ocellus; interocular distance more on vertex (36:28) than at clypeus; temple distinctly narrower dorsally towards vertex and smaller than eye in profile (8:28) (Fig. 171); antennae farther from each other than from eye (12:6); scape length 5.4x length of first flagellar segment; second flagellar segment 3.2x as long as

first flagellar segment and 2.4x (Fig. 170) (7:17) as long as wide at apex; apical antennal segment as long as wide (9:9) all other segments subequal in size.

Mesosoma: Closely and strongly punctate; covered with hairs, hairs longer on propodeum; propodeum turuncate posteriorly, with slight median groove, groove not broadened at apex; propodeum convex.

Metasoma: Covered with fine hairs; more densely punctate; granular; petiole longer than hind femur (47:30) and 3x as long as wide (15:47); second tergite longer than wide (45:42); second metasomal tergite about as long as petiole (45:47).

Male: Similar to female, except only petiole of metasoma granular second and succeeding segment punctate, shining; clypeus entirely yellow; yellow band on pronotum narrow.

Distribution: India: (Kerala), Sikhim, Burma, Tenasserim.

Biology: Unknown.

Habitat: Disturbed.

Material examined: ***Plesiotype:*** Female, INDIA: Kerala, Calicut University Campus, 16.xi.1997, Sheela, S. ***Other materials examined:*** 1 Female, INDIA: Kerala, Kozhikode, 12.vii.2000, Angadh Lambert. 1 Female, INDIA: Kerala, Calicut University Campus, 21.vi.2001, Sudeer, 1 Female, INDIA: Kerala, Kozhikode, 2.v.1999, L. Kishore (DZCU).

Discussion: This species comes close to *Eumenes architectus* Smith in key to species by Bingham (1897). However it differs from *Eumenes architectus* in the following characters: (1) In *Eumenes punctata* metasoma densely punctate and granular (In *Eumenes architectus* metasoma finely punctate). (2) In *Eumenes punctata* clypeus coffin shaped with two irregular mark on the lower margin (In *Eumenes architectus* clypeus normal without yellow markings). (3) In *Eumenes punctata* second metasomal segment with lateral yellow spots (In *Eumenes architectus* second metasomal segment without yellow spots). (4). In *Eumenes punctata* petiole with median lateral yellow spots. (In *Eumenes architectus* petiole without yellow spots). (5) In *Eumenes punctata* antennal carina present (*Eumenes architectus* antennal carina absent. (6) In *Eumenes punctata* propodeum roundly truncate with median sulcation (In *Eumenes architectus* propodeum rounded posteriorly and bulging).

Genus *LABUS* Saussure

Labus Saussure, 1867, *Zool. Novara* 2, *Hym.*: 3. Type species *Labus* Spiniger Saussure. 1867. Designated by Bingham, 1897, *Fauna Brit. India* Hym: 1: 348.

Diagnostic characters

Metanotum dentiform mesally; propodeal dorsum below plane of metanotum sloping posteriorly; female with fovea anterior to mid - ocellus; metasomal petiole abruptly swollen apically; propodeal valvula elongate, rectangular submarginal carina produced; second submarginal cell forming obtuse angle basally. Slender and black wasps with yellow markings.

Distribution: India (Kerala), Sri Lanka and Burma.

Biology: Unknown.

Remarks: Solitary wasps; common in Malabar; build nests indoors.

Labus humbertianus Saussure

(Figs. 172-176)

Labus humbertianus Saussure, 1857, *Novare-Reipe, Hymn.* p.4, F M, Pl. 1, Fig.2 (Wing).

Male: Length 8 mm. Black with yellow and reddish brown markings. Yellow marking as follows: clypeus, mandible, scape of

antennae in front, two spots on pronotum anteriorly, lateral angles of scutellum, apical margin of petiole, subapical margin of second tergite, all tibiae, tegulae except at centre, Reddish brown marking as follows: middle of tegulae, metasomal petiole, Wings fusco-hyaline; stigma dark brown; veins brown.

Head: Covered with obscure silvery pubescence; head width in anterior view as wide as long (80:80) distance between front ocellus and lower labral margin (Fig. 174); width in dorsal view 5.5x distance between front ocellus and posterior occipital margin; as wide as mesosoma (40:41); clypeus sparsely punctate, wider than long (28:23) (Fig. 174), convex, bidentate, apex with two distinct short longitudinal carinae; mandible sparsely punctate, apex dentate but not along inner margin, folded horizontally close to clypeus; vertex, frons, supraclypeal area, interantennal space, inner orbit, ocular sinus strongly and densely punctate; interocellar distance 4x as long as ocellocular distance and 4.8x diameter of posterior ocellus; interocular distance more on vertex (45:28) than at clypeus; temple distinctly narrower than eye in profile (11:30) (Fig. 176); antennae farther from each other than from eyes; antennae with scape length 3.6x length of first flagellar segment; second flagellar segment 1.1x as long as first flagellar segment and 1.2x (9:7) as long as wide at apex (Fig. 175); apical antennal segment hooked; all other segments subequal.

Mesosoma: With silvery white pubescence, pronotum, mesonotum, scutellum, sparsely and strongly punctate; propodeum sparsely and finely punctate; mesopleuron and metapleuron, strongly punctate; pronotum small, wide, anteriorly angular with a pair of teeth,

posteriorly narrowed and arched; scutellum angled laterally, tegula longer than parategula posteriorly; propodeum with a deep and broad sulcation, bidentate at apex; legs slender; tarsi elongate. Wings normal; second cubital not petiolate but angular towards radial cell, produced and truncate towards base of wing; radial cell wide truncate at apex.

Metasoma: Covered with fine pubescence; sparsely and finely punctate; basal half of petiole coarsely and closely punctate; third and following segment smooth; petiole longer than hind femur (44:25); second tergite wider than long (41:38) (Fig. 172) and 0.8x as long as first metasomal tergite.

Female: Similar to female except scape of antennae and clypeus not yellow.

Variation: The tibiae of all legs above yellow in some specimens (Binham, 1897).

Distribution: India: (Kerala, Aleppey, Muthukulam, Kozhikode), Sri Lanka, Burma, Tenasserim.

Biology: Unknown.

Habitat: Disturbed.

Material examined: ***Plesiotype:*** Male, India: Kerala, Allepey, Muthukullum, 10.vii.1992, Sheela. ***Other materials examined***: 2 Females, India: Kerala, Calicut University Campus, 5-v-2000, L. Kishore (DZCU).

Discussion: Since no other specimen of this genus is recorded from this region a comparison of related species is not provided here.

Genus *ODYNERUS* Latreille

Odynerus Latreille, 1802, *Hist. Nat. Crust. Ins.* 3: 362. Type species *Vespa spinipes* L., 1758. Designated by Shuckard 1837, *Mag. Nat. Hist.* (N.S.) 1: 494.

Odynera Illiger, 1807, *Magaz. Insectent.* 6: 196. Emendation.

Epipone Kirby and Spence, 1815, *Introd. Entomol* 1: 340, *non* "epipone" Latreille 1802, a vernacular name. Type species *Vespa spinipes* L., 1758. Monotypic.

Oplopus Wesmael, 1836. *Bull. Acad. Sci. Bruxelles* 3: 45 (as subgenus of *Odynerus*), *non Oplopus* Laporte, 1832. Type species *Vespa spinipes* L., 1758. Designated by Girard, 1879, *Traite Elem. Ent.* 2(2): 902.

Oplomerus Westwood, 1840, *Intro. Mod. Classifins* 2 (Synopsis): 84 New name for *Oplopus* Wesmael; *non Oplomerus* Dejean, 1833, a *nomen nudum*.

Hoplomerus Agassiz, 1846, *Nomend. Zool. Index Univ.* 185. Emendation of *Oplomerus* Westwood.

Hoplopus Agassiz, 1846. *Nomend. Zool. Index Univ.*: 186. Emendation of *Opulus* Wesmeal, *non Hoplopus* D' Orbigny, 1838.

Epiponus Saussure, 1875, *Smiths. Misc. Coll.* 254: 360 (as subgenus of *Odynerus* Latreille) Emendation of "*Epipona* Shuckard" *Sensu* Saussure, 1855, an incorrect spelling of *Epiponae* Kirby and Spence.

Hoplonus (!) Dalla Torre, 1889, *Ent. Atmanachill.*

Euepipona Dalla Torre, 1904, *Gen. Ins.* 19: 39. New name for *Epiponus* Saussure. Type species *Vespa spinipes* L., 1758 Designated by Richardi, 1937, Gen. Names *Br. Ins.* 5: 128.

Subgenus *Allogymnomerus* Bluethgen, 1951, *Mitt. Muench. Entomol. Ges* 41: 174 (as subgenus of *Hoplomerus* Westwood). Type species *Odynerus consobrinus* Dufour, 1839. Original designation.

Subgenus *Monoplomerus* Bluethgen, 1941, *Arch naturgesch.* IN.F) 10: 308 (as subgenus of *Hoplomerus* West Wood) Type species *Hoplomerus caroli* Morawitz, 1885. Original designation.

Subgenus *Spinicoxa* Bluethgen, 1938 (1937), *Konowia* 16: 285 (as subgenus of "*Hoplomerus* (Westwood) Agassiz" *Sensus* Bluethgen, 1938). Type species *Vespa veniformis* Gmelin, 1790. Original designation.

Diagnostic characters

Propodeum with lateral carina weak or absent; female with cephalic foveae; vertex not rugose; male sterna without fringe; temple and mesosoma with long hairs; tegula not emarginate and rounded posteriorly; parategula usually not reaching apex of tegula; axillary fossa slitlike; prestigma about more than half as long as pterostigma. Small (body length ranges 6 to 9 mm). Black with yellow marks.

Distribution: India: (Kerala).

Biology: Unknown.

Remark: Solitary wasps; widely distributed in Malabar.

Odynerus miniatus Saussure

(Figs. 177-181)

Odynerus miniatus Saussure, 1852, *Mon. Guiep. Sol. Suppl.* p.249, pl. Xi, Fig. 6, F; Dalla. Torre, 1894. *Cat.* ix, p.79.

Female: Length 7 mm. Black with yellow markings. Yellow marking as follows: a spot between antennae, scape in front, antennal segments beneath, a spot on ocular sinus, two spots at sides of clypeus, a line on temple, centre of pronotum, tegulae, parategulae, a spot on mesopleuron, lateral angles of scutellum and postscutellum, apical margin of first and second tergite, femora, tibiae and tarsi; base of first metasomal segment red. Wings hyaline; veins dark brown.

Head: Strongly punctate; covered with small silvery pubescence; width in anterior view about (106:90) as long as distance between front ocellus and lower labral margin (Fig. 179); slightly wider than mesosoma (45:41), width in dorsal view 4.5x distance between front ocellus and posterior occipital margin; clypeus wider than long (40:33), pyriform, with two longitudinal carinae, space between carinae punctuate; mandible with long hairs at inner edge, with scattered punctures; vertex, inner orbit, ocular sinus, interantennal space, temple, supraclypeal area strongly punctate; ocelli placed in grooves; interocellar distance 0.83x as long as ocellocular distance and 2.5x diameter of the posterior ocellus; interocular distance more on vertex (55:40) than at clypeus; temple distinctly narrower than eye in profile (11:23) (Fig. 181), antennae farther from each other than from eyes (17:5); scape length 5x length of first flagellar segment; second flagellar

segment 1.6x as long as first flagellar segment and 1.4x (10:7) (Fig. 180) as long as wide at apex; apical antennal segment wider than long (10:6); all other segments subequal.

Mesosoma: Strongly punctate; covered with short silvery pubuscence; propodeum convex; parategula longer than tegula.

Metasoma: Covered with short silvery pubuscence; finely and densely punctate; first metasomal segment subpetiolate, elongate, bell shaped, prominent above, shorter than hind femur (15:24), about as long as wide (15:16) and half width of second tergite (16:32) (Fig. 177); second metasomal tergite longer than wide (32:30) and 2 x a long as metasomal petiole.

Male: Unknown.

Variation: Slight difference in yellow markings.

Distribution: India: Kerala, Wayanad, Trichur, Kerala Forest Research Institute Campus.

Biology: Unknown.

Habitat: Undisturbed.

Material examined: ***Plesiotype:*** Female, INDIA: Kerala, Muthenga, 11.iv.2000, L. Kishore. ***Other materials examined:*** 1 Female, INDIA: Kerala, Trichur, Kerala Forest Research Institute Campus, 10.v.2001, Benoy (DZCU).

Discussion: This species comes near to *Odynerus diffinis* Saussure in the key to species by Bingham (1897). However it differs

from *Odynerus diffinis* in the following characters: (1) Head and mesosoma strongly punctate in *Odynerus miniatus* (Head and mesosoma finely punctate in *Odynerus diffinis*) (2) Clypeus carinate in *Odynerus miniatus* (Clypeus not carinate in *Odynerus diffins*). (3) Propodeum convex in *Odynerus miniatus* (Propodeum depressed beneath in *Odnerus diffinis*). (4) In *Odynerus miniatus* propodeum not carinate (in *Odynerus diffinis* propodeum carinate) (5). Radial cell in *Odynerus miniatus* hyaline (In *Odynerus diffinis* radical cell fuscous) and (6) In *Odynerus miniatus* scutellum and postscutellum not entirely yellow (In *Odynerus miniatus* the scutellum and postscutellum entirely yellow).

Genus *ORANCISTROCERUS* Van der Vecht

Orancistrocerus Vecht, 1963, *Zool. Verch* (Leiden) 60: 58, 99. Type species *Odynerus drecoseni* Saussure, 1857. Original designation.

Diagnostic characters: Propodeal dorsum below plane of metanotum sloping posteroventrally; first metasomal tergum transversely carinate; male antennae hooked apically; axillary fossa slit-like; tegula not exceeding parategula; prestigma less than half as long as pterostigma. Body length ranges from 6 mm to 10 mm. Black with yellow marks.

Distribution: India: (Kerala) Sikkim, Burma.

Biology: Unknown.

Remarks: Solitary wasps; moderately distributed in Malabar.

Orancistrocerus sichelii (Saussure) comb. nov.

(Fig. 182-186)

Odynerus sichelli Saussure, 1852. *Mon. Guep. Sol. Suppl.* p.206, O, pl. x. Fig. 8; Smith, 1857. *Cat.* V, p.58.

Female: Length 9.4 mm. Black with yellowish white markings. Yellowish white marking as follows: a spot between antennae, a line underneath scape, a spot on temple, two small lines on clypeus, a spot on ocular sinus, two small spots on pronotum, a transverse band on

apical margin of first tergite and second tergite, tibiae slightly. Wings clear hyaline; stigma and prestigma brown; veins brown.

Head: With small silvery white pubescence; strongly punctate; width in anterior view (89:95) as long as distance between front ocellus and lower labral margin (Fig. 184); width in dorsal view 4.3x distance between front ocellus and posterior occipital margin, slightly wider than mesosoma (43:40); clypeus wider than long (Fig. 184) (30:25), broadly pyriform, apex with two distinct short longitudinal carinae, forming slightly projecting teeth, upper side slightly emarginate; mandible smooth; vertex, frons, supraclypeal area, interantennal space, inner orbit, ocular sinus strongly and densely punctate; interocellar distance 1.4x as long as ocellocular distance and 2.2x diameter of posterior ocellus; interocular distance more on vertex (47:30) than at clypeus; temple distinctly narrower than eye in profile (12:22) (Fig. 186); interantennal space and distance between eye and antennal socket equal; antennae with scape length 4.3x length of first flagellar segment (Fig. 185); second flagellar segment 1.6x as long as first flagellar segment and 1.1x (10.9) as long as wide at apex; apical antennal segment as wide as long (9:9); all other segments subequal.

Mesosoma: With silvery white pubescence; hairs longer on propodeum; strongly and closely punctate; posterior margin of tegula equal to parategula; scutellum and postscutellum long, declivous; propodeum concave, truncate posteriorly, with two transverse distinct sutures close to its base.

Metasoma: Covered with fine pubescence; finely and sparsely punctate; first metasomal segment compressed, narrowed, campanulate, with two transverse, distinct sutures close to its base above; first tergite wider than long (30:23); second tergite long and raised wider than long (35:31); second metasomal tergite 1.3x as long as first metasomal tergite.

Male: Unknown.

Variation: Yellow markings on pronotum, temple and clypeus absent in some species.

Distribution: India: (Kerala, Kozhikode, Wayanad, Malappuram. Sikkim; Barrackpore; Mussoree); Burma, Tenasserim.

Biology: Unknown.

Habitat; Undisturbed and disturbed.

Material examined: ***Plesiotype:*** 1 Female, INDIA: Kerala, S. Batheri, 13.iv.2001, L. Kishore. ***Other materials examined:*** 1 Female, INDIA: Kerala, Calicut University Campus, 30.iv.2000, L. Kishore. 1 Female, INDIA: Kerala, Calicut University Campus, 18.xii.1997, T.C. Narendran. 1 Female, INDIA: Kerala, S. Batheri, 13.iv.2001, L. Kishore. 1 Female, INDIA: Kerala, Muthenga, 3.viii.1999, T.C. Narendran, 1 Female, INDIA: Kerala, Kozhikode, 5.1.1999, L. Kishore, 1 Female, INDIA: Kerala, Nilampur: 15.ix.2000, Sridharan (DZCU).

Discussion: Since no other species of this genus is recorded from this region a comparison is not attempted here.

Genus *PARALEPTOMENES* Giordani Soika

Paraleptomenes Soika, 1970, *Boll. Mus. Civ. Ven* 20/21. 79. Type species *Paraleptomenes nurseanus* Soika, 1970. Orginal designation.

Diagnostic characters

Pronotum with foveae coalesced; first metasomal segment subsessile, narrower than second metasomal tergite; second metasomal tergite not reflexed apically but ridged basally; anterior face of pronotum with two close set, deeply impressed foveae; propodeum with submarginal carina produced into pointed lamella apically and valvula enlarged and free posteriorly from submarginal carina. Body length 6 mm to 8 mm. Black with yellow marks.

Distribution: India: Kerala.

Biology: Unknown.

Remarks: Solitary wasps.

Paraleptomenes sp. indet.

(Figs. 188-192)

Female: Length 7.6 mm. Black with brown and yellow markings. Yellow marking as follows: a spot on interantennal space, a line underneath antennal scape, a spot on ocular sinus, two irregular marks on sides of clypeus and base of mandibles, a line on temple, two triangular spot on pronotum, a small spot on mesopleuron, tegula except

coalesced foveae; parategula longer than tegula posteriorly; propodeum with long hairs and opaque.

centre, a pair of spots on metanotum and postscutellum, a band on first tergite and second tergite, all tarsi, middle coxa, upper part of fore femur, Brown marking as follows: posterior end of clypeus, mandible except base, center of tegula, fore, mid and hind femur and tibia, anterior half of first tergite, Wings hyaline; stigma black; veins brown.

Head: Covered with small silvery pubescence, moderately punctate; width in anterior view (98:75) as long as distance between front ocellus and lower labral margin (Fig. 189); width in dorsal view 4.2x distance between front ocellus and posterior occipital margin, slightly narrower than mesosoma (34:37); clypeus wider than long (35:30), apex not dentate, upper margin not emarginate moderately punctate with two vertical carinae; mandible smooth; vertex, frons, supraclypeal area, interantennal space, inner orbit, ocular sinus moderately punctate; interocellar distance 1.5x as long as ocellocular distance and 2.5x diameter of posterior ocellus; interocular distance more on vertex (48:35) than at clypeus; temple distinctly narrower than eye in profile (8:30) (Fig. 192); antennae farther from each other than from eyes (10:5) antennae with scape length 6x length of first flagellar segment; second flagellar segment 1.8x (Fig. 191) as long as first flagellar segment and (9:9) as long as wide at apex; apical antennal segment wider than long (11.8); posterior segments wider than anterior segments.

Mesosoma: Covered with fine silvery pubescence; moderately punctate; pronotum with coalesced foveae; parategula longer than tegula posteriorly; propodeum with long hairs and opaque.

Metasoma: Covered with fine silvery pubescence; sparsely punctate; first tergite wider than long (27:13) and smaller than hind femur (22:13); second segment bulged, wider than long (40:37) (Fig.189) and 2.8x as long as first metasomal tergite.

Male: Unknown.

Distribution: India (Kerala, Wayanad).

Biology: Unknown.

Habitat: Undisturbed.

Material examined: ***Plesiotype:*** Female, INDIA: Kerala, Sulthan Bathery, 13.v.2001, L. Kishore (DZCU).

Discussion: Since relevant literature could not be procured, determination of species level could not be made.

Genus *RHYNCHIUM* Spinola

Rhynchium Spinola, 1806, emendation of *Rygchium* spinola, 1806; Validated b ICZN, Opinion, 747, 1965: 186. Type species *Rygchium* (!) *europaeum* Spinola, 1806 (= *Vespa oculata* Fabricius, 1781).

Rhynchium Spinola, 1806, *Ins. Ligur.* 1: 84 incorrect original spelling for *Rhynchium*.

Rhynchium Billberg, 1820 *Enum. Ins.:* 109. Emendation of *Rynchium* (!) Spinola.

Rhynchium sturm, 1829, *Verz.. Ins. Nurnberg.* 12. Emendation.

Rhynchium Saussure 1953. *Et. Fam. Vesp* 1: XXXI, 276. Emendation.

Rhynchium (!) (1863), *'Mem. So. Phy. Hist. Nat.* Geneve 17: 242.

Eurrhynchium Dalla Torre, 1904, *Gen. Ins.* 19: 33. New name.

Rygolium (!) Willink, 1982, *Bol. Ac. Nac. Sci.* 55: 195.

Diagnostic characters

Scutum posteriorly and scutellum impunctate; metanotum somewhat compressed medially; male midfemur basally emarginate; first metasomal segment sessile, about as wide as second metasomal segment; tegula shorter than parategula posteriorly; forewing with prestigma half or more length of pterostigma; axillary fossa narrowed, slit like. Stout medium sized (body length 14 mm to 20 mm). Brown with black markings.

Distribution: India: (Kerala, Tamil Nadu, West Bengal, Pondicherry) Bangladesh, Burma, Thailand, Vietnam.

Biology: Unknown.

Remark: Solitary wasps; widely distributed in study area and builds nests indoors.

KEY TO SPECIES OF GENUS *RHYNCHIUM* SPINOA OF ORIENTAL REGION

(Modified from Soika, 198)

1. Clypeus narrowly pyriform at apex, not truncate, ferrugenous; second tergite entirely yellow. India .... *R. oculatum levischtis* (Cameron)

— Clypeus strongly pyriform at apex, truncate, colouration different 2

2. Clypeus subopaque, sparsely punctate and indistinct; first metasomal tergite completely, second and third tergites punctate vertically at base. India (including Kerala) .... *R. carnaticum* (Fabricius)

— Clypeus and metasoma closely and strongly punctate 3

3. Scutellum almost smooth with few punctures at posterior angle; mesepisternum superficially punctate with wide interspace. Philippines ..... *R. atrissium* Van der Vecht

— Scutellum closely punctate; mesepisternum deeply punctate without wide interspace 4

4. Posterior part of mesoscutum and scutellum with close large punctures ..... *R. quinquecinctum* (Fabricius)

— Posterior part of mesoscutum and scutellum rarely with close large punctures, mostly smooth and superficially punctate (*haemorrhoidale*) 5

5. Wings upto basal third dark (upto middle) 6

— Wings not dark at base but dark at apex ... *R. clavipenne* G. Soika

6. Metasoma almost black; last tergite and sternite incompletely brownish or reddish brown 7

— Metasoma segment third and fourth, brown or reddish brown or yellow 10

7. Scutellum brownish; pronotum almost completely brown .... *R. rubropictum nigriventre* G. Soika

— Scutellum black; pronotum black or reddish brown with black band 8

8. Pronotum with reddish brown band .... *R. atrum atrum* (Saussure)

— Pronotum completely black 9

9. Clypeus in female reddish brown .... *R. atrum palwanense* Van der Vecht

— Clypeus in female black .....*R. atrum jacbsoni* G. Soika

10. First metasomal tergite black 11

— First metasomal tergite with apical band 13

11. Pronotum partially reddish brown ....
..... *R. haemorrhoidale haemorrhoidale* (Fabricius)

— Pronotum entirely black .....
..... *R. haemorrhoidale sanguineum* (Saussure)

12. Clypeus in female black .....*R. haemorrhoidale dohertyi* Schuls

— Clypeus in female reddish brown .....
..... *haemorrhoidale umeroatrum* (Gusenleiten)

13. All metasomal tergite with large yellow bands .....
..... *R. bathyxanthum* Van der Vecht

— All metasomal tergite without yellow bands 14

14. Propodeum black 15

— Propodeum almost ferrugenous 16

15. Mesoscutum black; with two reddish brown spots .....
.....*R. rubropictum rubropictum* (Smith)

— Mesoscutum almost entirely reddish brown .....
..... *rubropictum tenimberense* G. Soika

16. Black or brownish red species in vast distribution (Fig. 194) ....
India (including Kerala) ..... *R. brunneum brunneum* (Fabricius)

— Black or yellowish brown ..... *R. brunneum ceylonicum* G. Soika

Rhynchium brunneum brunneum (Fabricius)

(Figs. 193-197)

Vespa brunnea Fabricius, 1793, *Entom.*, 2: 264. *Rhygahium brunneum* Saussure, 1852, *Et. Fam. Vesp.*, 1: 112, Pl.14, Fig.4.

Rhynchium haemorrhoidale brunneum Maindron, 1882, *Ann. Soc. Entom*, 6, 11:27.

Rhynchium haemorrhoidale quinquecinctum Dalla Torre, 1894, *Cat. Hum*, 9:45.

Rhynchium brunneum; Bingham, 1897, *Fauna Br. India* 1: 353, Fig. 103.

Rhynchium khandalense Dusmet, 1930, *Bol. Soc. Esp. Entom.*, 1930, 105 O.

Female: Length 26.3. Reddish brown with black markings. Black marking as follows: a spot between antennae, a vertical line on front, a large triangular spot on mesonotum in front, a line along its apex, sutures on mesopleuron, basal half of legs, basal two-thirds of first, and basal half of second metasomal segment. Pale black fasica on base of third and fourth metasomal segments. Wings yellowish brown, deeper and darker towards base; veins yellow.

Head: Width in anterior view about as long as (93:93) distance between front ocellus and lower labral margin (Fig. 197), head width in dorsal view 5.27x distance between front ocellus and posterior occipital margin, slightly smaller than mesosoma (58:59); clypeus wider than

long (40:30) (Fig. 197), apex not pointed, upper margin not emarginate, strongly convex, pyriform, apical third with a broad medial vertical groove, moderatey punctate; mandible with scattered punctures; supra clypeal area, interantennal space, innerorbit, ocularsinus, vertex, temple finely and sparsely punctate; interocular distance more on vertex (46:40) than at clypeus; interocellar distance 0.8x as long as ocellocular distance and 1.5x diameter of posterior ocelus; temple distinctly narrower dorsally towards vertex (Fig. 196) and smaller than eye in profile (30:15); antennae farther from each other than from eyes (15:4); antennal scape length 6x length of first flagellar segment; second flagellar segment 2.7x as long as first flagellar segment (11:4), second flagellar segment 1.35x (8:7) as long as wide at apex, apical antennal segment longer than wide (9:6) all other segments subequal.

Mesosoma: Stout; pronotum and mesonotum finely and sparsely punctate; scutellum and postscutellum smooth and shining; postscutellum gibbous, oblique and narrow; mesopleuron and metapleuron moderately punctate; propodeum very short, depressed below postscutellum, concavo-truncate posteriorly, sides rounded, not angularly produced back, face of truncation lightly and transversely striate.

Metasoma: Finely punctate; punctures shallow on base of metasomal segments, coarse and somewhat more dense on apical margins of segments two to five above; first metasomal tergite wider than long (50:28); second metasomal tergite wider than long (55:35) (Fig. 194); second metasomal tergite 1.2x as long as and 1.1x as wide as first metasomal segment.

Male: Similar to female except in having median segment more deeply concavo-truncate, side produced posteriorly and armed with two stout spines; and apical margins of metasomal segments two to five much more coarsely punctate.

Variation: Slight differences found in black markings.

Distribution: (Throughout India), Burma, Tenasserim, Sri Lanka, Malacca, Sumatra, Borneo, Afghanistan.

Biology: Unknown.

Habitat: Disturbed.

Material examined: ***Plesiotype:*** Female, INDIA: Kerala, Calicut University Campus, 9.x.1998, L. Kishore. ***Other materials examined:*** 1 Female, INDIA: Kerala, Trichur, 5.v.1997, Usha, K. 1 Female, INDIA: Kerala,, Kannur, 6.xi.1997, Swaran, 1 Female, INDIA: Kerala, Kollam, 6.x.1999, L. Kishore, 1 Female, INDIA: Kerala, Trivandrum, 11.x.1999, Sr. Karmaly.

Discussion: This subspecies comes closer to *Rhynchium brunneum ceylonicum* Soika in the key to the Oriental Species of genera *Rhynhium* Spinola by Soika (1994). However it differs from *Rhynchium brunncum ceylonicam* in following characters. (1) *Rhychium brunneum brunneum* is brownish red with black marking (*Rhynchium brunneum ceylonicum* yellowish brown with black markings). (2) In *Rhynchium brunneum brunneum* first tegite black with apical reddish colour (In *Rhynchium brunneum ceylonicum* first tergite yellow with apical brown band). (3) In *Rhynchium brunncum brunneum* manidble, clypeus,

antennae reddish brown (In *Rhynchium brunneum ceylonicum* mandible, clypeus, antennae yellowish brown. (4) In *Rhynchium brunneum brunneum* tegulae and parategulae reddish (In *Rhynchium brunneum ceylonicum* tegulae and parategulae yellowish brown).

Rhynchium carnaticum (Fabricius)

Vespa carnatica Fabricius, 1798, Suppl. *Entom. Syst*: 261.

Rhygchium carnaticum; Saussure, 1852. *Et. Fam. Vesp.* 1: 112.

Rhynchium brunneum var. *carnaticum*; Saussure, 1956 *Et. Fam. Vesp.*, 111, Suppl: 172.

Rhynchium haemorrhoidale var. *carnatum*; Maindron, 1882, *Ann. Soc. entom.* France, 6, 11/277.

Rhynhcium carnaticum G. Soika, 1994. *Soc. Ven. Sc. Nat.* 19: 50.

Female: Brownish red with black markings; black markings as follows: base of the second and third metasomal tergite.

Head: Sparsely punctate; clypeus subopaque, sparsely punctate, apex truncate or lightly incised.

Mesosoma: Finely and sparsely punctate; scutellum and postscutellum smooth and shining; propodeum very short, concavotruncate posteriorly, sides rounded, not angularly produced into back.

Metasoma: First metasomal tergite and two third of second metasomal tergite sparsely and superficially punctate.

Male: Similar to female except in having: Frons, ocellus, anterior side of mesepisternum, anterior side of first tergite, second and third tergite, posterior side, black. Clypeus, a dot in front of frons, scape of antennae yellow.

Biology: Unknown.

Habitat: Disturbed.

Distribution: India (Kerala, Maharashtra, Pondicherry, Tamil Nadu).

Remark: Since no specimen of this species has been encountered in the present investigation, the above description is based on the description of the species by Bingham (1897).

Genus *XENORHYNCHIUM* Van der Vecht

Xenorhynchium Vecht, 1963, *Zool. Verh* (Leiden) 60: 111. Type species *Vespa nitidula* Fabricius, 1798. Original designation.

Diagnostic Characters

Propodeum with concavity delimited by carinae, with sclerotised apical projection; tegula enlarged laterally; female without cephalic foveae; metanotum angled and projecting over propodeum; propodeum dorsum not at same level; forewing with third submarginal cell separated from apex of marginal cell by about its own length; in male seventh metasomal sternum without tubercles; scutellum and scutum punctate; metanotum not compressed medially; first metasomal segment sessile, about as wide as second metasomal segment. Stout medium sized (Body length 16 mm to 24 mm). Head and mesosoma black; metasoma brown.

Distribution: India (Throughout India) Burma.

Biology: Unknown.

Remark: Solitary wasps; moderately distributed in study area.

Xenorhynchium abdominale(Illiger)comb. nov.

(Fig. 198-202)

Vespa abdominalis, Illiger, 1807. *Mag. Ins.*, i, p.192.

Vespa transversa, Fabricius, 1804. *Syst. Piez.* p.257.

Rugchium dichotomum Saussure, 1852. *Mom. Guep.* Sol. p.116, F M.

Rugchium transversum Saussure, 1852. *Mon. Guep. Sol.* p.117, O.

Rhynchium abdominale Saussure, 1852. *Mon. Guep. Sol. Suppl.* p.172.

Rhynchium dichotoum Smith, 1861. *Cat. V*, p.45.

Female: Length 15.5 mm; head and mesosoma black; metasoma dull orange-red with black markings. Black marking as follows: a band on apex of first metasomal tergite, a spot on apex of second tergite in middle, a spot on third and fourth tergites, Wings dark fuscous with a purple effulgence, veins black.

Head: Closely and densely punctate, granular; head width in anterior view (118:82) as long as distance between front ocellus and lower labral margin (Fig. 200); width in dorsal view 4.1x distance between front ocellus and posterior occipital margin, smaller than mesosoma (33:36); clypeus sparsely punctate, convex, broadly pyriform, apex with two short acute teeth, as long as wide (35:34) (Fig. 200), basal margin straight; mandible sparsely punctate; interantennal space raised; vertex, frons, supraclypeal area, interantennal space, inner orbit, occular sinus strongly and densely punctate; interocellar distance 2x as long as ocellocular distance and 1.25x diameter of posterior ocellus;

interocular distance on vertex (35:34) as on clypeus; antennae farther from each other than from eyes (13:6); temple distinctly narrower than eye in profile (15:29) (Fig. 202); antennae with scape length 6x length of first flagellar segment; second flagellar segment 2x as long as first flagellar segment and 1.2x (10:8) as long as wide at apex (Fig. 201); apical antennal segment not hooked and longer than wide (10:8); all other segments subequal in size.

Mesosoma: Densely and strongly punctate, granular; parategula slightly longer than tegula, posteriorly; postscutellum raised posteriorly, truncate; propodeum vertical, truncate, sides bulging, lower angles dentate posteriorly; propodeal concavity lateraly carinate.

Metasoma: Opaque; impunctate except an irregular subapical band of coarse punctures on posterior margins above second and fifth segments and as long as hind femur (20:21); second tergite wider than long (36:25) and 1.25x as long as (Fig. 199) first metasomal tergite.

Male: Similar to female except: smaller; clypeus and sometimes a line on front of scape of antennae, yellow; all segments of metasoma more or less dull black in middle of their apical margins.

Distribution: India (Throught India), Pegh, Burma.

Biology: Unknown.

Habitat: Disturbed.

Material examined: ***Plesiotype:*** Female, INDIA: Kerala, Calicut University Campus, 12.v.2000, Thaha, P.P. ***Other materials examined:*** 1 Female, INDIA: Kerala, Palaghat, 17.viii.1996, K.R.

Sasidharan, 1 Male, INDIA: Kerala, Trichur, 20.xi.1998, Usha, K. 1 Female, INDIA, Kerala, Nilambur, 4.xi.1998, L. Kishore (DZCU).

Discussion: Since no other species of this genus is recorded from this region a comparison is not attempted here.

Subfamily POLISTINAE

Diagnostic characters

Body usually elongate; apical margin of clypeus gradually tapering into a sharp or blunt tooth; occipital carina always present on vertex behind posterior ocelli; oval area on apical margtin of pronotal lobe in front of subtegular area without row of fine hairs; apical margin of postscutellum truncate weakly produced in middle of propodeum at base; mesepisternum with or without dorsal episternal groove and with or without epicnemial carina; hindwing with an anal lobe; first metasomal segment petiolate or subpetiolate.

Biology: Unknown.

Distribution: Worldwide except New Zealand; widely distributed in Kerala.

Remark: Commonly called paper wasps, they construct papery comb; *Ropalidia* builds an envelope round the comb; some species have more than one comb. Several species are social forms.

KEY TO TRIBES AND GENERA OF THE SUBFAMILY POLISTINAE OCCURING IN THE INDIAN SUBREGION

(Modified from Das and Gupta, 1989)

1. Pronotal lobe in front of tegula apically without carina (Fig. 27); first metasomal segment petiolate usually strongly swollen apically; subtegular area at base in front of pronotal lobe not marginated with a carina (Fig. 27); dorsal episternal groove absent (Fig. 27); second metasomal sternite and tergite fused. Ropalidini ..... *Ropalidia* Guérin

— Pronotal lobe in front of tegula with a carina (Fig. 18); first metasomal segment either petiolate or subpetiolate; subtegular area at base in front of pronotal lobe margined with distinct carina (Fig. 18); dorsal episternal groove either present or absent (Fig. 18); second metasomal sternite never fused 2

2. Propodeum with long and narrow muscle slit (Fig.16); first metasomal segment subpetiolate and shorter than second segment; apical margin of postscutellum usually almost truncate; sub discoideous joins postnervulus at or close to middle (Fig. 11) (Polistini) ..... *Polistes* Latreille

— Propodeum with short and wide muscle slit (Fig. 19). First metasomal segment petiolate and not shorter than second segment; apical margin of postscutellum weakly produced in middle, just at base of propodeum; subdiscoideus joins postnervulus below middle (Fig. 21) ... (Polybiini) 3

3. First abdominal segment wider and swollen at apex; antenna twelve segmented in female and thirteen segmented in male; dorsal episternal groove present ..... Oriental, S. Palearctic ..... *Parapolybia* Saussure

— First metasomal segment narrow and gradually a bit swollen towards apex; antenna eleven segmented in female and twelve segmented in male; dorsal episternal groove either present or absent 4

4. Propodeum with median groove; dorsal episternal groove present; pronotal carina absent; Oriental, Ethopian .... *Polybioides* Buysson

— Propodeum without median groove; dorsal episternal groove absent; pronotal carina reduced ..... Oriental, Palearctic, Ethiopian ..... *Belonogaster* Saussure

Genus *POLISTES* Latreille

Diagnostic characters

Body small to large, varying from 8.5-35 mm long; clypeus moderately convex, with well developed lateral angles, extending or not extending far beyond anterior tentorial pits, apical margin produced into a blunt tooth, lateral margin touching inner eye margin; occipital carina either complete or incomplete; pronotal carina thick and complete; scutellum usually convex and raised above level of mesoscutum; mesepisternum with or without epicnemial carina and dorsal episternal groove; propodeum strong or weak striations reaching or not reaching inner margin on sides, with or without distinct lateral edge, median groove shallow or deep and wide; metasoma almost smooth, first metasomal segment subpetiolate; first metasomal sternite with or without well developed margin at base.

Distribution

India (Throughout India), Pakistan, Taiwan, China, Japan, Iran, Nepal,Burma, Sri Lanka, Thailand.

Biology

Unknown.

Remark

Widely distributed in study area; they are social wasps.

KEY TO SUBGENERA OF THE GENUS *POLISTES* LATREILLE OCCURRING IN THE INDIAN SUBREGION

(Modified from Das and Gupta 1989)

1. Clypeus not extending far beyond anterior tentorial pit (Fig. 35); pronotal fovea present; mesepisternum usually with epicnemial carina (except in subgenus *Nygmopolistes*) and dorsal episternal groove (except in subgenus *Gyrostoma*); anal lobe of hindwing very large seperated from the rest of the wing membrane by a smooth incision 2

– Clypeus extending far beyond the anterior tentorial pit (Fig. 37); pronotal fovea absent; mesepisterum without epicnemial carina and dorsal episternal groove; anal lobe of hindwing more or less reduced 5

2. First metasomal sternite with well developed margin at base; in male terminal antennal segment coiled apically (Fig. 41) and clypeus touching inner margin of eyes. Oriental, Palearctic .... *Polistes* (*Polistes*) Latreille

– First metasomal sternite without well developed margin at base; in male terminal antennal segment not coiled; clypeus not touching inner margin of eye 3

3. Interantennal space with a blunt tooth; mesepisternum without dorsal episternal groove; parastigma of forewing 1.4 x as long as first intercubitus Oriental .... *Polistes* (*Gyrostoma*) Kirby & Spence

– Interantennal space normal; mesepisternum with clear episternal groove; parastigma shorter than first intercubitus 4

4. Epicnemial carina absent; subgenital plate in male not squarish, narrow at apex, without apophyses. Oriental, Palearctic ..... *Polistes (Nygmopolisten)* Richards

– Epicnemial carina present; subgenital plate in male squarish, wide at base, with a pair of apophyses. Oriental, Australian, Oceanic islands, Palearctic, Ethiopian .... *Polistes* (*Megapolistes*) van der Vecht

5. Interocellar distance as long as, or less than diameter of posterior ocellus; anal lobe of hindwing reduced, apex almost rounded, seperated rest of wing membrane by a wide gap; first metasomal sternite without a well developed margin at base. Oriental, Australian ..... *Polistes (Stenopolistes)* Van der Vecht

– Interocellar distance more than diameter of posterior ocellus; anal lobe of hindwing larger, apex straight and seperatal from rest of wing membrane by a smaller gap; first metasomal sternite with well developed margin at base. Oriental, Wallacea, Australian, Palearetic ..... *Polistes* (*Polistella*) Ashmead

KEY TO SPECIES OF THE GENUS *POLISTES* (*POLISTELLA*) ASHMEAD FROM INDIAN SUBREGION

(Modified from Das & Gupta, 1989)

1. Metasoma black with reddish-brown or red or yellow markings. I. The Adustus Group 2

– Metasoma coloured other than black 7

2. First and apical metasomal segments red. India .... *P. (P.) ephippium* Cameron

– Metasomal with red or yellow band 3

3. Scutellum at same level with mesoscutum; metasoma with yellow marks or band. Burma ..... *P. (P.) dawnae* Dover & Rao

– Scutellum elevated from level of mesoscutum; metasoma with red bands 4

4. Propodeum with sharp lateral edges; second metasomal sternite angular at base 5

– Propodeum with round lateral edges; second metasomal sternite rounded at base 6

5. Apical margin of first and fourth metasomal tergite with red band; legs completely black. In male apical antennal segment about as long as twelveth segment. India ..... *P. (P.) lepcha* Cameron

– Apical margin of first and fifth metasomal tergite with broad red band; legs not completely black. In male apical antennal segment

1.5x as long as twelveth segment. India, Nepal .... *P. (P.) adustus* Bingham

6. Postscutellum with a carina at base; propodeum shiny and with sharp striations. India ..... *P. (P.) santoshae* Das & Gupta

– Postscutellum without carina; propodeum dull and with weak striations. India ..... *P. (P.) similis* Das & Gupta

7. Propodeum with shallow median groove, with fine striations; forewing with subapical cloud; II Stigma Group 8

– Propodeum with deep median groove with strong transverse striations; forewing without subapical cloud. III. Maculipennis Group 9

8. First metasomal tergite about as long as wide (Fig. 203); first metasomal sternite without distinct margin at base. Oriental; Wallacea, China ..... *P. (P.) stigma* (Fabricius)

– First metasomal tergite shorter than wide at apex; first metasomal sternite with distinct margin at base .... *P. (P.) latinis* Das & Gupta

9. Apical margin of metasomal tergite without yellow band 10

– First four or five metasomal tergite with narrow apical yellow band 11

10. Head narrower than thorax (Fig. 213); pronotum ribbed; second metasomal sternite almost yellow. India, Taiwan, China ..... *P. (P.) strigosus* Bequaert

– Head about as wide as mesosoma; pronotum not ribbed; second metasomal tergite entirely reddish-brown India, Nepal, Burma, Hongkong ..... *P. (P.) sagittarium* Saussure

11. Mesoscutum closely and finely punctate; first to fifth metasomal tergite with apical yellow band. India .... *P. (P.) assamensis* Bingham

– Mesoscutum strongly punctate; usually first to fourth metasomal tergite with apical yellow band. Java, South Africa .... *P. (P.) maculipennis* Saussures

KEY TO SUBSPECIES OF THE SPECIES *POLISTES* (*POLISTELLA*) *STIGMA* (FABRICIUS)

(Revised and Modified from Das & Gupta 1989)

1. Yellow band present on metasomal tergum two; mesoscutum black with two yellow lines; pronotum broadly yellow along anterior margin Nicobar islands ..... *P. (P.) stigma novarae* Saussure

– Yellow band absent on metasomal tergum two; mesoscutum red or black without any yellow line; apical and basal margins of pronotum narrowly yellow 2

2. Body light brown with some yellow and very few black markings. Metasoma without any black stripes (Fig. 203); tergite one and three with yellow band (Fig. 209) 3

– Body brown with conspicuous black and yellow markings 4

3. Clypeus yellow (Fig. 211); pronotal margin and apex of scutellum yellow (Fig. 209); mesopleuron with irregular black spot . India (Car Nicobar Island, Kerala) ..... *P. (P.) stigma sauiensis* Peterson

– Clypeus brown (Fig. 206); pronotal margin and apex of scutellum not yellow (Fig. 203); mesopleuron without black spot. India (Kerala) ..... *P. (P.) stigma nigra* subsp. nov.

4. Ocellar triangle black; mesoscutum almost black; apex of tergite one yellow; sternite brown; base of first second and third tergite with narrow black markings. South Nicobar Island .... *P. (P.) stigma galatheae* Peterson

– Ocellar triangle brown; mesoscutum almost brown; tergite one and three or one, three, and four yellow; sternite with yellow markings 5

5. Second and third tergite with broad black bands; tergite one and three with broad yellow bands; sternite narrowly yellow. Thailand (extralimital) ..... *P. (P) stigma stigma* (Fabricius)

– Second and third tergite with small basal spots, tergites one, three and four extensively yellow marked; sternites broadly yellow. India, Sri Lanka ..... *P. (P.) stigma tamula* (Fabricius)

***Polistes (Polistella) stigma nigra* subsp. nov.**

(Fig. 203-207)

Female: Length 13.5 mm. Dark brown with yellow markings and a few black markings. Yellow marking as follows: base of postscutellum, two vertical bands on propodeum, apex of first tergite, apex of third tergite and fourth tergite almost, apical margin of third sternite. Black marking as follows: Margins of the mesoscutum, base of the first tergite, base of the second tergite, third tergite just above the yellow band. Wings yellowish with apical cloud, veins brown.

Head: Width in anterior view 1.2 x (90:73) as long as distance between front ocellus and labral margin (Fig. 206); head width in dorsal view 5.5x distance between front ocellus and posterior occipital margin, slightly narrower than mesosoma (41:43). Clypeus wider than long (48:44) (Fig. 206), upper marin of clypeus not straight but emarginate, pointed apically, lateral margin lies along the inner eye margin as long as malar space, with a few scattered fine punctures; mandible, malar space, and lower part of temple sparsely and finely punctate; rest of the head almost smooth; interocular distance about as long at clypeus as on vertex (46:48); interocellar distance 0.6 x (9.14) and about 1.5 x as equal as the posterior ocellus; temple narrower than eye in profile (11:28) (Fig. 205); antennae farther from each other than from eye (20:9); antennae with scape length 6x the length of first flagellar segment; second flagellar segment 3.5 (5:26) as long as wide at apex (Fig. 204); last flagellar segment longer than wide (10:8) and all other segment are subequal.

Mesosoma: Pronotum sparsely finely punctate; mesoscutum, scutellum, postscutellum mat; mesepisternum, mesosternum with moderately close and deep punctures; mesepimeron, clonal metapleuron almost smooth; ventral metapleuron with a few scattered fine punctures; transverse striations of propodeum weak, not distinct on the inner margin on sides; second cubital cell at top about as long as the distance between first intercubitus and first recurrent vein.

Metasoma: Moderately punctate and interspace between the punctures smooth; first metasomal tergite as long as wide (25:25); second metasomal tergite wider than long (40:25) (Fig. 203) and slightly narrower than mesosoma (40:43); first metasomal tergite blunt at base, not with well developed margin; metasomal petiole shorter than hind femur (25:35); second metasomal tergite as long as (25:25) and (40:25) as wide as first metasomal tergite.

Male: Unknown.

Distribution: India: (Kerala, Trichur)

Biology: Unknown.

Habitat: Disturbed.

Material examined: ***Holotype:*** Female, India: Kerala, Trichur, 5.v.1997. Usha, K. (DZCU).

Discussion: This new subspecies comes closer to *Polistes (Polistella) stigma saciensis* Peterson in the key to the subgenera and species occurring in the Indian subregion (Das and Gupta, 1989). However it differs from *Polistes (Polistella) stigma sauiensis* in the

following characters: (1) In *Polistes stigma nigra* subsp. nov. clypeus brown (In *Polistes stigma sauiensis* clypeus yellow) 2. In *Polistes stigma nigra* subsp. nov. pronotal margin and apex of the scatellum not yellow (In *Polistes stigma sauiensis* promotal margin and apex of the scutellum yellow). 3. In *Polistes stigma nigra* subsp. nov. irregular black spot on mesopleuron absent (In *Polistes stigma sauiensis* the irregular black spot on mesopleron present). 4. General colour of the *Polistes stigma nigra* subsp. nov. is brown. (The general colour of the *Polistes stigma sauiensis* pale brown).

Polistes (Polistella) stigma sauiensis **Peterson**

(Fig. 208-212)

Polistes stigma sauiensis Peterson, 1987. *Ent. Scand.*, 18: 240. M. F., des, Fig. Type: F. India: Nicobar to Saci, Car Nicobar (VIENNA).

Female: Length 13 mm. Light brown with some yellow and very few black markings. Dark yellow marking as follows: Mandibles, clypeus and malar space. Yellow marking as follows: pronotal margins, apex of scutellum, area below wings, axillae, longitudinal stipes on propodeum, propodeal valvulae, stripes on hindcoxa and midcoxa, front of forecoxa completely apico-ventral areas of first tergite, apex of third tergite and apical margin of second and third sternites. Black marking as follows: irregular spot ventrally on mesopleuron and line on anterior margin of propodeum. Wings yellowish with apical part cloud; veins brown.

Head: Width in anterior view 1.2 x (95: 78) as long as distance between front ocellus and lower labral margin (Fig. 211); head width in dorsal view 5x distance between front ocellus and posterior occipital margin, about as wide as or slightly narrower than (40:42) mesosoma; clypeus wider than long (42:38). Upper margin of clypeus not straight (Fig.211), pointed apically, lateral margin lies along inner eye margin as long as malar space, with a few scattered fine punctures; mandible, malar space and lower part of temple sparsely and finely punctate; rest of head almost smooth; interocular distance about as long wide at clypeus as on vertex (47:45); interocellar distance as long as ocellocular distance (13:13) and about 2x as equal as the posterior ocellus; temple narrower than eye in profile (16:26) (Fig. 210); interantennal space and distance between eye and antennal socket equal; antennae with scape length 6.5x length of first flagellar segment; second flagellar segment 6.5x as long as first flagellar segment; second flagellar segment 3x (8:24) as long as wide at apex (Fig. 212); last flagellar segment longer than wide (11:9) and all other segments are subequal.

Mesosoma: Pronotum sparsely finely punctate; mesoscutum, scutellum, postscutellum mat; mesepisternum, mesosternum with moderately close and deep punctures; mesepimeron, dorsal metapleuron almost smooth; ventral metapleuron with a few scattered fine punctures; transverse striations of propodeum weak, not distinct on inner margin on sides; second cubital cell at top about as long as distance between first intercubitus and first recurrent vein.

Metasoma: Moderately punctate interspace between punctures smooth. First metasomal tergite (Fig. 209) slighty wider than long

(20:26); second metasomal tergite wider than long (39:23) and slightly narrower than mesosoma (42:39); first metasomal termite blunt at base, not with well developed margin; metasomal petiole shorter than hind femur (20:30); second metasomal tergite (39:20) as long as and (39:23) as wide as first metasomal tergite.

Male: Unknown.

Distribution: India (Kerala, Calicut) Car Nicobar Island.

Biology: Unknown.

Habitat: Disturbed.

Material examined: ***Plesiotype:*** Female: INDIA: Kerala, Calicut University Campus, 10.x.1999, L. Kishore. 1 Female: INDIA: Kerala, Calicut. 1.vii.1999. L. Kishore (DZCU).

Discussion: This species comes closer to *Polistes (Polistella) stigma novarae* Saussure and *Polistes (Polistella) stigma galatheae* Peterson in the key to the subgenera and species occurring in the Indian subregion (Das and Gupta, 1989). However it differs from *Polistes stigma novarae* Saussure in following characters: 1. In *Polistes stigma sauiensis* the second metasomal tergum without yellow band (In *Polistes stigma novarae* the second metasomal tergum with yellow band). 2. *Polistes stigma sauiensis* the mesoscutum reddish without yellow markings (In *Polistes stigma movarae* mesoscutum black with yellow markings). 3. In *Polistes stigma sauiensis* the first and third metasomal tergite with yellow stripes (In *Postistes stigma novarae* only second metasomal segment yellow). *Polistes stigma sauiensis* differs

from *Polistes stigma galathoeae* Peterson in following characters. 1. In *Polistes stigma sauiensis* mesoscutum red (In *Polistes stigma galatheae* mesoscutum black). 2. In *Polistes stigma sauiensis* metasomal segments without black marks (In *Polistes, stigma galatheae* first, second and third metasomal tergite with narrow black marks). 3. In *Polistes stigma sacuiensis* third metasomal tergite with yellow band (In *Polistes stigma galatheae* third metasomal tergite without yellow band.

***Polistes (Polistella) strigosus atratus* Das & Gupta**

(Fig. 213-217)

Polistes (Polistella) strigosus atratus Das & Gupta, 1989. *Oriental Ins.*

Female: Length 18.5. Reddish brown with black and yellow markings. Yellow marking as follows: Apex of first tergite faintly, second tergite almost completely and apex of third tergite. The black markings are: supraclypeal area, a black band on vertex; antennal flagellum dorsally, upper margin of clypeus, mesoscutum except one median and two latral small marks, two large median marks on propodeum, legs except femora partly and foretibia almost entirely red. Wings brownish-yellow; veins yellow, apical cloud absent.

Head: Width in anterior view 1.1x (95:87) as long as distance between front ocellus and lower labral margin (Fig. 216), head width in dorsal view 5.5 x distance between front ocellus and posterior occipital margin, as wide as mesosoma; clypeus wide than long (50:43) (Fig. 216); upper margin of clypeus emarginate, pointed apically, lateral margin that lies along the inner eye margin as long as malar space, with

scattered deep punctures; lower part of inner orbit, supraclypeal area, vertex behind poster ocelli, temple and malar space with scattered punctures; ocular sinus, frons, vertex up to posterior ocellus, densely rugosoreticulate; upper part of inner orbit smooth; interocular distance more at clypeus as on vertex (50:38); ocello-occipital distance (6:11); interocellar distance about as equal as the posterior ocellus; temple narrower than eye in profile (20:26) (Fig. 217); antennae farther from each other than from eyes; antennae with scape length 6x as long as first flagellar segment; second flagellar segment 4.2 x (6:26) as long as wide at apex (Fig. 215); last antennal segment longer than wide (10:6) and all other segments are subequal.

Mesosoma: Pronotum with strong ribs, in between ribs cross connections present, Scutellum, postscutellum densely rugose; mesoscutum densely rugos-reticulate; mesopleuron and ventral metapleuron reticulatorugose; dorsal metapleuron, propodeum, metasternum with strong striation; about apical half of mesosterum with dense deep punctures; second cubital cell at top slightly longer than the distance between first intercubitus and first recurent vein.

Metasoma: Smooth; first metasomal tergite wider than long (20:40); second metasomal tergite wider than long (53:32) and slightly wider than thorax (53:50) and head (53:50). Second metasomal tergite (53.32) wider than long (Fig. 213), (53:40) as wide as and (32:20) as long as first metasomal tergite; apical metasomal sternite with a broad contral tubercle at base.

Male: Unknown.

***Distribution*:** India (Delhi, Uttar Pradesh; Sikkim; Bihar, West Bengal, Assam; Manipur; Tripura, Kerala).

Variation: One female from India (Delhi) (7.x.1978) has the head and thorax wholly reddish.

***Biology*:** Unknown.

***Habitat*:** Disturbed.

***Material examined*: *Plesiotype*:** Female, INDIA: Kerala, Calicut, 20.iv.1999 Vyjayanthi, 1 female, INDIA, Kerala, Trichur, 5.v.1999. Usha, K. 1 Female INDIA: Kerala, Calicut, 13.xi.1999, Jobi raj. 1 Female, INDIA: Kerala, Thanur, 2.i.2000, Roshini (DZCU).

Discussion: This species comes closer to *Polistes (Polistella) strigosus strigosus* Bequaert in the key to the subgenera and species occuring in the Indian subregion (Das and Gupta 1989). However, it differs from *Polistes strigosus strigosus* in following characters: 1. In *Polistes strigosus atriatus* thorax black with pronotum, an elongated broad mark on mesosutum, scutellum, postscutellum and broad marks as on propodeum redish (In *Polistes strigosus strigosus* thorax dull reddish with some of the sutures black) 2. *Polistes strigosus atratus* distributed in India (*Polistes strigosus strigosus* absent in India and distributed in China, Taiwan and Haiman (sand).

KEY TO SPECIES OF THE GENUS *POLISTES (STENOPOLISTES)* VAN DER VECHT FROM THE INDIAN SUBREGION

(Modified from Das & Gupta, 1989)

1. Clypeus longer than wide (35:29); in female lateral margin of clypeus along inner eye margin slightly shorter than malar space (10:13); in male lateral margin of clypeus along inner eye margin 2.5x as long as malar space; propodeum with moderate lateral edges; forewing without subapical cloud; apical four joints of hind tarsus pale yellow. India ..... *P. (S.) khasianus* Cameron

– Clypeus as wide as long (29:30); in female lateral margin of clypeus along inner eye margin as long as malar space (Fig. 219); propodeum without lateral edges; forewing with subapical cloud; hind tarsus almost black 2

2. Propodeum with strong striations and wide median groove; mesopleuron strongly punctate; interocellar distance 1.0x diameter of posterior ocellus; interocular distance more on vertex than at clypeus (30:23); body stout, reddish-brown with prominent mark. India ..... *P. (S.) dehiensisi* Das & Gupta

– Propodeum with weak striations and shallow median groove (Fig. 218); mesopleuron sparsely punctate; interocellar distance 0.5x diameter of posterior ocellus; interocular distance on vertex as long as at clypeus (29:28.5); body narrow, reddish-brown with yellow bands or marks. India ..... *P. (S.) nigritarsis* Cameron

Polistes (Stenopolistes) nigritarsis Cameron

(Fig. 218-222)

Polistes nigritarsis Cameron, 1900. *Ann. Mag. Nat. Hist.*, (7) 6: 413. M. Des. Type: M, India: West Bengal: Barrachpore (OXFORD). Das & Gupta. 1983 *Oriented Ins.*, 17: 411. Cat., Syn., ret., distr. India.

***Female*:** Length 16 mm. Reddish brown with yellow marking as follows: Four large marks on mandible at base, clypeus entirely, inner orbit including ocular sinus narrowly, malar space, a broad line on temple towards mandible, basal and apical margin of pronotum narrowly, a mark on tegula, scutellum and postscutellum broadly at base, two large marks on mesopleuron, one mark on subtegular area, another on dorsal metapleuron, a line on ventral metapleuron towards propodeum, two large oval spots on propodeum, forecoxa partly in front, midcoxa above, forefemur above, middle and hind femur apically, foretibia at apex, foretarsus basel two thirds of middle portion of metatarsus, first metasomal targites on sides broadly, apical margin of first four metasomal targites, first metasomal sternite, and narrow band on second and third metasomal sternites. Brownish-black portions are: Occiput, mesoscutum narrowly at base and apex, a line running along median scutal groove, median groove of propodeum, hind tarsus, first and second metasomal tergite at base. Wings blackish hyaline, forewing with almost whole of radial cell and upper portion of second and third cubital cell covered with fuscous cloud; stigma and median cell apically yellow, veins yellowish brown.

Head: Width in anterior view 1.2x (91:75) as long as distance between front ocellus and lower labral margin (Fig. 219), head width in dorsal view 5x distance between front ocellus and posterior occipital margin, about as wide as or slightly greater than (39:42) mesosoma; clypeus as wide as long (48:46); the basal margin of clypeus (Fig. 219) beyond anterior tentorial pits, not printed, clypeus with scattered deep punctures on apical half; mandible with a few deep scattered punctures; malar space and lower one-third of temple with a few scattered punctures; rest of the head smooth; interocular distance about as long wide at clypeus as on vertex (53:50); interocellar distance 2x as long as ocellocular distance and 0.5x as equal as the posterior ocellus; temple narrower than eye in profile (11:30) (Fig. 222). Antennae placed farther from each other than from eyes (16:8); malar space as long as fourth antennal segment; antennae with scape length 3.8 x length of first flagellar segment; second flagellar segment 4.4 x as long as first flagellar segment (Fig. 221); second flagellar segment 3 x (11:35) as long as wide at apex; last flagellar segment longer than wide (14:10) and all other segments subequal.

Mesosoma: Pronotum, mesocutum mat; scutellum mat with scattered shallow large punctures; metapleuron smooth; mesepisterum apically mat with scattered shallow punctures; propodeum with numerous weak striations, median groove with deep without lateral edges.

Metasoma: Smooth; first metasomal tergite not angled at base when seen in profile and 1.4 x as wide as long (Fig. 220); second

metasomal tergite slightly narrower than mesosoma (42:35); (25:20) as long as and as wide as first metasomal tergite.

***Distribution*:** India (West Bengal, Meghalaya, Kerala).

***Biology*:** Unknown.

***Habitat*:** Disturbed.

***Material examined*: *Plesiotype*:** Female: INDIA: Kerala, Calicut, 6.1.2000, L. Kishore (DZCU).

Discussion: This species comes closes to *Polistes* (*Stenopolistes*) *delhiensis* Das & Gupta in the key to the subgenera and species occuring in the Indian subregion (Das and Gupta, 1989). However it differs from *Polistes (Stenopolistes) delhiensis* in following characters: In *Polistes (S.) nigritarsis* interocellar distance 0.5 x the diameter of posterior ocellus (In *Polistes (S.) delhiensis* interocellar distance 1.0 x the diameter of posterior ocellus) 2. In *Polistes (S.) nigritarsis* interocular distance on vertex about as long as wide at clypeus. (In *Polistes (S.) delhiensis* interocular distance more on vertex than at clypeus). 3. (In *Polistes (S.) nigritarsis* propodeum with weak striation and shallow median groove). (In *Polistes (S.) delhiensis* propodeum with strong striations and wide median grooves). 4. In *Polistes (S.) nigritarsis* punctation smooth (In *Polistes delhiensis* punctation strong. 5. *Polistes (S.) nigritarsis* reddish brown with prominent yellow bands or marks (*Polistes (S.) delhiensis* reddish - brown with prominent black mark).

Genus *ROPALIDIA* Guérin

Ropalidia Guérin, 1831 in *Duperrey, Voyage de la Coquille, Zool., Ins. Atlas*: Pl. 9. Fig. 8. Type species *Ropalidia maculiventris* Guérin 1831 by monotypy.

Icaria Saussure, 1853. *Et. Fam. Vesp.* 2: 22, pls. 4 and 5, Type species: *Icaria maculiventris* (Guérin) (= *Ropalidia maculiventris* Guérin, 1831) by subsequent designation of Bingham, 1897. *Fauna Brit. India Hym.* 1: 385. Junior Objective Synonym of *Ropalidia* Guérin, 1831.

Diagnostic characters

Medium to large sized wasps 5.5 to 17 mm long; clypeus convex, usually wider than long with well developed lateral angle, apical margin produced into blunt to pointed tooth, lateral margin touching inner eye margin, basal margin slightly extending beyond anterior tentorial pits; mandible quadridentate, usually with a few scattered deep big punctures; occipital carina complete; antenna twelve segmented in female; pronotal carina complete, pronotal fovea absent; scutellum raised, usually without median carina and groove; postscutellum with apical triangular area in middle, apical margin usually truncate, rarely slightly reduced in middle at base of propodeum, mesepisternum with or without epicnemial carina; propodeum with complete or incomplete median groove, with or without transverse striations; first metasomal segment petiolate.

Distribution

India (throughout India), Pakistan, Sri Lanka, Burma, Tibet, Thailand, Sumatra, Malaysia, China.

Biology

Unknown.

Remarks

Ropalidia is a large genus of social wasps. One hundred and thirty species are widely distributed throughout the warmer parts of Old World; they are unique in their nest architecture and nesting behaviour.

KEY TO SUBGENERA AND SPECIES OF THE GENUS *ROPALIDA* OCCURING IN THE INDIAN SUBREGION

(Revisied and Modified from Das and Gupta 1989)

1. Mesopleuron with a clear epicnemial carina 2

— Mesopleuron without a clear epicnemial carina 28

2. Forewing with two cubital cells; fine punctures on epicnemium (subgenus *Paraicaria* Gribodo); median groove of propodeum wide and deep like a cavity. India. Burma, Thailand .... *R. (Paraicaria) bicolorata* Van der Vecht

— Forewing with three cubital cells; epicnemium smooth (subgenus *Anthreneida* White) 3

3. Propodeum at base with a pair of carina (Fig. 49). I. The marginata group 4

— Propodeum without a carina (Fig. 50) 8

4. Head narrower than mesosoma in front of tegulae; second metasomal tergite with two sharp spines at apex. Burma, Thailand ..... (extralimital) ..... *R. (A.) binghami* van der Vecht

— Head wider than mesosoma in front of tegulae; second metasomal tergite without spines at apex 5

5. Metasomal petiole shorter than hind femur (50:52); large species (14.0 - 17.0 mm long); second metasomal tergite black or brown; if brown, with a narrow yellow faint apical band. Burma, China, India (Kerala) ..... *R. (A.) magnanima* van der Vecht

— Metasomal petiole at least as long as hind femur (except in spatulata); usually smaller species (10.0 - 13.0 mm long); second metasomal tergite reddish brown with apical yellow band 6

6. Second metasomal tergite reddish-brown with narrow yellow fascia, sometimes entirely brownish-black. In males, clypeus nearly as wide as long (23:22). Pakistan, Sri Lanka, India (Kerala, Karnataka) ..... *R. (A.) marginata* (Lepeletier)

— Second metasomal tergite with a broad yellow fascia. In males, clypeus wider than long 27:23) 7

7. Second metasomal tergite 2.5x as wide as metasomal petiole; apical antennal segment strongly curved in male; aedeagus

broadly spatulate India (Fig. 57) (Kerala) .... *R. (A.) spatulata.* van der Vecht

— Second metasomal tergite 2.1-2.2x as wide as metasomal petiole. In male, apical antennal segment less strongly curved India .. aedeagus as in figure 58 ..... *R. (A.) brevita* Das & Gupta

8. Second metasomal tergite and sternite not fused. II. The stigma group 9

— Second metasomal tergite and sternite fused III The sumatrae group 17

9. Propodeum with deep almost complete median groove; metasomal petiole 1.7x as long as wide; scutellum with strong and close reticulate punctures. India .... *R. (A.) santoshae* Gupta & Das

— Propodeum with shallow median groove, obsolete at base; metasomal petiole more than 2x as long as wide 10

10. Second metasomal tergite strongly raised apically in middle. Burma Java (extralimital) ..... *R. (A.) artifex* Saussure

— Second metasomal tergite normal 11

11. Third antennal segment atleast 3x as long as wide at apex; sides of second metasomal tergite marked with yellow at base 12

— Third antennal segment slightly less than 3x as long as wide at apex; sides of the second metasomal tergite marked otherwise 13

12. Head wider than mesosoma; temple as equal as eye in profile; second metasomal tergite with yellow marking at base; mesosoma and metasoma black. India, Tibet, Burma .... *R. (A.) ruficollaris* Cameron

— Head slighty narrower than mesosoma (Fig. 234); temple smaller than eye in profile; second metasomal tergite without yellow marking; mesosoma and metasoma reddish brown India. (Kerala) ..... *R. (A.) indica* sp. nov

13. Metapleuron smooth ventrally 14

— Metapleuron punctate ventrally 16

14. Red with black and yellow markings; metasomal petiole not predominantly black 15

— Black with red and yellow marking; basal two thirds of metasomal petiole black. India ..... *R. (A.) nigrita* Das & Gupta

15. Clypeus longer than wide (Fig. 271); pronotum, mesoscutum, scutellum, mesopleuron behind epicnemial carina with close superficial puncture; inner orbit, ocular sinus, abroad line on temple and scutellum with yellow markings ... Oriental Region, India (Kerala) ..... *R. (A.) stigma* (Smith)

— Clypeus wider than long (Fig. 265); pronotum, mesocutum, scutellum, mesopleuron behind epicnemial carina with close strong reticulate punctures; inner orbit, ocular sinus, temple, scutellum without yellow markings. Inndia (Kerala) .... *R. (A.) sridharani* sp. nov.

16. Metasomal petiole 2.4x as long as wide, swollen apically and narrowed at apex; metapleuron ventrally with few scattered and superficial punctures; temple about as wide as eye in profile. Oriental Region (extralimital) .... *R. (A.) hongkongensis* (Saussure)

— Metasomal petiole more than 2.5x as long as wide, not much narrowed again at apex; metapleuron ventrally with comparatively deep punctures; temple slightly narrower than eye in profile. India, Sulawesi, Lombok .... *R. (A.) mathematica* (Smith)

17. Ocellocular distance 3x as long as interocellar distance; suture between second metasomal, tergite and sternite very clearly visible all along its course 18

— Ocellocular distance (1.2 - 2.2x) interocellar distance; suture between second metasomal tergite and sternite visible only at base 20

18. Second metasomal tergite and sternite with strongly depressed apical margin and many longitudinal carinae; second metasomal tergite with a narrow apical yellow band; temple 0.75x as wide as eye in profile; two apical third of radial cell slightly darker. Burma, Taiwan, South China ..... *R. (A.) taiwana* Sonan

— Second metasomal tergite and sternite normal; temple as wide as eye in profile; radial cell either entirely dark brown or entirely yellow 19

19. Radial cell yellow; propodeum with distinct striations; temple with deep moderately close punctures; second metasomal tergite obliquely cut off apically. Burma, Thailand, Malaya, Sarawak, Sumatra, Kalimantan, Java ..... *R. (A.) modesta* (Smith)

— Radial cell dark brown; propodeum almost smooth in middle; temple smooth; second metasomal tergite verticaly cut off apically. India, Burma, Indo-China, Thailand, Malaya, Bangla Island, Sumatra, Kalimantan ..... *R. (A.) sumatrae* (Weber)

20. Metasomal petiole strongly swollen just after with end of basal slit and about as long as wide, apical margin strongly depressed 21

— Metasomal petiole gradually swollen apically and longer than wide, apical margin normal 22

21. Propodeum with deep median groove like a wide cavity (Fig. 51) and sharp edges; mesoscutum rugoso-punctate; postscutellum slightly produced apically in the middle. Thailand, Bangla Island, Sumatra, Java, Sumbawa ..... *R. (A.) rufoplagiata* (Cameron)

— Propodeum with shallow, narrow median groove and without sharp edges (Fig. 52); mesoscutum mat; postscutellum not produced in middle .....India .... *R. (A.) andamanensis* Das and Gupta

22. Metasomal petiole 2.0 - 2.2x as long as wide, narrowed apically and swollen towards apex; propodeum with narrow uniform median groove; second metasomal tergite petiolate or normal 23

— Metasomal petiole 1.5x as long as wide (Fig. 224), not narrowed apically and gradually swollen apically; propodeum with wide median groove; second metasomal tergite not petiolate 24

23. Second metasomal tergite petiolate and obliquely cut off apically; propodeum with fine close striations; scutellum and postscutellum entirely yellow. Oriental Region. India (Kerala) .... *R. (A.) fasciata* (Fabricius)

— Second metasomal tergite not petiolate and normal (Fig. 224); propodeum without fine close striations; scutellum and postscutellum partially yellow. India, (Karnataka) .... *R. (A.) bangalorica* sp. nov.

24. Propodeum with clear striations; metapleuron with a few superficial large punctures ventrally; wings yellowish hyaline except for apical brown cloud; radial cell long. Pakistan, India (extralimital) ..... *R. (A.) colorata* van der Vecht

— Propodeum almost smooth; metapleuron ventrally smooth; wings transparent hyaline, forewing with apical cloud; radial cell relatively shorter and wide 25

25. Clypeus not shiny; radial cell with apical half brown cloud; male antenna without tyloid; metasomal petiole without yellow band; second metasomal tergite with broad apical band 26

— Clypeus shiny; radial cell with two third apical brown cloud; male antenna with tyloids; metasomal petiole and second tergite with apical narrow yellow band. India (Kerala, Karnataka), Nepal, Sri

Lanka, Malaya, Java, Sumba, Sulawesi.....
..... *R. (A.) cyathiformis* (Fabricius)

26. Temple as wide as eye in profile; median line of median groove at propodeum not distinct, groove wider in middle (Fig. 54). India, Nepal, Malaya, East Indies, Liuchow island .....
..... *R. (A.)* variegata (Smith)

— Temple narrower than eye in profile; median line of median groove distinct or indistinct 27

27. Median line of median groove distinct; head wider than mesosoma (Fig. 239); clypeus with black mark; small insect 6 to 7 mm in length. India (Kerala), Bangla, Java ... *R. (A.) jacobsoni* Buysson

— Median line of median groove indistinct; head smaller than mesosoma (Fig. 254); clypeus entirely yellow; large insect 16 to 17 mm in length. India (Kerala) ..... *R. (A.) rodiatipa* sp. nov.

28. Frons, mesoscutum not shiny, with moderately close fine superficial punctures, interspaces not smooth; metasomal petiole more than 2x as long as wide 29

— Frons, mesoscutum shiny with scattered, large punctures; interspace between punctures smooth and nearly always more than diameter of punctures; metasomal petiole 1.4 x as long as wide (Fig. 281) India (Kerala) ..... *R. (I.) montana* Carl.

29. Radial cell entirely dark-brown. Malaya, Thailand (extralimital)
..... *R. (I.) aristocratica* (Saussure)

— Radial cell with only anterior margin dark brown 30

30. Propodeum almost smooth; mesoscutum with yellow line. Oriental Region ..... *R. (I.) flavopicta* (Smith)

— Propodeum either rugoso-reticulate or finely transversely striated; mesoscutum usually without yellow line 31

31. Propodeum completely and finely striated; scutellum and postscutellum with yellow markings 32

— Propodeum not completely striated, only middle part striated; scutellum and postscutellum not as above 33

32. Body reddish brown with yellow and black markings; length 7 to 8 mm; second metasomal tergite with lateral yellow spots (Fig. 276); all other metasomal tergite with yellow fascia (Fig. 276) .... *R. (I.) anupama* sp. nov.

— Pale brown with yellow markings; length 12 to 13 mm; second metasomal tergite without yellow spots (Fig. 286); all other metasomal tergite without yellow fascia (Fig. 286) ....*R. (I.) travancorica* sp. nov.

33. Propodeum finely striated only in the middle; scutellum and postscutellum black with yellow marks. (Burma) .... *R. (I.) malaisci* Van der Vecht

— Propodeum rugose on sides and very finely transversely striated in middle; scutellum and postscutellum orange-red; median groove of propodeum wide. India, Burma ..... *R. (I.) scitula* Bingham

Ropalidia (Anthreneida) bangalorica sp. nov.

(Fig. 223-228)

Female: Length 8.2 mm. Brown with yellow and black marking. Yellow marking as follows: clypeus except centre, two line on lower margin of mandible, lower sides of antennal scape and flagellomeres, a marking between toruli, a line towards occularsinus, a line on anterior margin of pronotum, two spots on upper margin of scutellum, a pair of spots on postscutellum, two elongated marks on sides of propodeum, pale band on apical margin of metasomal petiole, a broad band on apical margin of second metasomal segment, an irregulr spot on base of second metasomal segment on sides, fourth and fifth segment with pale apical band, forecoxa completely, midcoxa partially, hindcoxa sides, a line on forefemur and foretibia, a line on midtibia and hindtibia. Black marking as follows: a line on base of mandible, middle region of clypeus, upper emargination of clypeus, a pair of line just above antennae towards ocular sinus, triangular mark enclosing ocelli, a spot on side of pronotum, inner margin of mesocutum broadly, a spot below tegula, margins of meso and metapleuron, upper margins of scutellum and postscutellum, middle of propodeum, upper sides of propodeum, base of the petiole, base of second metasomal segment. Wings hyaline; apex of radial cell and stigma brown; veins brown.

Head: Covered with short silvery pubescence; width in anterior view 1.1x (76:70) as long as distance between front ocellus and lower labral margin (Fig. 228), head width in dorsal view 5.3x distance between front ocellus and posterior occipital margin, wider than

mesosoma (65:60); clypeus longer than wide (21:15) (Fig. 228), clypeus on apical area with long hairs, apical margin pointed, long hairs on mandible, upper margin of clypeus emarginated, clypeus with moderately close shallow punctures; mandible with few scattered fine superficial punctures, supraclypeal area, interantennal space, inner orbit of ocular sinus, vertex, temple with fine superficial punctures; inter spaces between punctures smooth; in yellow area interspace larger than diameter of puncture; interocular distance more on vertex than at clypeus (45:24); interocellar distance 0.58x as long as ocellocular distance and 2.5x diameter of posterior ocellus; temple distinctly narrower dorsally towards vertex (Fig. 225) and smaller than eye in profile (8:14); antennae farther from eyes than to each other (9:7); antenna with scape length 4.2x length of first flagellar segment; second flagellar segment 2.8x as long as first flagellar segment (Fig. 226), second flagellar segment 2.8x (14:5) as long as wide at apex; apical antennal segments width and length subequal (5:5); all other segments subequal.

Mesosoma: Stout; covered with silvery pubuscence; pronotum, mesoscutum and mesopleuron behind epicnemial carina closely reticulately punctate, sides of postscutellum, scutellum with deep punctures, epicnemial carina not distinct; ventral metapleuron with moderately close deep punctures; ventral metapleuron with a few strong oblique striations; propodeum without lateral carinae; hairs on propodeum larg towards posterior.

Metasoma: Metasomal petiole shorter than hindfemur (32:45) and about 2x as long as wide (18:9); second metasomal tergite as long as

wide (44:44) second metasomal tergite 1.3x as long as and 2.3x as wide as metasomal petiole (Fig. 224), obliquely cut off at apex, metasomal petiole strongly swollen just after end of basal slit.

Etymology: Named after collection locality.

Host: *Inglisia bivaliata.*

Host Plant: S andal.

Male: Unknown

Biology: Unknown.

Distribution: India (Karnataka/ Bangalore).

Material examined: ***Holotype***, Female, INDIA: Karnataka, Bangalore, 12.vii.1996, O.K. Ramadevi.

Discussion: This new species comes closer to *Ropalidia* (*Anthreneida*) *fasciata* in the key to the subgenera and species occuring in the Indian subregion by Das and Gupta (1989). However it differs from *Ropalidia (Anthreneida) faciata* in following characters: (1) In *Ropalidia (Anthreneida) banglorica* sp. nov. the second metasomal tergite normal and not petiolate (In *Ropalidia* (*Anthreneida*) *fasciata* second metasomal tergite petiolate; (2) In *Ropalidia (Anthreneida) banglorica* sp. nov. propodeum without close fine striations (In *Ropalidia (Anthreneida) fasciata* propodeum with striation). (3) In *Ropalidia (Anthreneida) banglorica* sp. nov. a broad yellow line on temple absent (In *Ropalidia* (*Anthreneida*) *fasciata* a broad yellow line present). (4) In *Ropalidia (Anthreneida) banglorica* sp. nov. scutellum

and postscutellum partially yellow coloured (In *Ropalidia (Anthreneida) fasciata* scutellum, postscutellum entirely yellow). (5) In *Ropalidia (Anthreneida) banglorica* sp. nov. a yellow spot present on interantennal space, not exceeding frons. (In *Ropalidia (Anthreneida) fasciata* a yellow mark present between the antennae and exceeding towards the frons.

***Ropalidia (Anthreneida) cyathiformis* (Fabriaus)**

(Fig. 229-233)

Eumenes cyathiformis Fabricius, 1804, *Syst. Piez.*, P. 289. F. des. type: F, Jave (COPENHAGEN).

Icaria ceylonica Cameron, 1898. *Mem. Manch. Let. Phil. Soc.*, 42 (11): 48. F. Type: F, Sri Lanka (OXFORD); Syn. by Van der Vecht, 1941. – Dalla Torre, 1904. Genera Insectorum, 19: 73. Sri Lanka – Aiyar, 1916, *J. Bombay Nat. Hist. Soc.*, 24: 713. cat.

Icaria cayayanensis Ashmead, 1905. *Canad. Ent.*, 37: 3. F. des. Type F, Philippines: Manila (WASHINGTON); syn. by Van der Vecht, 1941. – Ashmead, 1905. *Proc. U.S. Natl. Mus.*, 28: 962. (*Icaria cagayanensis*, emendation).

Icaria cyathiformis: Schulz, 1912. *Berlin. Ent. Zeitschr.*, 57: 88. (*I. cyathiformis* (F.) should be identical with *Eumenes fasciata* F. and *Icaria variegata* (Smith).

Ropalidia cyathiformis: van der Vecht, 1941. *Treubia* 18(1): 112, 158. m f. DES., TAX., DISTR. Pre. loc. records + Burma (Rangoon). India: Assam: (Mishmi Hills, Upper Renging); Karimon Djawa Island; Malaya; Sulawesi.

Ropalidia (A.) cyathiformis: van der Vecht, 1962. Zool. Verh., 57: 31. biol., distr. Prev. loc. records + Burma (Myitkyina). Sumba. – Yamane & Yamane, 1979. *Insecta Matsumurana*, 15: 4, 14, 32. F. key, des., distr. Prev. loc. records + Indonesia. Nepal.

Ropalidia (Icariola) cyathiformis: Richards, 1978. *Aust. J. Zool.. Suppl. Ser.*, 61: 58. list.

Female: Length 10 mm. Reddish brown with yellow marking. Yellow marking as follows: Clypeus (except a median irregular mark), mandible, supraclypeal area, interantennal space continued up to a short distance on fronts; inner orbit up to ocular sinus, a line below antennal scape, temple with a small line, pronotum broadly at base, two large marks on sides of scutellum and postscutellum, two large marks on propodeum separated by median dark brown line, fore and middle coxae entirely, hindcoxa on side, a line below forefemur, metatarsi of all legs, rest of legs partly, apical margin of metasomal petiole and second metasomal tergite narrowly, and a large irregular mark on each side of second metasomal ltergite and an area at base of third and fourth metasomal segment. Wings transparent hyaline; apical half of radial cell brown; stigma yellow and veins pale brown.

Head: Covered with yellowish white hairs; width in anterior view 1.27x (103:81) as long as distance between front ocellus and lower labral

margin (Fig. 230); head width in dorsal view 5.76x distance between front ocellus and posterior occipital margin, wider than mesosoma (76:65), clypeus wider than long (46:35) (Fig. 230), apical margin pointed, lower margin emarginate, shiny covered with yellowish white hairs; mandible shiny with few hairs; supraclypeal area, inter antennal space, orbit, frons, ocular sinus and vertex almost smooth; interocular distance more on vertex than at clypeus (52:41); interocellar distance 0.68 x as long as ocellocular distance and 1.37x diameter of posterior ocellus; temple distinctly narrower dorsally towards vertex and smaller than eye in profile (31:17) (Fig. 230); antennae closer to eyes than from each other (8:12); antenna with scape length 4.1x length of first flagellar segment; second flagellar segment 2.1x as long as first flagellar segment (Fig. 231); second flagellar segment about 3x (16:5) as long as wide at apex; apical antennal segment as long as wide at base (8:9), all other segments are subequal.

Mesosoma: Stout; covered with small hairs; pronotum, mesoscutum, scutellum, mesopleuron smoothly and reticulately punctate; postscutellum apical half almost shiny; mesepisterum and metapleuron with moderately close superficial punctures; propodeum almost smooth, with a wide median groove, hairs on posterior side longer.

Metasoma (Fig. 229): Metasomal petiole shorter than hind femur (31:49) and about 2.8x as long as wide; second metasomal tergite as long as wide (61:59) and 1.8x as long as and 2.3x as wide as metasomal petiole.

Male: Length 5.5 mm. Agree with the female but differs as follows: Temple narrower; third and following segments of antennae with tyloids, apical segment slightly curved apically; mandible and clypeus wholly yellow; an almost curved mark above antenna; a mark enclosing ocelli; black; mesopleuron except the upper reddish-brown part; metapleuron, propodeum, except two yellow marks, and mesocutum towards scutellum dark brown.

Biology: Unknown.

Habitat: Disturbed.

Variations: Specimens from Bangalore show black markings on the following part: Basal margin of the clypeus narrowly, one spot each above the antennel socket, a broad line on mesoscutum apically, propleuron, a mark on ventral metapleuron, median mark (separating the two yellow markings) and sides of the propodeum partly, mesosternum, metasomal petiole below, and middle and hind femur and trochanther partly black. In another specimen clypeus with middle brown spot; with yellow large markings on scutellum, postscutellum and propodeum; one yellow mark on upper part of mesopleuron; a black spot sourrounding ocelli; no yellow mark on supraclypeal area; interantennal space, inner orbit, temple and propodeum; antenna complete dark brown; third and fourth metasomal sternite with yellow fascia at base.

Distribution: India: Bihar, Ranchi, Karnataka, Bangalore, Madhyapradesh, Raipur, Maharashtra, Buvabeswar, Uttarpradesh, Dehra Dun, Mussoorie, Nepal, Sri Lanka, Malaya, Sulawesi, Sumba.

Materials examined*: *Plesiotype: Female, INDIA: Karnataka, Indian Institute of Science campus, Bangalore, 10.11.1999, Sujatha. ***Other materials examined:*** 2 Females, INDIA: Karnataka, Indian Institute of Science campus Bangalore, 10.11.1999. Sujatha.

***Discussion*:** This species comes near to *Ropalidia (A.) stigma* in the key to species of *Ropalidia* in the Indian subregion (Gupta & Das, 1989). However it differs from *Ropalidia* (*Anthreneida*) *Cyanthiformis* in following characters. 1. In *Ropalidia* (*Anthreneida*) *Cynanthiformis* second gastral tergite and sternite fused (In *Ropalidia (A.) stigma* second gastral tergite and sternite not fused). 2. In *Ropalidia* (*Anthreneida*) *cyanthiformis* yellow marks of propodeum separated by wide median groove (In *Ropalidia (A.) stigma* yellow marks united. 3. In *Ropalidia* (*Anthreneida*) *cyanthiformis* metasomal petiole longer and not strongly swollen apicly. (In *Ropalidia (A.) stigma* metasomal petiole shorter and strongly swollen apically).

***Remarks*:** This species is not so far known from Kerala but included here since it is likely to be present in this region.

Ropalidia (Anthreneida) indica sp. nov.

(Fig. 234-238)

***Female*:** Length 15 mm. Reddish brown with yellow and black markings. Yellow marking as follows: apical margin of clypeus irregularly; base of mandible broadly; a line below antennal scape, seven to twelve segments of the antenna entirely, mid anterior margin of

pronotum, apical margin of metasomal petiole and second metasomal segment faintly, all tarsi, hindtiba and upper region of foretibia. Black marking as fllows: a spot at centre of clypeus, apical margin and emargination; just above antennal socket, frons, vertex enclosing ocelli, outer margin of mesoscutum and an irregular mark from anterior side to posterior side, just below wings, mesopleuron and metapleuron, almost all mesosomal sutures, ventral sides of meso and metapleuron. Wings yellowish; three fourth of radial cells and last cubital cell blackish brown; stigma yellow; veins dark brown.

Head: Covered with short silvery pubescence; width in anterior view 1.3x as long as (114: 84) distance between front ocellus and lower labral margin (Fig. 237), head width in dorsal view 4.3x distance between front ocellus and posterior occipital margin, slightly smaller than mesosoma (57:59); clypeus wider than long (54:34) (Fig. 237) with long hairs on apical margin, pointed, upper margin emarginate, with few scattered punctures; mandible with scattered punctures; supraclypeal area, interantennal space, inner orbit, ocular sinus, vertex, and temple moderately punctate; temple with long silvery hairs; interocular distance more on vertex than at clypeus (50:45); interocellar distance 0.5x as long as ocellocullar distance and 0.75x diameter of posterior ocellus; temple distinctly narrower dorsally towards vertex and smaller than eye in profile (35:14) (Fig. 236); antennae farther from each other than from eyes (13:9), antenna with scape length 4.4x length of first flagellar segment; second flagellar segment 4.1x as long as first flagellar segment (7:30) (Fig. 238), second flagellar segment 3.1x (7:30)

as long as wide at apex; apical antennal segment longer than wide (11:9), all other segments subequal.

Mesosoma: Stout; covered with silvery pubescence; pronotum, mesonotum, scutellum post-scutellum (except a triangle mark on center) strongly punctate; mesopleuron strongly punctate, ventral metapleuron smooth with few scattered punctures, side of ventral metapleuron with striations, propodeum with long hairs and lateral carinae, covered with fine silvery hairs, reticulately punctate.

Metasoma: Metasomal petiole longer than hindfemur (44:39), about 2.3x as long as wide (44:19); second metasomal tergite slightly longer than wide (64:62) (Fig. 234), second metasomal tergite 1.45x as long as and 3.3x as wide as metasomal petiole.

Male: Unknown.

Etymology: Name after India.

Distribution: India: Kerala, Kasarkode.

Biology: Unknown.

Habitat: Disturbed.

Material examined: ***Holotype***: Female. INDIA: Kerala, Kasarkode, 24.1.1994, Gopi. K. ***Paratype***: Female. INDIA, Kerala, Kasarkode, 2.1.1994, Gopi. K. (DZCU).

Discussion: This new species comes closer to *Ropalidia (A.) ruficollaris* (Cameron) in the key to the subgenera and species occuring in the Indian sub region by Das & Gupta (1989). However, it differs

from *Ropalidia (A.) ruficolaris* in the following character: 1. In *Ropalidia indica* sp. nov. mesosoma wider than head (In *Ropalidia (A.) ruficollaris* head wider than mesosoma). 2. In *Ropalidia (A.) indica* sp. nov. temple smaller than eye in profile (in *Ropalidia (A.) ruficollaris* temple as equal as eye in profile). 3. Second metasomal tergite in *Ropalidia (A.) indica* sp. nov. without yellow marking at base (In *Ropalidia (A.) ruficollaris* second metasomal tergite with yellow marking at base). 4. *In Ropalidia (A.) indica* sp. nov. last six (apical) flagellomeres of the antenna yellow (In *Ropalidia ruficollaris* apical six flagellomers of the antenna black above). 5. In *Ropalidia (A.) indica* sp. nov. apical margin of the clypeus yellow (In *Ropalidia (A.) ruficollaris* a triangular mark present at apical margin of clypeus. 6. In *Ropalidia (A.) indica* sp. nov. mesosoma and metasoma reddish brown (In *Ropalidia (A.) ruficollaris* mesosoma and metasoma black).

KEY TO SUBSPECIES OF THE SPECIES *ROPALIDIA (ANTHRENEIDA) JACOBSONI* (BUYSSON) OCCURING IN THE INDIAN SUBREGION

(Modified from Das & Gupta, 1989)

1. Metapleuron smooth; fore and mid coxa yellow in front: second metasomal sternite without yellow mark at base (Fig. 239); temple without yellow line. India (Kerala), Bangla island, Java ..... *R. (A.) jacobsoni jacobsoni* Buysson

— Metapleuron sometimes with few indistinct-punctures; coxae yellow in front; second metasomal sternite usually with yellow marks at base; temple with yellow line. India (Assam) ..... *R. (A.) jacobsoni flavoscutellata* Das & Gupta

Ropalidia (Anthreneida) jacobsoni jacobsoni (Buysson)

(Fig. 239-243)

Icaria jacobsoni Buysson 1908, *Notes Leiden Mus.*, 30: 123. F. des. Type; F, Java: Djakarta (=Batavia) (LEIDEN).

Ropalidia variegata jacobsoni: Van der Vecht, 1941. *Treubia*, 18 (1): 156, 157. M F, key, des., distr. Bangka Island; India: Maharashtra (Bombay), Rajasthan (Abu); Java.

Ropalidia (Anthreneida) variegata jacobsoni: Van der Vecht, 1962. *Zool. Verh.*, 57: 29. biol., distr. Burma: (Bhámo, Schwego Myo, Washaung); India: Kerala (Walayar Forest), Tamil Nadu

(Coimbatore); Java; Sulawesi; Sumatra. – Yamane & Yamane, 1979. *Insecta Matsumurana*, 15: 32. distr. South India.

Ropalidia (Icariola) jacobsoni: Richards, 1978. *Aust. J. Zool. Suppl. Ser.*, 61: 58. list.

Female: Length 7.6 mm. Reddish brown with yellow and black markings. Yellow marking as follows: clypeus except a characteristic black mark, mandible except for black reddish-brown teeth, inner orbit up to ocular sinus narrowly, a line below the antennal scape, lower sides of all antennal segment, narrow line on pronotal carina, basal and lateral margin of scutellum, two marks on postscutellum, a small mark on upper part of mesopleuron, two broad marks on propodeum seperated by black mark on median groove, fore and middle coxae in front, a line on hindcoxa laterally another line below forefemur, a small mark on middle femur laterally, narrow line on tibia above, foretarsi, second metasomal tergite with a large irregular mark on each side at base and an apical band. The black marking as follows: a mark at base to centre on clypeus, supraclypeal area, a mark enclosing ocellus, a large spot above antennal socket, margins of mesoscutum narrowly, apical margin towards scutellum broadly, dorsal metapleuron, basal and apical margins of propodeum and broadly along median groove. Wings transparent hyaline with apical half of radial cell brown; stigma yellow, veins brown.

Head: Covered with short silvery pubescence; width in anterior view 1.3x as long as (115:88) distance between front ocellus and lower labral margin (Fig. 242), head width in dorsal view 5x distance between

front ocellus and posterior occipital margin, slightly bigger than mesosoma (51:49); clypeus wider than long (48: 33) (Fig. 242), long hairs on apex, pointed, upper margin slightly emarginated, with few scattered punctures; mandible with scattered few punctures; supraclypeal area, interantennal space and inner orbit below ocular sinus smoothly punctate; frons, ocular sinus, vertex and temple with moderately close deep punctures; inter ocular distance more on vertex than at clypeus (50:40) (Fig. 242); interocellar distance (0.75 x as long as ocellocular distance and 1.8x as equal as posterior ocellus (15:8); temple distinctly narrower dorsally towards vertex and smaller than eye in profile (16:32) (Fig. 243); antennae closer from each other than eye (9:12); antenna with scape length 4.5x length of first flagellar segment, second flagellar segment 2.25x as long as first flagellar segment (7:16) (Fig. 241). Second flagellar segment 2x as long as wide at apex (8:16), apical antennal segment wider than long (14:11), all other segments subequal.

Mesosoma: Stout; covered with small silvery pubescence; pronotum, mesonotum with close large deep punctures; scutellum with scatterd superficial large punctures; postscutellum with a few indistinct punctures except for the apical smooth shiny triangular area; mesopleuron with moderately raised distinct epicnemial carina with relatively close large moderately deep punctures; metapleuron and propodeum smooth; median line of median groove distinct and posterior side with long hairs.

Metasoma: Covered with fine silvery small hairs; a few large deep punctures on apical swollen part of first metasomal segment;

metasomal petiole shorter than hind femur (27:23) and 1.1 x as long as wide; second metasomal tergite slightly wider than long (43:41), 2.1x as wide as and 1.75x as long as metasomal petiole (Fig. 239), moderately and closely punctate and vertically cut off apically.

Distribution: India: Delhi, Karnataka: Banglore, Tamil Nadu, Coimbatore, Uttar Pradesh: Dehra Dun, Kerala, Rajastan, Maharashtra; Bangka Island, Java.

Biology: Unknown.

Habitat: Disturbed.

Host : Polyathia.

Material examined: ***Plesiotype:*** Female, INDIA: Kerala, Malabar Christian College Campus, 19.xi.1998, L. Kishore. ***Other materials examined:*** 7 Females, INDIA: Kerala, Malabar Christian College Campus, 19.xi.1988, L. Kishore (DZCU).

Discussion: This subspecies comes closes to *Ropalidia (A.) jacobsoni flavoscutellata* in the key to subgenera and species occuring in the Indian subregion (Das and Gupta 1989). However it differs from *Ropalidia (A.) jacobsoni flavoscutellata* in having following characters. (1) In *Ropalidia (A.) jacobsoni jacobsoni* yellow line absent on temple (In *Ropalidia (A.) jacobsoni flavoscutellata* yellow line present on temple). (2) In *Ropalidia (A.) jacobsoni jacobsoni* metapleuron smooth (In *Ropalidia (A.) jacobsoni flavoscutellata* metapleuron with a few indistinct punctures. (3) In *Ropalidia (A.) jacobsoni jacobsoni* a spot on

sides of scutellum yellow (In *Ropalidia (A.) jacobsoni flavoscutellata* scutellum complete yellow) and (4) In *Ropalidia (A.) jacobsoni jacobsoni* basal margin of pronotum narrowly yellow (In *Ropalidia (A.) jacobsoni flavoscutellata* basal margin of pronotum broadly yellow.

KEY TO SUBSPECIES OF THE SPECIES *ROPALIDIA (ANTHRENEIDA) MAGNANIMA* VAN DER VECHT IN THE INDIAN SUBREGION

1. Clypeus, supraclypeal area, interantennal space around antennal socket yellow; frons with a broad black mark; petiole red; second metasoma tergite completely black without any markings. (= Burma) ..... *R. (A.) magnanima anthracina* Das & Gupta

— Clypeus at lateral margin and space around antennal sockets yellow; frons with a small black spot; petiole coloured differently; second metasomal tergite not completely yellow 2

2. Second metasomal tergite dark reddish brown with narrow apical faint brownish yellow band (Fig. 244); middle and hind metatarsus yellowish white; petiole reddish brown India (Kerala), Burma ..... *R. (A.) magnanima magnanima* Van der Vecht

— Second metasomal tergite without clear reddish mark at base; basel two-three joints of middle and hind tarsi yellowish-white; petiole black with swollen apical part marked with red. Burma, Indochina ..... *R. (A.) magnanima albitarisis* Van der Vecht

Ropalidia (Anthreneida) magnanima magnanima Van der Vecht

(Figs. 244-249)

Icaria guttatipennis Saussure: Bingham, 1897. *Fauna of British India, Hymenoptera*, 1: 386, 387. FM (Misdet. of *guttatipennis* from Africa). Burma: (Pegu Hills, Rangoon, Tenasserim).

Ropalidia guttatipennis: Dover, 1929. *Bull. Raffles Mus.*, 2: 46. distr. Malaya: Singapore Island. (Misdet. of *guttatipennis* Saussure).

Ropalidia magnanima magnanima Van der Vecht, 1941. *Treubia*, 18(1): 109, 125. M F. key, des., distr. Type: F, Burma: Schwego Myo (Type location mentioned as "Mus. Venice"). Burma: (Tenasserim, Toungoo).

Ropalidia (A.) magnanima magnanima: Van der Vecht, 1962. *Zool. Verh.*, 57: 9. Burma: Pegu (Palon), Rangoon, Tenasserim (Ataran Valley). (Type location stated to be "London").

Ropalidia (Icariola) guttatipennis: Richards, 1978. *Aust. J. Zool. Suppl. Ser.*, 61: 58. list.

Female: Length: 14 mm. Dark brown with pale yellow and red marking: Pale yellow marking as follows: Clypeus (except an oval shaped marking on middle of clypeus), apex of first metasomal tergite reddish yellow and second tergite pale yellow, middle and hind metatarsus at apex yellowish white. Red marking as follows: Antennal scape and first two flagellomeres entirely, anterior one third of pronotum, tegula almost, teeth of mandible, joints of femur and tibia

and upper region of fore and hind tibia, Wings hyaline with apical dark brown cloud; veins reddish brown.

Head: Width in anterior view 1.18x (100 : 85) as long as distance between front ocellus and lower labral margin (Fig. 245); head width in dorsal view 6.3x distance between front ocellus and posterior occipital margin; wider than mesosoma (70:66), clypeus wider than long (43:35), apical margin of the clypeus pointed, lower margin emarginated, with moderately close superficial punctures; mandible with few scattered superficial punctures; supraclypeal area, interantennal space, inner orbit upto ocular sinus almost smooth, covered with dense pubescence; frons, ocular sinus and vertex reticulately punctate; interocular distance on vertex slightly more than at clypeus (57:52) (Fig. 245); interocellar distance 0.59x as long as ocellocular distance and 16x diameter of posterior ocellus; temple slightly narrower dorsally towards vertex and smaller than eye in profile (21:28) (Fig. 248); antennae farther from each other than from eyes (10.6), antennae with scape length 5.5x length of first flagellar segment; second flagellar segment 2.7x length of first flagellar segment (Fig. 247); second flagellar segment about 3x (20.7) as long as wide at apex; apical antennal segment subequal (7:8) and pointed at apex, all other segments subequal.

Mesosoma: Stout; pronotum, mesoscutum, scutellum and mesopleuron behind epicnemial carina, densely reticulately punctate; postscutellum with moderately close deep large punctures (except apical triangle area); dorsal metapleuron with 3-4 moderately distinct oblique striations, ventral metapleuron with a few scattered moderately deep

reticulate punctures; striations on propodeum not continuous; propodeum with a pair of strong vertical carina.

Metasoma: Metasomal petiole shorter than hind femur (50:52) and about 1.7x as long as wide; second metasomal tergite 1.7x as long as and 1.7x as wide as metasomal petiole (Fig. 244), former petiolate at base and vertically cut off at apex.

Male: Unknown.

Habitat: Disturbed.

Biology: Unknown.

Distribution: India (Kerala), Burma.

Materials examined: ***Plesiotype:*** Female, INDIA: Kerala, Kozhikode, Mukkam 18.v.1982, K.N. Nair and Party. ***Other materials examined:*** 1 Female, INDIA: Kerala, Kannur, Sureshan and Party, 3.11.1995 (DZCU).

Discussion: This species comes near to *Ropalidia* (*Anthreneida*) *binghami binghami* in the key to species of *Ropalidia* in the Indian subregion (Gupta & Das, 1989). However, it differs from *Ropalidia* (*Anthrenedia*) *magnanima magnanima* in having: (1) In *Ropalidia (A.) magnanima magnanima* head broader than mesosoma (in *Ropalidia (A.) binghami binghami* mesosoma broader than head. (2) In *Ropalidia (A.) magnanima magnanima* apical margin of second metasomal tergite without sharp spines (In *Ropalidia (A.) binghami binghami* apical margin of second metasomal tergite without sharp spines (In *Ropalidia (A.) binghami binghami* apical margin of the second metasomal tergite

with sharp spines). (3) *Ropalidia (A.) magnanima magnanima* is dark brown (*Ropalidia (A.) binghami binghami* is black). (4) In *Ropalidia (A.) magnanima magnanima* no spot on swollen part of petiole (In *Ropalidia (A.) binghami binghami* an ill defined spot present at base of swollen region of petiole).

KEY TO SUBSPECIES OF THE SPECIES *ROPALIDIA (ANTHRENEIDA) MARGINATA* (LEPELETIER) OCCURING IN THE INDIAN SUBREGION

1. Second metasomal tergite reddish brown with a narrow yellow apical band (Fig. 249); scutellum and postscutellum with large yellow marks; fore coxa completely yellow in front, middle and hind coxa with yellow marks. India (Kerala, Karnataka), Pakistan, Sri Lanka, Ceram, Flores .. *R. (A.) marginata marginata* (Lepeletier)

— Second metasomal tergite completely brownish-black; scutellum and postscutellum reddish brown. Burma .... *R. (A.) marginata rufitarsis* Van der Vecht

Ropalidia (Anthrencida) marginata marginata (Lepeletier)

(Fig. 249-253)

Vespa ferruginae Fabricus, 1793. *Ent. Syst.* 2: 280. des. Type: F (COPENHAGEN); preoccupied by *Vespa ferruginea* Gmelin, 1790 and Oliver, 1791.

Polistes ferruginea: Fabricius, 1804. *Syst. Piez.*, p.277.

Epipona marginata Lepeletier, 1836. *Hist. Nat. Ins. Hymenoptera*, 1: 541. M F. Type: ? (loc. unknown). – Smith, 1852. *Ann. Mag. Nat. Hist.*, (2) 9: 47.

Icaria marginata: Saussure, 1853. *Etud. Fam. Vespidae*, 2: 237. F, des., tax., distr. "Indes Orientales" – Smith, 1857. Cat. Hym. Brit. Mus., 5: 97. cat. – Saussure, 1862. *Stettin. Ent. Ztg.*, 23: 139. – Gribodo, 1884. Catalogus *Ann. Mus. Civ. Genova*, 21: 355. F. – Dalla Torre, 1894. *Catalogus Hymenopterorum*, 9: 119. *cat.* India – Bingham, 1897. *Fauna of British India*, Hymenoptera, 1: 387, 388. F. *key, des., distr. India*: Karnataka (Bangalore); Tamil Nadu (Madras); Sri Lanka.

Icaria ferruginea: Saussure, 1853. *Etud. Fam. Vespidae*, 2: 38. F. des., distr. "Indes Orientales". – Horne, 1870. *Trans. Zool. Soc. London*, 7(3): 169. (mis det. ?). – Smith, 1871. *Linn. Soc. Zool.*, 11: 378. distr. Ceram; Flores; India; Kalimantan; Dalla Torre, 1894. Catalogus Hymenopterorum, 9: 118. Cat. (misdet. ?). – Dalla Torre, 1904. Genera Insectorum, 19: 73. cat. India. (misdet. ?).

Ropalidia ferruginea: Bequaert, 1918. *Bull. Amer. Mus. Nat. Hist.*, 39: 247. (misdet. ?). – Dover & Rao, 1922. *J. Asiat. Soc.* Bengal. (N.S.) 18: 244. (misdet. ?). – Dover, 1931. J. Fed. Malay. St. Mus., 16: 257. distr. Malacca; many loc. in Malaya.

Ropalidia marginata: Dover & Rao, 1922. *J. Asiat. Soc. Bengal*, (N.S.) 18: 244. distr.

Ropalidia marginata marginata: Van der Vecht, 1941. *Treubia*, 18(1): 109. 117. M F, key, des., fig., tax., distr. India: Gujarat (Deesa), Karnataka (Bangalore), Madhya Pradesh (Jabalpur), Maharashtra (Bombay), Rajasthan (Abu), Tamil Nadu (Madras), Uttar Pradesh (Kumaon); Sri Lanka: (Colombo, Puttalam).

Ropalidia marginata indica Van der Vecht, 1941. *Treubia*, 18(1): 121. F. des., distr. India: Bihar (Paresnath), Karnataka (Bangalore), Orissa (Chilka Lake: Barkuda Island), Punjab (Ambala), Tamil Nadu (Madras), West Bengal (Calcutta); Indo-China; Pakistan: Sind (Karachi: Manora). (New name for *ferruginea* Fabricius (in part); Van der Vecht, 1962, clarified that this was a replacement name for *ferruginea* Fabricius and not to be considered as a new taxa).

Ropalidia (A.) marginata marginata: Van der Vecht, 1962. *Zool. Verh.*, 57: 11. distr. Prev. loc. records + India: Kerala (Walayar Forest), Rajasthan (Suratgarh), Tamil Nadu: Coimbatore, Madras (Tuticorin). – Yamane & Yamane, 1979. *Insecta Matsumurana*, 15: 32. distr. South India.

Female: Length 11.9. Reddish-brown with yellow marking as follows: Mandible almost entirely, apical margin of clypeus broadly, a line below antennal scape, basal margin of pronotum with a narrow pale line, two large spot on potscutellum, two elongated mark on apical region of propodeum, forecoxa entirely in front, metasomal petiole and second metasomal tergite apically with narrow fascia, basal two or three tarsal joints of middle and hind legs sometimes yellowish white, wings yellowish hyaline, apical half of radial cell dark brown, stigma yellow.

Head: Covered with short silvery pubescence, width in anterior view 1.12x (85:76) as long as distance between front ocellus and lower labral margin (Fig. 250), head width in dorsal view 4.5x distance between front ocellus and posterior occipital margin, as equal as mesosoma (63:63); clypeus wider than long (35:30); long hairs on apical margin of clypeus, pointed, upper margin emarginated, with a few scattered punctures, mandible with scattered punctures; supraclypeal area, interantennal space, inner orbit, ocular sinus, vertex and temple with fine superficial punctures, interspace between the punctures smooth; in yellow area; interspace larger than diameter of punctures; interocular distance more on vertex than at clypeus (41:36); interocellar distance 0.75x as long as ocellocular distance and 1.25x diameter of posterior ocellus; temple distinctly narrower dorsally towards vertex and smaller than eye in profile (Fig. 253) (17:26); antennae farther from each other than from eyes (13:6); antenna (Fig. 252) with scape length 5x length of first flagellar segment, second flagellar segment 3.6x as long as first flagellar segment (5:18) second flagellar segment 2x (18:9)

as long as wide at apex, apical antennal segment 1.25x as long as wide at base and slightly curved in middle; all other segments subequal.

Mesosoma: Stout; covered with silvery pubescence; very long whitish hairs at posterior side of propodeum; pronotum, mesonotum and pleuron, closely and reticulately punctured; propodeum with strong lateral striation on middle region; metapleuron with a few superficial large punctures.

Metasoma: Metasomal petiole (Fig. 251) shorter than hind femur (4:43) and about 1.8 x as long as wide (40:22); second metasomal tergite slightly longer than wide (61:59), second metasomal tergite 1.55x as long as and 2.7x as wide as metasomal petiole; metasomal petiole strongly swollen just after end of basal slit.

Male: Unknown.

Distribution: India, Andhra Pradesh, Gujarat, Karnataka, Kerala, Madhya Pradesh, Calcutta, New Delhi, Tamil Nadu, Coimbatore, Sri Lanka, Pakistan.

Biology: Unknown.

Habitat: Disturbed.

Variation: Some females from Karnataka show reduction of yellow markings especially on apical margin of metasomal petiole and on second metasoma, tergite.

Material examined: ***Plesiotype:*** Females, INDIA: Karnataka, Bangalore, Indian Institute of Science campus, 17.11.1999, Agrahori.

Other materials examined: 5 Females, INDIA: Karnataka, Bangalore, Indian Institute of Science, 17.xi.1999, Agrahori.

Discussion: This species comes closer to *Ropalidia (A.) spatulata* Van der Vecht in the key to the subgenera and species occuring in the Indian sub region of Das & Gupta (1989), However, it differs from *Ropalidia (A.) spatulata* Van der Vacht. in the following characters: (1) In *Ropalidia (A.) marginata marginata* second metasomal segment with narrow yellow fascia (In *Ropalidia (A.) spatulata* second metasomal tergite with broad yellow fascia. (2) In *Ropalidia (A.) marginata marginata* the aedeagus normal (In *Ropalidia (A.) spatulata* the aedeagus broadly spatulated. (3) In *Ropalidia (A.) marginata marginata* body without any black markings (In *Ropalidia (A.) spatulata* the body with black marking. (4) In male *Ropalidia (A.) marginata marginata* last antennal segment slightly curved. (In male *Ropalidia (A.) spatulata* it is strongly curved and rounded at apex).

Ropalidia (Anthreneida) rodiatipa sp. nov.

(Figs. 254-258)

Male: Length 16.5 mm. Reddish-brown with yellow marking. Yellow marking as follows: upper sides of mandible, clypeus entirely, a line below antennal scape, interantennal space, basal margin of pronotum, forecoxa and hindcoxa almost entirely, lower sides of fore femur and hind femur, metasomal petiole and second metasomal tergite with narrow apical fascica, pale yellow bands on third, fourth and fifth

metasomal tergite. Wings yellowish hyaline; apical half of radial cell dark brown; stigma yellow.

Head: Covered with short silvery pubescence; width in anterior view 1.2x (105:82) as long as distance between front ocellus and lower labral margin (Fig. 255); head width in dorsal view 3.6x distance between front ocellus and posterior occipital margin, as equal as mesosoma (6:65); clypeus wider than long (45:35) (Fig. 255), with small hairs, shiny, not pointed, upper margin slightly curved, with few scattered punctures; mandible with scattered punctures; supra clypeal area, interantennal space, inner orbit and ocularsinus smoothly punctate; frons and temple strongly and reticulately punctate; interocular distance more on vertex than at clypeus (50:45); interocellar distance 0.33x as long as ocellocular distance and 0.85x diameter of posterior ocellus; temple slightly narrower dorsally towards vertex and smaller than eye in profile (15:28) (Fig. 258); antennae farther from each other than eye (7:14); antennae with scape length 4.4x length of first flagellar segment; second flagellar segment 5.4x as long as first flagellar segment (7:41) (Fig. 256), second flagellar segment 4.5 (9:41) as long as wide at apex; apical antennal segment curved at apex; cell other segments subequal.

Mesosoma: Stout; covered with silvery pubescence; long whitish hairs at posterior side of propodeum; pronotum, mesonotum, mesopleuron closely strongly punctate; metapleuron with strong striations; propodeum without striations; postscutellum declive, place below level of scutellum.

Metasoma: Metasomal petiole longer than hind femur (43:33) (Fig. 254) and about 1.12x as long as wide (43:36); second metasomal tergite longer than wide (74:64), second metasomal tergite 1.72x as long as and 2.1x as wide as metasomal petiole (Fig. 257), all metasomal segments reticulately punctate, covered with fine silvery hairs.

Female: Unknown.

Etymology: Species name is an anagram of *Ropalidia*.

Distribution: India: Kerala, Kasarkode.

Biology: Unknown.

Habitat: Disturbed.

Material examined: Holotype, Male, INDIA: Kerala, Kasarkode, 14.x.1993, K.S. Gopi (DZCU).

Discussion: This new species comes closer to *Ropalidia* (*Anthreneida*) *jacobsoni* (Buysson). In key to the subgenera and species occuring in Indian subregion. However it differs from *Ropalidia (A.) jacobsoni* in following characters: (1) In *Ropalidia (A.) rodiatipa* sp. nov. median line of median groove of propodeum not distinct (In *Ropalidia (A.) jacobsoni* the median line of median groove of propodeum distinct). (2) In *Ropalidia (A.) rodiatipa* sp. nov. width of head as equal as mesosoma (In *Ropalidia (A.) jacobsoni* head wider than mesosoma). (3) In *Ropalidia (A.) rodiatipa* sp. nov. clypeus entirely yellow (In *Ropalidia (A.) jacobsoni* a black mark on clypeus present). (4) In *Ropalidia (A.) rodiatipa* sp. nov. metasomal petiole with apical yellow band (In *Ropalidia (A.) jacobsoni* metasomal petiole without yellow band). (5) In

Ropalidia (A.) rodiatipa sp. nov. temple distinctly shorter than eye in profile (In *Ropalidia (A.) jacobsoni* temple slightly shorter than eye in profile. (6) *Ropalidia (A.) rodiatipa* sp. nov. 16.5 mm in length (*Ropalidia (A.) jacobsoni* only 6 to 7 mm in length).

KEY TO THE SUBSPECIES OF *ROPALIDIA (ANTHRENEIDA) RUFOPLAGIATA* (CAMERON) OCCURRING IN INDIAN SUBREGION

1. Clypeus yellow with a large "U" or "O" shaped red mark at base; postscutellum entirely yellow; two curved yellow lines on apical 0.66 of propodeum 2

— Clypeus black with sides and apical margin red; postscutellum with a broad yellow band apically; propodeum with a small yellow spot on each side. India (Uttar Pradesh, Kerala), Burma, Thailand, Malaya, Sumatra .... *R. (A.) rufoplagiata gravelyi* (Dover & Rao)

2. Metapleuron black; mesopleuron with one or two reddish spots; mesoscutum with two lateral and one apical red mark. India (Andamans), Bangka island, Java, Sumbwa .... *R. (A.) rufoplagiata rufoplagiata* (Cameron)

— Both dorsal and ventral metapleuron red at base; mesopleuron with a broad reddish band; reddish marks on mesoscutum larger. India (Maharashtra)..... *R. (A.) rufoplagiata nursei* Van der Vecht

Ropalidia (Anthreneida) rufoplagiata gravelyi Dover & Rao

Ropalidia gravelyi Dover & Rao. 1922. *J. Asiat. Soc. Bengal* (N.S.), 18: 244. *F. des.* Type: F, India: Kerala, Karali (Cochin) (CALCUTTA).

Ropalidia rufoplagiata gravelyi: Van Der Vecht, 1941. *Treubia*, 18 (1): 168. des., distr. Burma: (Carin Cheba, Schwego Myo); Malaya; Sumatra; Thailand.

Ropalidia (A.) rufoplagiata gravelyi: Van der Vecht, 1962. *Zool. Verh.*, 57: 33. biol., distr. Prev. loc. records – Yamane & Yamane, 1979. *Insecta Matsumurana*, 15: 32. distr. South India.

Female: Length 8.5 mm. Body distinctly narrow. Black with predominant red and a few yellow markings; Reddish yellow marking as follows: apical margin of clypeus (sometimes yellow), a mark between antennae, a broad line along inner orbit (sometimes a large mark on frons), a small line on temple; first and second antennal segments and pronotum almost entirely, antennal flagellum below, all femora partly at apex and all tibiae and tarsi, a large pale mark on each side of second metasomal tergite; Yellow marking as follows: a mark at base of mandible, a band on postscutellum apically, a small spot on each side of propodeum, a large mark on middle and hind coxa below, and a band on metasomal petiole and second metasomal tergite apically.

Mesosoma: Median groove of propodeum deep and wide like a cavity, sides of the cavity sharp; scutellum and postscutellum nearly flat, latter slightly produced in middle apically.

Metasoma: Metasomal petiole as long as wide and abruptly swollen just after end of basal slit; apical margin of metasomal petiole strongly depressed; sutures between second metasomal tergite and sternite not visible throughout its course.

Variation: One female from India (Uttar Pradesh) is darker than the typical *gravelyi.* It has no mark on frons and propodeum, and postscutellum is entirely yellow except for a narrow black basal area.

Distribution: India: Uttar Pradesh, Karnataka, Kerala, Burma, Thailand, Malaya, Sumatra.

Biology: Unknown.

Habitat: Disturbed.

Discussion: This subspecies can be separated from the nominal subspecies by the key given above. This subspecies were reported from Cochin, Kerala by Dover & Rao (1922). Since no specimen of this species have been encountered in present investigation the above description is based on the redescription of the species by Das & Gupta, 1989.

Ropalidia (Anthreneida) spatulata Van der Vecht

(Fig. 259-263)

Icaria ferruginea (Fbricius): Saussure, 1853. *Etud. fam.* Vespidae, 2: 38. F. Fig. (misdet; not. *V. Ferruginea* Fabricius, 1793, preoccupied). – Bingham, 1877, Fauna of British India, Hymenoptera, 1: 386. 387, F, M. Key, des., distr. Burma (Tenasserim); India: Maharashtra, Sikkim, Tamil Nadu, Uttar Pradesh, West Bengal, Sri Lanka – Rothnes, 1903. *Trans. Ent. Soc.* London, 1903: 107.

Ropalidia marginata indica Van der Vecht, 1941. *Treubia* 18(1): 121. (new name for *Vespa ferruginea* Fabricius, 1793, nec. *V. ferruginea* Gmelin, 1790, nec. *Icaria ferruginea* auctt.) (in part) (specimen from India: Haryana, Ambala belong here).

Ropalidia (A.) spatulata Van der Vecht, 1962. *Zool. Verh.*, 57: 9. M. des., fig. tax., distr. Type M, India: Kerala: Walayar forest (LEIDEN) India: Haryana, Kerala, Maharashtra, Tamil Nadu, Pakistan – Yamane Yamane, 1979. *Insecta Matsumurana* 15: 4, 6, 32. F. des. Fig., distr. prev. loc. records + Nepal.

Ropalidia (Icariola) spathulata: Richards, 1978. *Aust. J. Zool. Suppl. Ser.* 61: 58. list.

Female: Length 13 mm. Reddish brown with yellow and black marking. Yellow marking as follows: anterior margin of clypeus broadly, a spot at base of mandible towards clypeus, a line below antennal scape, another line on basal margin of pronotum, two elongated marks on apical half of propodeum, a broad mark on fore coxa

in front, middle metatarsus, hind metatarsus except a small basal part, second to fourth hind tarsal segments, a broad band on apical petiole, and another broad band on apical second metasomal tergite. Black mark as follows: a faint triangular mark at base of mandible just next to yellow mark, lateral margins of clypeus narrowly, a circular spot on antennal socket dorsally, ocelli along margin, a faint irregular band next to yellow basal margin of propodeum, a narrow margin on mesoscutum, a broad mark at base and apex of mesoscutum, postscutellum faintly at base, suture between mesopleuron and metapleuron, postscutellum and propodeum broadly, mesosternum, metapleuron, a faint mark surrounding two yellow marks on propodeum, and a band adjacent to apical yellow band on first and second metasomal tergite. Hind tibia black, dorsally. Wings with brownish tint; veins brownish, radial cell with apical cloud.

Head: Width in anterior view 1.23x (80:66) as long as distance between front ocellus and lower labral margin (Fig. 253); head width in dorsal view 6.5x distance between front ocellus and posterior occipital margin; wider than mesosoma (66:59), clypeus wider than long (41:31), apical margin of the clypeus pointed, lower margin as in figure (263) with emargination, clypeus with moderately close large deep punctures; mandible with a few scattered fine superficial punctures; supraclypeal area and interantennal space almost smooth; inner orbit below ocular sinus smooth; frons, ocular sinus, vertex up to level of median ocellus closely and reticulately punctate; rest of vertex and temple with moderately close punctures, inter spaces between punctures smooth; interocular distance slightly more on vertex than at clypeus (39:36);

interocellar distance 0.75x as long as ocellocular distance and 2x diameter of posterior ocellus; temple distinctly narrower dorsally towards vertex and only slightly smaller than eye in profile (11:13) (Fig. 260); antennae farther from eyes than to each other (12:10); antenna with scape length 4.8x length of first flagellar segment; second flagellar segment 3x as long as first flagellar segment (Fig. 261); second flagellar segment about 3x (15:5) as long as wide at apex, apical antennal segment longer than wide at base (6:5) and pointed at apex; all other segments subequal.

Mesosoma: Stout. Pronotum, mesoscutum, scutellum, mesopleuron behind epicnemical carina closely and reticulately punctate; postscutellum with moderately close and deep punctures leaving median apical smooth and shiny triangular area; mesepisternum and ventral metapleuron with moderately close deep punctures; ventral metapleuron with a few strong oblique striations, propodeum without lateral carinae.

Metasoma: Metasomal petiole shorter than hind femur (Fig. 262) (32:39) and about 2x as long as wide (42:20); second metasomal tergite 1.1x as long as wide and 1.7x as long as and 2.25x as wide as metasomal petiole, obliquely cut off at apex.

Male: Similar to female but differing as follows: temple narrower than eye in profile view (12:16); antenna with distinct tyloids, apical antennal segment apically rounded and strongly curved, about 3x as long as wide in middle; ventral metapleuron with a few scattered fine punctures; aedeagus broadly spatulate at tip, and parameral spine with

bunalin of fine hairs. Colouration resembling that of female except that clypeus, mandible, supraclypeal area, interantennal space, inner orbit below ocular sinus, fore and midcoxae in front, and hindcoxa almost enterily in front, yellow.

Distribution: India (throughout Kerala).

Biology: Unknown.

Habitat: Disturbed.

Material examined: ***Plesiotype***: Female, INDIA: Kerala, Calicut, 30.x.1998, L. Kishore. ***Other materials examined:*** 1 Male INDIA: Kerala, Calicut 29.iv.1999, (k4). 1 Female, INDIA: Kerala, Nilambur, 4.xi.1998. L. Kishore, 1 Female, INDIA: Kerala, Karumala 15.vi.1998, Jobiraj, Female, INDIA: Kerala, Manjeri, 18.iv.2000, Jobiraj, 1 Female, INDIA: Kerala, Pulpally 24.iv.1999, L. Kishore. 1 Female, INDIA: Kerala, Trichur, 4.x.1999. Usha, K. 1 Female, INDIA: Kerala, Trivandrum, 10.iii.2000, Jobiraj. 1 Female. INDIA: Kerala, Ernakulam, 24.vi.1999, 1 Female, INDIA: Kerala, S. Bathery, 24.v.2000. L. Kishore (DZCU).

Discussion: This species comes near *Ropalidia* (*Anthreneida*) *brevita* in the key to species of *Ropalidia* of Indian subregion (Gupta & Das 1989). However it differs from *Ropalidia (Anthreneida) brevita* in following characters: (1) In *Ropalidia* (*Anthreneida*) *patulata* metasomal petiole shorter than hind femur (In *Ropalidia* (*Anthreneida*) *brevita* gastral petiole longer than hind femur). (2) In *Ropalidia* (*Anthreneida*) *spatulata* aedeagus strongly spatulate (In *Ropalidia*

(*Anthreneida*) *brevit* it is normal). (3) In *Ropalidia* (*Anthreneida*) *spatulata* male have apical antennal segment strongly curved and rounded at apex (In *Ropalidia* (*Anthreneida*) *brevita* apical antennal segment curved and bluntly pointed apically).

***Ropalidia (Anthreneida) sridharani* sp. nov.**

(Fig. 264-269)

***Female*:** Length 16 mm. Reddish brown with yellow and black marking: Yellow marking as follows: apical margin of clypeus partially, base of mandible broadly, a small irregular spot on interantennal space, anterior margin of pronotum in middle faintly, postscutellum broadly, sides of propodeum, lateral sides of the metasomal petiole and its apical margin, base of second metasomal tergite irregularly and apical margin narrowly, front sides of forecoxae and midcoxae, latral sides of the hindcoxae. The black marking as follows: faintly just above antennal sockets, joints of flagellomeres and last antennal segments, irregular spot on occiput enclosing ocelli, mesonotum entirely except two pairs of irregular brown markings, mesopleuron ventrally, metapleuron almost entirely, propodeum except yellow markings; dorsal side of metasomal petiole and metasomal tergites. Wings yellow, three fourth of radial cell blackish brown; stigma yellow; veins dark brown.

***Head*:** Covered with short silvery pubescence; width in anterior view 1.25x as long as (100: 82) distance between front ocellus and lower labral margin (Fig. 265), head width in dorsal view 5.5 x distance between front ocellus and posterior occipital margin, about as equal as

mesosoma (64:64); clypeus wider than long (48:33) (Fig. 265), with long hairs on apical margin, upper margin emarginate, apical margin pointed, with few scattered punctures; supraclypeal area, interantennal space, inner orbit, ocular sinus, vertex and temple, smoothly punctate; interocular distance more on vertex then at clypeus (47:42); interocellar distance 0.5x as long as ocellocellar distance and 0.75x the diameter of posterior ocellus; temple narrower dorsally towards vertex and smaller than eye in profile (Fig. 269) (28:14); antenna with the scape length 3.75x length of first flagellar segment (8:31); second flagellar segment 2.2x (8:18) as long as first flagellar segment (Fig. 267), 2x as long as wide at apex; apical antennal segment longer than wide (10:7); all other segments subequal to each other.

Mesosoma: Stout; covered with silvery pubascensce; pronotum, mesonotum, scutellum and postscutellum (except a shiny triangular mark) strongly and reticulately punctate; mesopleuron strongly punctate; ventral metapleuron smooth, dorsally striated; propodeum finely striated, posterior side with long hairs.

Metasoma: Covered with fine silvary small hairs;smoothly and reticulately punctate; metasomal petiole longer than hindfemur (Fig. 268) (50:40) and about 2:4 x as long as wide (21:50); second metasomal tergite slightly wider than long (61:58) (Fig. 264), second metasomal tergite 1.15 x as long as and 2.8 x as wide as metasomal petiole.

Male: Unknown.

Etymology: Named after Sreedharan, who collected the specimen.

Distribution: INDIA, Kerala, Nilambur.

Biology: Unknown.

Habitat: Undisturbed.

Material examined: ***Holotype***, female. INDIA: Kerala, Nilambur, 15.xi.2000, Sridharan.

Discussion: This new species comes closer to *Ropalidia (A.) stigma* (Smith) in the key to the subgenera and species occuring in the Indian subregion (Das and Gupta, 1989). However it differs from *Ropalidia (Anthreneida) stigma* (Smith) in following characters: (1) In *Ropalidia (A.) sridharani* sp nov. clypeus without brownish marking and with apical partial yellow band. (In *Ropalidia (A.) stigma* the clypeus with brownish marking on centre and apical partial yellow band partially). (2) In *Ropalidia (A.) sridharani* sp. nov. clypeus wider than long (In *Ropalidia stigma* Clypeus longer than wide). (3) In *Ropalidia (A.) sridharani* sp. nov. pronotum, mesoscutum, scutellum, mesopleuron behind epicnemial carina with close strong reticulate punctures. (In *Ropalidia (A.) stigma* pronotum, mesoscutum, scutellum, mesopleuron behind epicnemial carina with close superficial punctures). (4) In *Ropalidia (A.) sridharani* sp. nov. mesonotum black with two pairs of irregular dark brown mark. (In *Ropalidia (A.) stigma* mesonotum reddish brown without any markings). (5) In *Ropalidia (A.) sridharani* sp. nov. without yellow markings on inner orbit, ocular sinus, a broad line on temple and scutellum. (In *Ropalidia (A.) stigma* with yellow markings on inner orbit, ocular sinus, a broad line on temple and scutellum). (6) In *Ropalidia (A.) sridharani* sp. nov. basal

margin of clypeus not black (In *Ropalidia (A.) stigma* basal margin of clypeus black). (7) In *Ropalidia (A.) sridharani* sp. nov. basal margin of the second sternite yellow (In *Ropalidia stigma* the basal margin of second metasomal tergite and sternite with large yellow spots).

KEY TO SUBSPECIES OF THE SPECIES *ROPALIDIA (ANTHRENEIDA) STIGMA* (SMITH) OCCURING IN THE INDIAN SUBREGION

1. Mesoscutum not completely black; mesopleuron with yellow spot 2

— Mesoscutum completely black; mesopleuron black with red spot below tegula. Burma (extralimital) .... *R. (A.) stigma nigrolineata* Van der Vecht

2. Clypeus yellow at base (Fig. 271); temple with broad yellow line; antennal scape with yellow line below; yellow spots at base of second metasomal tergite and sternite large. India (Kerala). Sri Lanka, Philippines, Indochina, Thailand, Malaysia, Indonesia ..... *R. (A.) stigma stigma* (Smith)

— Clypeus red at base; temple with one short yellow line; antennal scape without a yellow line below; yellow spots at base of second metasomal tergite and sternite small or absent. Nepal, Eastern India, South China ..... *R. (A.) stigma rufa* Van der Vecht

Ropalidia (Anthreneida) *stigma stigma* (Smith)

(Fig. 270-274)

Polybia stigma Smith, 1858. *J. Proc. Linn. Soc. Zool.*, 2: 114. M. Type: M Malaysia: Sarawak (OXFORD).

Icaria bioculata Saussure, 1867. *Reise Novara Zool.*, 2 (Hym.): 22.

Icaria artifex Smith, 1871. *J. Proc. Linn. Soc. Zool.*, 11: 379. (not "*I. artifex* Saussure" – Van der Vecht, 1941). distr. Type: ? India; Java. (loc. unknown) – Bingham, 1897. *Fauna of British India,* Hymenoptera, 1: 386, 389. F M, key, des., distr. Burma: (Pegu Hills, Tenasserim); India: Sikkim, Uttar Pradesh: (Dhra Dun, Mussoorie), West Bengal (Barrackpore); Java – Cameron, 1907. *J. Strait Br. Roy. Asiat. Soc.* Bengal, 48: 26.

Icaria stigma: Schulthess, 1913. *Mitt. Schweiz. Ent. Ges.*, 12: 164.

Ropalidia artifex: Bequaert, 1918. *J. Bull. Amer. Mus. Nat. Hist.*, 39: 247. – Dover, 1925. *J. Asiat. Soc. Bengal*, (N.S.) 29 (1924): 301. – Dover, 1931. *J. Fed. Malay St. Mus.*, 26: 257. tax., distr. Many loc. in Malaya and Thailand.

Ropalidia stigma stigma: Van der Vecht, 1941. *Treubia*, 18(1): 110, 126. M F. key, des., fig., distr. Burma: Tenasserim (Maulmein); India: Assam (Margherita), Maharashtra (Bombay); Indo-China; Java, Kalimantan; Malaya; Sarawak; Philippine Islands; Selesi Island and Verlaten Islands; Sri Lanka (Ratanpura); Sumatra.

Ropalidia (A.) stigma stigma: Van der Vecht, 1962. *Zool. Verh.*, 57: 16. distr. Prev. loc. records + Bali; Burma: Bhámo, Inle Lake, Pegu (Palon), Pekkon, Schwego Myo, Washaung.

Ropalidia (Icariola) stigma: Richards, 1978. *Aust. J. Zool. Suppl. Ser.*, 61: 58. list.

Female: Length 11 mm. Reddish brown with yellow and black marking. Yellow marking as follows: Clypeus with dark brown mark as in Fig. 271, mandible except reddish brown teeth, a mark on interantennal space, inner orbit broadly below occular sinus, a broad mark on temple, a line below antennal scape, basal margin of pronotum narrowly, postscutellum almost entirely, a broad line bleow fore femur, a narrow line on apex of middle femur, a line on basal half of metasomal petiole on each side, second metasomal tergite narrowly at apex, both tergite and sternite with a large mark on each side at base. Black portions as follows: basal margin of clypeus narrowly, supraclypeal area, a mark on vertex enclosing ocelli, occiput pronotum narrowly at base, mesoscutum narrowly at margin and broadly at apex, thoracic sutures, metapleuron, mesosternum partially and propodeum except yellow markings and about half of metasomal petiole. Wings hyaline with brown veins, stigma reddish, and apical half of radial cell dark brown.

Head: Width in anterior view 1.34x (85:65) as long as distance between front ocellus and lower labral margin (Fig. 271); head width in dorsal view 5.2x distance between front ocellus and posterior occipital margin, wider than mesosoma (54:51); clypeus wider than long (41:31) (Fig. 271), upper margin of the clypeus not straight (Fig. 271), pointed

apically, and with scattered fine punctures; supraclypeal area, interantennal space, inner orbit below ocular sinus and temple smooth; ocularsinus, frons, vertex with close fine superficial punctures, interocular distance more on vertex than at clypeus (68:30); interocellar distance 0.41x as long as ocellocular distance and as equal as diameter of posterior ocellus; temple narrower than eye in profile (8:14) (Fig. 272); antennae slightly farther from each other than from eye (6:7) (Fig. 271); antenna with scape length 6x length of first flagellar segment; second flagellar segment 3.6x as long as first flagellar segment (Fig. 274); second flagellar segment 3 x (18:6) as long as wide at apex; last flagellar segment wider than long (9:8) and with a groove at middle; all other segments subequal.

Mesosoma: Pronotum, mesoscutum, scutellum, mesopleuron behind epicnemial carina with close fine superficial punctures; postscutellum smooth except few scattered indistinct punctures; metapleuron smooth; propodeum very finely striated, median groove only present at apical half, interspace between punctures more than diameter of individual punctures.

Metasoma : Metasomal petiole longer than hind femur (46:39) and about 2.2x as long as wide (46:21), second metasomal tergite about as long as wide (45:45) (Fig. 273) second metasomal tergite about (46:45) as long as and 2.1x as wide as metasomal petiole, moderately punctured, interspace between punctures smooth, oblique cut off at apex.

Male: Unknown.

Distribution: ***Distribution***: India: Kerala, Sikkim: Ranjit Valley, Tripura, Uttar Pradesh, West Bengal, Darjeeling, Assam, Burma, Thailand.

Biology: Unknown.

Habitat: Disturbed.

Material examined: ***Plesiotype***: 1. Female: INDIA: Kerala, Calicut University Campus 10.iii.1999. L. Kishore. ***Other material examined:*** 1 Female, INDIA: Kerala Calicut, 2.11.2000. L. Kishore.

Discussion: This species comes close to *Ropalidia* (*Anthreneida*) *nigrita* in the key to the subgenera and species occuring in the Indian subregion (Das and Gupta, 1989). However, it differs from *Ropalidia* (*Anthreneida*) *stigma stigma* in following characters. (1) *Ropalidia (A.) stigma stigma* lateral edge of aedeagus rounded (It is not similar in *Ropalidia (A.) nigrita*). (2) *Ropalidia (A.) stigma stigma* body red with black and yellow markings (In *Ropalidia (A.) nigrita* the body is black). (3) In *Ropalidia (A.) stigma stigma*, metasomal petiole not prominantly blck (In *Ropalidia (A.) nigrita* metasomal petiole black). (4) *Ropalidia (A.) stigma stigma* center of clypeus with broad reddish brown marking (In *Ropalidia nigrita* it is with spindle shaped black mark).

Ropalidia (Icarielia) anupama sp. nov.

(Fig. 276-280)

Female: Length: 7.6 mm. Reddish brown with yellow and black marking. Yellow marking as follows: Clypeus entirely except an irregular mark at centre, middle and apex of labrum, a line below antennal scape, all antennal flagellomeres at base, interantennal space, ocularsinus, upper and lower region of temple broadly, base of pronotum and apical margin of pronotum; metanotum almost entirely, two spots on postmetanotum, sides of propodeum broadly, a short line on mesopleuron, upper parts of fore coxa, mesocoxa and metacoxa, dots on fore tarsal segment, mesotarsal segment and metatarsal segment. Black marking as follows: A blackish brown spot on centre of clypeus, small line just above clypeal emargination, upper margin of clypeus, base of mandible, each ocellus separately, mesoscutum anterior end narrowly, posterior end broadly, metascutum except yellow marking on sides and centre of propodeum, Radial cell apical half dark brown; stigma yellow; veins brown.

Head: Covered with short silvery pubescence; width in anterior view 1.25x (100:80) as long as distance between front ocellus and lower labral margin (Fig. 277), head width in dorsal view 5.3x distance between front ocellus and posterior occipital margin, bigger than mesosoma (59:48); clypeus wider than long (Fig. 277) (51:33) with long hairs on apex, pointed, upper margin slightly emarginate, with few scattered punctures; mandible with scattered punctures; supraclypeal area, interantennal space, inner orbit, ocular sinus, vertex and temple

smoothly punctate; interocular distance more on vertex than at clypeus (55:40); interocellar distance 0.58x as long as ocellocular distance and about as equal as posterior ocellus (10:10); temple distinctly narrower dorsally towards vertex (Fig. 280) and smaller than eye in profile (29:16); antennae closer from each other than eye (9:12), antenna with scape length 4.2x length of first flagellar segment; second flagellar segment 1.7x as long as first flagellar segment (7:12), second flagellar segment 1.7x as long as wide at apex (7:12) (Fig. 278), apical antennal segment wider than long (11:9); all other segments subequal.

Mesosoma: Stout; covered with small silvery pubescence; pronotum, mesonotum mesopleuron reticulately, smoothly and closely punctate; scutellum, postscutellum, metapleuron with scattered punctures; interspace between punctures more than diameter of punctures; propodeum finely striated, and posterior side with long hairs.

Metasoma: Covered with fine silvery small hairs; smoothly and reticulately punctate; metasomal petiole shorter than hind femur (36:28); second metasomal tergite slightly wider than long (46:40) (Fig. 276), second metsomal tergite 1.4x as long as and 2.4x as wide as metasomal petiole.

Etymology: Incomparable.

Distribution: INDIA: Kerala, Kozhikode.

Biology: Unknown.

Habitat: Disturbed.

Material examined: ***Holotype***: Female, INDIA: Kerala, Calicut University Campus, 6.ix.2000, T.C. Narendran. ***Paratypes***: 1 Female, INDIA: Kerala, Calicut University Campus 6.ix.2000, T.C. Narendran, 1 Female, INDIA, Kerala, Elathoor, 10.viii.2000, Sridharan.

Discussion: This new species comes closer to *Ropalidia (I.) malaisei* Van der Vecht and *Ropalidia (I.) scitula* Bingham in the key to the subgenera and species occuring in the Indian subregion by Das and Gupta (1989). However it differs from *Ropalidia (I.) malaisei* and *Ropalidia (I.) scitala* in many characters. It differs from *Ropalidia (I.) malaisei* in the following characters: (1) In *Ropalidia (I.) anupama* sp. nov. the propodeum completely and finely striated (in *Ropalidia (I.) malaisei* the propodeum only at center striated). (2) In *Ropalidia anupama* sp. nov. scutellum and postscutellum brown with yellow markings (In *Ropalidia (I.) malaisci* scutellum and postscutellum black with yellow marking). (3) In *Ropalidia anupama* sp. nov. metasomal petiole not 2x as long as wide at the swollen apical region . (In *Ropalidia (I.) malaisei* the gastral petiole 2x as long as wide at the swollen apical part). (4) *Ropalidic (I.) anupama* sp. nov. reddish brown (*Ropalidia (I.) malaisei* is black).

Ropalidia (I.) anupama sp. nov. differs from *Ropalidia scitula* Binham in the following characters: (1) In *Ropalidia (I.) anupama* sp. nov. median groove normal and distinct (In *Ropalidia (I.) scitula* the median groove wide at base and narrowed at apex. (2) In *Ropalidia (I.) anupama* sp. nov. scutellum and post scutellum brown with yellow markings (In *Ropalidia (I.) scitula* scutellum and postscutellum black with red markings). (3) In *Ropalidia (I.) anupama* sp. nov. third

antennal segment not more than 2 x as long as wide at apex (In *Ropalidia (I.) scitula* third antennal segment more than 2x as long as wide at apex). (4) *Ropalidia (I.) anupama* sp. nov. is reddish brown (*Ropalidia scitula* is black).

***Ropalidia (Icarielia) montana* Carl.**

(Fig. 281-285)

Icaria montana Carl, 1930, *Memoris due "Globe"* 49: 22 (nomen nudum).

Ropalidia (Icarielia) montana: Carl, 1934. *Rev. Suisse Zool.*, 41: 676. M F. figs. Type: ? India: Kerala: Southern slopes of Nilgiri Hills: Coonoor (Genoa) – Van der Vecht, 1962. *Zool. Verh.*, 57: 42, 70. key, distr. India: (Many loc. in Kerala, including Malabar, Nilgiri Hills: Coonoor), Anamalai Hills, South India: (Hellampathi Hills, Tenmalai) – Richards, 1978. *Aust. J. Zool. Suppl. Ser.*, 61: 59. list. – Yamane & Yamane, 1979. *Insecta Matsumurana*, 15: 32. distr. South India.

Female: Length 6.9 mm. Black, with yellow marking as follows: Clypeus except centre, supraclypeal area, interantennal space except a spot on centre, two bands towards ocular sinus, a rectngular mark at base of mandible, two marks on temple, a line below antennal scape, a broad line on pronotal carina, two large marks on scutellum and postscutellum, a narrow line along the basal margin of tegula, two marks on mesopleuron, one mark on ventral metapleuron, forecoxa in front, a mark on middle and hind coxae on sides, on apical margin of first metasomal tergite and second metasomal tergite. Mandible

apically, including teeth, antenna flagellum below and legs partially red. Wing hyaline; veins brown, and radial cell almost entirely dark brown.

Head: Covered with very fine scattered pubescence; width in anterior view1.3x (84:64) as long as distance between front ocellus and lower labral margin (Fig. 282), head width in dorsal view 4.4x distance between front ocellus and posterior occipital margin, wider than mesosoma (50:45); clypeus (Fig. 282) wider than long (20:15), upper margin of the clypeus not straight (Fig.), pointed apically, apical margin with long hairs, and with moderately scattered shallow punctures; supraclypeal area, interantennal space and area below ocularsinus, smooth; mandible, vertex and temple with superficial fine scattered punctures frons shiny, interspace between puncturs smooth; interocular distance more on vertex than at clypeus (62:20); interocellar distance 0.47x as long as ocellocular distance and 2.5x diameter of posterior ocellus; temple narrower than eye in profile (Fig. 284) (6:10); antennae slightly farther from each other than from the eye (10:12), antanna with scape length 4 x length of first flagellar segment; second flagellar segment 2.25 x as long as first flagellar segment (Fig. 285), second flagellar segment 2:2 x as long as wide at apex, last flagellomere wider than long (8:6) all other segments subequal.

Mesosoma: Covered with very fine scattered pubescence; mesoscutum shiny; metapleuron and propodeum smooth; median groove of propodeum wide the middle, pronotum, mesoscutum, scutellum, postscutellum (except apical smooth triangle area), and mesopleuron with comaparitively larger and deeper punctures; interspace between the punctures more than diameter of individual punctures; propodeum

without latral carinae; hairs on the propodeum larger towards posterior end.

Metasoma: Petiole shorter than hindfemur (22:32) and about 1.5x as long as wide (18:12); second metasomal tergite about as long as wide (38: 37); second metasomal tergite 2.1x as long as and 2.3x as wide as metasomal petiole (Fig. 281), with moderately close deep margined punctures; interspace between punctures smooth; metasoma oblique cut off at apex.

Male: Unknown.

Biology: Unknown.

Habitat: Disturbed and undisturbed.

Distribution: India: Kerala, Karnataka, Tamil Nadu.

Materials examined: ***Plesiotype***: Female. INDIA: Kerala, Palaghat, Parambikulam, 11.xii.1998, L. Kishore. ***Other materials examined:*** 1 Female, INDIA: Kerala Nilambur, 5.iii.1998, T.C. Narendran. 1. Female, INDIA: Tamilnadu, Topslip, 21.1i1995, K. Rajesh. 1 Female, INDIA: Kerala, Silent Valley. 6.xi.1995, Binoy. 1 Female, INDIA: Kerala, Muthanga, 8.v.2000, L. Kishore. 1 Female, INDIA: Kerala, Kasarkode, 26.1.1994, G. Gopi.

Discussion: This species comes close to *Ropalidia (Icarielia) flavopicta* (Smith) in the key to the subgenera and species occurring in the Indian subregion (Das and Gupta, 1989). However, it differs from *Ropalidia (Icarielia) flavopicta* in following characters: 1. In *Ropalidia (I.) monatana* with scattered and comparatively larger and distinct

punctures on frons, pronotum, mesoscutum, scutellum, postscutellum and mesopleuron (In *Ropalidia (I.) flavopicta* these areas closely and finely punctate). 2. In *Ropalidia (I.) monatana* body almost entirely shiny (In *Ropalidia flavopicta* body is dull and not shiny). 3. In *Ropalidia (I.) monatana* mesoscutum without yellow line (In *Ropalidia (I.) flavopicta* mesoscutum with yellow line). 4. In *Ropalidia (I.) monatana*, body is dark black (In *Ropalidia (I.) flavopicta* body is dull).

***Ropalidia (Icarielia) travancorica* sp. nov.**

(Fig. 286-290)

Female: length 12.8 mm; Brown, with pale yellow marking. Pale yellow marking as follows: Apical margin of clypeus, two markings at lower sides of mandible, lower sides of antennal scape, in between antennal socket and eye, anterior margin of pronotum, a marking on mesopleuron just below wing, lower margin and upper margins of scutellum and postscutellum, small markings on sides of propodeum, pale fasica on second sternite and forecoxa basally. Wings hyaline; veins brown; radial cell with apical cloud; stigma brown.

Head: Covered with short silvery pubescence; width in anterior view 1.15x (86:75) as long as distance between front ocellus and lower labral margin (Fig. 287), width in dorsal view 5.3x distance between front ocellus and posterior occipital margin, wider than mesosoma (65:53); clypeus wider than long (41:30) (Fig. 287), apical margin pointed with long hairs, lower margin emarginate, with few scattered punctures;

mandible with scattered punctures; supraclypeal area, inter antennal space, inner orbit; ocular sinus, vertex, temple with fine superficial punctures; inter space between punctures smooth, in yellow area interspace larger than the diameter of the punctures; interocular distance more on vertex than at clypeus (44:38), interocellar distance 0.7x as long as ocellocular distance and 1.25x diameter of posterior ocellus; temple distinctly narrower dorsally towards vertex (Fig. 290) and smaller than eye in profile (14:25); antennae farther from eyes than to each other (11:8), antenna with scape length 4.4x length of first flagellar segment (Fig. 289), second flagellar segment 4.2x as long as first flagellar segment; second flagellar segment 2.6x (24:8) as long as wide at apex; apical antennal segment, width and length subequal (10:10); all other segments subequal.

Mesosoma: Stout, covered with silvery pubescence, very long white hairs at posterior side of propodeum, pronotum, mesonotum and mesopleuron, closely and reticulately punctate; scutellum and postscutellum with long hairs, porpodeum with strong transverse striation almost completely.

Metasoma: Petiole longer than hind femur (45:38) and about 2.1x as long as wide (20:42) second metasomal tergite longer than wide (60:54), second metasomal tergite (Fig. 286) 1.2x as long as and 2.2x as wide as metasomal petiole; oblique cut at apex; metasomal petiole strongly swollen just after end of basal slit.

Etymology: Named after the collection locality.

Male: Unknown.

Biology: Unknown.

Habitat: Disturbed.

Distribution : INDIA, (Kerala).

Material examined: Holotype, Female, INDIA, Kerala, Trivandrum, Palayam Kotta, 3.xii.1998, Thovali.

Discussion: This new species comes closes to *Ropalidia (Icarielia) scitula* Bingham in the key to the subgenera and species occuring in the Indian subregion (Das and Gupta, 1989). However it differs from *Ropalidia (Icarielia) scitala* Bingham in the following characters: (1) In *Roplaidia (I.) travancorica* sp. nov. the second flagellar segment 2.6 x as long as wide at apex (*Ropalidia (I.) scitula* it is 2x as long as wide at apex). (2) In *Ropalidia (I.) travancorica* propodeum strongly striated in middle (In *Ropalidia (I.) scitula* it is very weakly striated. (3) In *Ropalidia (I.) travancoria* temple more than 0.5x as wide as eye in profile (In *Ropalidia (I.) scitula* it is 0.5x as wide as eye in profile). (4) *Ropalidia (I.) travancorica* sp. nov. 12.8 mm in length and Brown in colour. (*Ropalidia (I.) scitula* Bingham 7 mm in length and Black in colour).

Subfamily STENOGASTRINAE

Diagnostic characters

Body elongate; clypeus strongly convex basally, slightly depressed below middle and convex apically, its apical margin produced into a distinct point tooth; antennal sockets far apart from basal margin of clypeus; supraclypeal area very long; ocular sinus reduced; temple narrow, hidden behind; eye strongly convex; occipital carina either joining or reaching near hypostomal carina; antenna with twelve segment in female and thirteen segment in male; pronotal carina absent; pronotum without fovea; scutellum without median groove, with or without median carina; apical margin of postscutellum normal; propodeum with or without distinct median groove and striation; first metasomal segment petiolate, much longer than the rest of metasomal segments.

Distribution

India (Kerala, Tamil Nadu, Assam, Meghalaya), Burma, Thailand, Vietnam, Malaysia, Indonesia.

Biology

Unknown.

Remarks

Their social behaviour ranging from solitary to primitively social to eusocial behaviour. The stenogastrinae are primitive group of wasps

that occupy an intermediate position between solitary *Eumeninae* and social *Polistinae* and *Vespinae*. There are 3 genera in this subfamily and only one viz., *Eustenogaster* Van der Vecht and one species *E. exima eximoides* Dover & Rar) is reported from Kerala.

KEY TO THE GENERA OF STENOGASTRINAE OCCURING IN INDIAN SUBREGION

(Modified from Das & Gupta 1989)

1. Maxillary palpus with second segment more than 2x as long as third segment; hindwing with brownish narrow band on ventral margin at base; large species. India to Sulawesi .... *Eustenogaster* Van der Vecht

–– Maxillary palpus with second segment less than 2 x as long as third segment; hindwing without brownish narrow band; usually smaller species 2

2. Metasomal petiole more than 1.5 x as long as mesosoma; occipital carina meeting hypostomal carina; second metasomal segment petiolate at base; mouth parts short, extended slightly beyond tip of clypeus; antenna strongly swollen beyond seventh segment. India to Sulawesi ..... *Parischnogaster* Schulthess

–– Metasomal petiole about 1.5x as long as mesosoma occipital carina not meeting hypostomal carina; second metasomal segment not petiolate at base; mouth parts long, extended far beyond tip of clypeus; antennal gradually swollen apically. Burma and Thailand to Sulawesi and Java ..... *Liostenogaster* Van der Vecht

Genus *EUSTENOGASTER* Van der Vecht

Eustenogaster Van der Vecht, 1969. *Nature & Life in S.E.* Asia, 6: 165.

Type-species: *Ischnogaster micans*, 1852; original designation.

Diagnostic characters

Large sized insects, 13.0-18.0 mm long; body covered with small to moderately large hairs; head usually wider than high and also wider than mesosoma; clypeus moderately convex, usually impunctate, covered with dense silvery pubescence; mandible long; occipital carina joining hypostomal carina; antenna moderately clavate, gradually swollen apically, last segment almost pointed at apex; propodeum with median groove, smooth; propodeal valvula well developed; gastral petiole 1.3x as long as mesosoma, not swollen at spiracle; second metasomal segment not petiolate at base.

Distribution

India (Kerala, Tamil Nadu), Thailand, Burma, Malaysia, Indonesia.

Biology

Unknown.

Remarks

This is a comparatively large genus restricted to Oriental region, very few recorded from India.

KEY TO THE SPECIES AND SUBSPECIES OF GENUS *EUSTENOGASTER* VAN DER VECHT OCCURING IN THE INDIAN SUBREGION

(Modified from Das & Gupta 1989)

1. Antenna with last segment of male about 1.5x as long as wide at base; propodeum with large yellow mark on each side; metasoma widest at both second and third segment; male subgenital plate about 1.5x as long as wide at base 2

-- Antenna with last segment about as long as wide at base; propodeum usually entirely black; metasoma widest at second segment only; male subgenital plate slightly longer than wide at base (37:34) India ..... *E. scitula* (Bingham)

2. In males, clypeus not continuous with inner eye margin supraclypeal area with a large central black mark; propodeum with an inverted "T" shaped mark on each side. India, Burma, Kalimantan .....*E. hauxwellii* (Bingham)

-- In males, clypeus continuous with inner eye margin; supraclypeal area entirely yellow. India, Sri Lanka, Malaya, Thailand .... *E. eximia* (Bingham).. (a)

(a) Metasomal petiole uniformily red; second metasomal tergite red with two yellow marks; yellow marks on side of propodeum; yellow mark on mesepisterum above dorsal episternal groove comparatively smaller; yellow apical band on pronotum

comparatively narrower. Sri Lanka, Thailand, Malaya .....
..... *E. eximia eximia* (Bingham)

(b) Metasomal petiole not uniformly red; second metasomal tergite yellow at base; yellow mark on propodeum not as above mentioned; mark on mesepisternum above dorsal episternal groove comparatively bigger; pronotum with comparatively broad apical yellow band. India (Kerala) and Tamil Nadu) ..... *eximia eximioides* (Dover & Rao)

Eustenogaster eximia eximioides (Dover & Rao)

Stenogaster eximioides (Dover & Rao), 1922. *J. Asiat. Soc.* Bengal, 18: 242. M. des., distr. Lectotype (hereby selected); M, India. Tamil Nadu: Nilgiri Hills: Nadgani (Calcutta) India: Kerala: Cochin Das & Gupta, 1983.

Paravespa eva Bell, 1936. *J. Bombay Nat. Hist. Soc.*, 38: 803. M F, key, des., fig. Types. M F, India: Maharashtra: Bombay, Kanara Dist. (London). *New Syn.*

Eustenogaster eximioides: Iwata, 1976. *Evolution of Instinct: Comp. Ethol Hymenoptera*, p. 275. biol.

Male: Length: 15 mm. Black with yellow and reddish brown markings. Yellow marking as follows: Clypeus, supraclypeal area, interantennal space, ocular sinus entirely, apical margin of pronotum broadly, a large semicircular mark on each side of scutellum at base, a broad band on postscutellum at base gradually narrowed at middle, two

marks on mesopleuron, a large elongated mark on each side of propodeum, femur and tibia of fore leg below only tibia of middle leg below and a line below hind coxa, a broad band dilated on sides of second metasomal tergite at base, one elongated transverse mark on each side of third to fifth metasomal tergite at base, one large irregular mark on third metasomal sternite; reddish-brown portions: antennae, metasomal petiole, legs. Wings brownish hyaline; veins brown; costal margin, radial cell and stigma brown.

Head: Wider than high (75:71) and 1.3x as wide as mesosoma; covered with short and long silvery pubescence, clypeus, supraclypeal area and interantennal space irridescent; clypeus about 1.4x - 1.7x as long as wide, basally convex but apically slightly concave, covered with short dense pubescence excepting 0.3 apical portion, laterally touching inner eye margin; mandible with inner cutting surface almost straight devoid of teeth, with moderately close superficial punctures; supraclypeal area densely and finely punctate, in between with a few scattered large punctures, specially on sides, punctures more on sides; interantennal space with a median furrow, close five punctures in between a few scattered superficial large punctures; frons and vertex up to posterior ocelli with close deep punctures and beyond posterior ocelli with a few scattered superficial punctures; pubescence long on frons and vertex and dense on sides of propodeum; last antennal segment 1.5x as long as wide at base; interocular distance slightly more at clypeus than at vertex (24: 22).

Mesosoma: Pronotum, mesopleuron, propodeum with moderately close punctures; mesoscutum with moderately close deep

punctures; scutellum, postscutellum with moderately close deep punctures; legs densely pubescent.

Metasoma: With very fine dense superficial punctures; greatest width of metasoma at second and third segments; second metasomal segment as long as wide at apex (59: 58); subgenital plate about 1.3x - 1.5x as long as wide.

Distribution: India (Kerala, Tamil Nadu).

Biology: Unknown.

Habitat: Disturbed and undisturbed.

Discussion: This subspecies can be separated from the nominal subspecies by the key given above. This subspecies were reported from Cochin, Kerala byDover & Rao (1922) and Das and Gupta (1989). Since no specimen of this species have been encountered in the present investigation, the above description is based on the redescription of the species by Das & Gupta (1989).

Subfamily VESPINAE

Diagnostic characters

Apical margin of clypeus broadly truncate or concave medially and emarginate laterally, ending in two rounded lateral lobes; mandible short and wide, folded beneath clypeus and sharply toothed; antennae with twelve segments in female and worker and thirteen segments in male; a pair of lateral carinae running from base of scutellum towards base of mesoscutum usually present; pronotal carina present or absent; mesepimeron separated from mesepisternum by a suture; forewing longitudinally folded, with three cubital cells; metasoma subsessile, first metasomal tergite with a distinct edge or rounded angle between anterior vertical and posterior horizontal face.

Distribution

India (throughout India), Nepal, Burma, Thailand, China, Malaya, Sumatra, Bhutan, Sri Lanka, Pakistan. Widely distributed in Euresia, North America.

Biology

Commonly called yellow jackets and hornets; highly evolved social wasps, nests are built of wood pulp. They have large colonies consisting of single female queen and a large number of sterile workers.

KEY TO THE GENERA OF SUBFAMILY VESPINAE OF INDIAN SUBREGION

(Modified from Das & Gupta, 1989)

1. Head small, with short vertex and narrow temple; ocelli very large; posterior ocelli much closer to eyes than each other, about as far from occiput as from eyes, hind coxa with carina incomplete; forewing with large stigma; first metasomal tergite cup shaped ... . *Provespa* Ashmead

– Head large, with long vertex (Fig.291) and broad temple; ocelli normal; interocellar distance shorter than ocellocular distance; hind coxa with a carina on its posterior surface; forewing with short (Fig. 291) stigma; first metasomal tergite truncate and abruptly sloping anteriorly 2

2. Clypeus with short hairs on its apical 0.33 only; posterior ocelli at level of center of eyes; vertex wide (Fig. 66); temple wider than eyes; pronotal carina strong; male antenna with tyloids (Fig.293); large sized, over 20 mm long ..... *Vespa* Linnaeus

– Clypeus with long hairs on its whole surface; posterior ocelli in level with hind margin of eyes; vertex not appreciably wider (Fig. 65); pronotum either without a carina or with a weak carina; male antenna without distinct tyloids; length less than 20 mm 3

3. Malar space very short shorter than width of pedicel; eye almost touching base of mandible; lower edge of mandible not straight but convex basally; occipital carina present laterally, reaching or

not reaching base of mandible; frontal carina weak or absent; male antenna with a long scape, equal to or a little shorter than third flagellar segment; without tyloids ..... *Vespula* Thomson

– Malar space long longer than maximum width of pedicel, as long as basal width of mandible; lower edge of mandible straight, not convex basally occipital carina almost entirely absent; pronotal carina present; male antenna with short scape, about 0.5 to 0.66 as long as second flagellar segment with weak tyloids .... *Dolichovespula* Ashmead

Genus VESPA Linnaeus

Vespa Linnaeus, 1758. *Systema Naturae* (10th Ed.) 1: 343. Type species: *Vespa crabro* Linnaeus, designated by Lamark, 1801.

Macrovespa Dalla Torre, 1904. *Genera Insectorum*, 19: 64. Type species: *Vespa crabro* L.; designated by Bequaert 1930.

Nyctovespa van der Vecht, 1959. *Zool. Meded.*, 36 (13): 210. syn. by Carpenter, 1987. Type species: *Vespa binghami* Buysson; original designation.

Diagnostic characters

Head large, swollen behind eyes; vertex wider; temple away from eyes; gena wider; ocelli small; ocelli situated in middle of vertex, posterior ocelli in line with centre of eyes; interocellar distance shorter than ocellocular distance; antenna of male with tyloids; occipital carina present laterally and extending to base of mandible; malar space long or short, equal to or less than maximum width of pedicel; pronotal carina present, with a pit or fovea close to its posterior edge in lower half; first metasomal segment truncate anteriorly, metasomal tergites angular.

Distribution : India (throughout India), Burma, China, Malaya, Sumatra, Pakistan, Tailand.

Biology *:* Unknown.

Remark:Widely distributed in India; Binghami group includes *Vespa binghami* which is nocturnal in habit. They are social forms.

KEY TO SPECIES OF THE GENUS VESPA LINNAEUS OCCURING IN THE INDIAN SUBREGION

(Modified from Das & Gupta 1989)

(Female and worker; antenna 12 segmented, metasoma 6 segmented; Males; antenna 13 segmented, metasoma 7 segmented)

1. Females 2

– Males 11

2. Large ocelli, ocellocular distance little shorter than interocellar distance; malar space short (extralimital) ... *V. binghami* Buysson

– Small ocelli; ocellocular distance little longer than interocellar distance; malar space long 3

3. Clypeus with a deep broad and deep apical emargination forming long lateral lobes, 2x of median lobe coarsely punctate; sixth metasomal segment yellow (Fig. 76((extralimital) .... *V. analis* Fabricius

– Clypeus emarginate apically or broadly truncate, without median lobe 4

4. Head widened strongly and produced behind eyes; temple 2x as wide as eye in profile; posterior ocelli more than 3x further from occiput than from eyes large size above 35 mm long (extralimital) ..... *V. mandarinia* Smith

– Head normal; temple at most 1.5 x as wide as eye; posterior ocelli less than 3x farther from occiput than from eye size smaller than 35 mm 5

5. Clypeus strongly punctate or lower vertical area of pronotum with clear transverse striations; head black to red; thorax black not marked with yellow; metasoma brown second tergite yellow (Fig. 295) 6

– Clypeus subpolished with scattered punctures; lower vertical area of pronotum without striations; head, thorax and gaster black to brown, with reddish or yellow area 8

6. Clypeus with hairy apical margin and bluntly triangular tooth on each side of median emargination (Fig.296); body covered with strong stiff hairs; pronotum with strong transverse striations near pronotal pit; second tergite yellow. India ..... *V. tropica* Linnaeus

– Clypeus with less hairy apical margin and broadly rounded tooth on each side of median emargination (Fig. 292); body hairs fine; striations on pronotum finer 7

7. Temple, vertex, mesocutum, scutellum, postscutellum, metapleuron and propodeum granulosely punctate (Fig. 70), pronotum without transverse striations. India (Kerala) .... *V. affinis* Linnaeus

– Temple, vertex,, mesoscutum, scutellum postscutellum, metapleuron and propodeum almost impunctate; pronotum with some striations ..... *V. moscaryana* Buysson

8. Clypeus is wide as long or a little long (Fig. 81), rather flat or elongate, with scattered moderate sized punctures, its lateral emarginations long and convergent yellow frons (Fig. 82); third tergite and fourth tergite yellow (Fig. 84) ...*V. orientalis* Linnaeus

– Clypeus wider than long, convex, not elongate lateral emarginations short finely punctate, body largely black or yellow 9

9. Clypeus almost impunctate, apical emargintions without lateral lobes (Fig. 75); middle tibia with long hairs, hairs longer than width of tibia; metasoma largely black (Fig. 78); postscutellum brown (Fig. 79); body hairs yellowish brown (extralimital) .... *V. basalis* Smith

– Clypeus punctate, apical emarginations with lateral lobes; middle tibia with fewer long hairs; body hairs black 10

10. Metasoma almost yellow (Fig. 67); vertex, frons and mesoscutum with less dense hairs; metasoma densely covered with erect hairs; mesocutum black ..... *V. bicolor* Fabricius

– Metasoma almost black (Fig. 77); vertex, frons and mesoscatum with dense long hairs; metasoma with fine hairs; mesoscutum partly orange-yellow .....*V. velutina* Lepeletier

11. Ocelli large; antenna without tyloids; thirteenth segment lunger than twelveth segment and curved; ocellocular distance about equal to interocellar distance; apical metasomal segments without incisions or emarginations ..... *V. binghami* Buyssom

– Ocelli small; antenna with tyloids; thirteenth segment not longer and not curved; ocellocular distance longer than interocellar distance; apical metasomal segments of male emarginate apically (Fig. 80) 12

12. Head large and swollen ..... *V. mandarinia* Smith

– Head normal 13

13. Clypeus not touching eyes at sides, separated from them by narrow extensions of inner orbit 14

– Clypeus touching eyes at sides 16

14. Clypeus rather coarsely punctate; fourth antennal segment with only basal tyloid; emargination of sixth metasomal sternite broad and semi-elliptical, its sides curving gradually towards sides of hind margin .. Kerala ..... *V. tropica* Linnaeus

– Clypeus finely punctate; fourth antennal segment with two tyloids; emargination of sixth metasomal sternite as wide as deep 15

15. Body (Fig. 68) yellow; vertex and mesoscutum black; junction of post scutellum and propodeum with a 'Y'-shaped black mark (extralimital) ..... *V. bicolor* Fabricius

– Body almost black; or mesoscutum (Fig. 77) partly orange-yellow (extralimital) .....*V. velutina* Lepeletier

16. Clypeus sparsely and shallowly punctate; antenna long and slender; fourth segment 2x as long as wide, without tyloids (extralimital) ..... *V. basalis* Smith

– Clypeus (Fig. 71) closely punctate; antenna short, fourth segment less than 2x as long as wide 17

17. Metapleuron strongly punctate; seventh tergite with a short sharp median apical notch (Fig. 72). India (Kerala) ... *V. affinis* Linnaeus

– Metapleuron almost impunctate; seventh tergite without any median notch (Fig. 76) 18

18. Clypeus with apical margin depressed, depression often produced medially into a groove reaching middle of clypeus; incision of sixth sternite semi-elliptical, wider than deep ..... *V. analis* Fabricius

– Clypeus with hardly depressed apical margin; incision of sixth sternite almost as deep as wide (extralimital) .... *V. mocsaryana* Buysson

KEY TO THE SUBSPECIES OF *VESPA AFFINIS* (LINNAEUS) OCCURING IN THE INDIAN SUB REGION

(Modified from Das & Gupta 1989)

1. First tergite with narrow orange-yellow striae either incomple or almost absent (Fig. 291); other tergites black or reddish brown; head black or reddish brown; mesosoma and legs black or reddish.

S. India, Sri Lanka, Burma, Lower Thailand .....
..... *affinis continentais* Bequaert

– First tergite completely orange-yellow, its base reddish-brown or black 2

2. Head black or dull reddish brown; thorax wholly black or with very faint reddish-brown marks on pronotum; legs almostly black. Indochina, Malaya, Sumatra, Java, Thailand, Burma, India .....
..... *V. affinis indoinensis* Perez

– Head almost bright reddish brown; antenna reddish-brown; mesoscutum black or marked with reddish-brown India, Burma, Sri Lanka, S. China, Taiwan, Indonesia .....
..... *V. affinis affinis* (Linnaeus)

***Vespa affinis continentalis* Bequaert**

(Fig. 291-294)

Vespa affinis continentalis Bequaert, 1936. Treubia, 15: 350. F, W. des. Type: F. India: Karnataka: Mangalore (Washington).

Male: Length 30 mm, Reddish brown with yellow and black markings. Yellow marking as follows: apex of the first tergite, second tergite almost yellow orange, wings yellowish red with brownish yellow vein. Black marking as follows: Almost of mandible, apex and base of the clypeus, dorsal sides of the antennae, anterior region of mesoscutum and its margins, median line of the propodeum, coxae, third, fourth, fifth, sixth tergite and sternite dark black.

Head: Hairy; width in anterior 0.87x (81:93) as long as distance between front ocellus and lower labral margin (Fig. 292), head width in dorsal view 5x distance between front ocellus and posterior occipital margin; about as wide as or slightly broader than (46.47) mesosoma, head, not swollen behind eyes; in profile view upper temple, 0.66x the eye width (Fig. 292); vertex posteriorly straight; malar space about 0.7x - 0.8x the length of penultimate antennal segment (4:5); interantennal shield carinated and semi-elliptical; eyes not converging below; interocellar distance 0.75x ocellocular distance; posterior ocellus 0.8x interocellar distance; clypeus wider than long (47:34) (Fig. 292), its sides touching eyes, its apical margin shallowly emarginated, lateral lobes prominent, and strongly punctate; temple and vertex moderately punctate; malar space 0.5x length of seventh antennal segment; antenna (Fig. 293) relatively shorter and slender, placed farther each other than from the eyes, with scape length 6x length of first flagellar segment; second flagellar segment 3.5x as long as first flagellar segment; second flagellar segment 1.8x (14:8) as long as wide at apex; third flagellar segment 1.4x as long as wide, with two tyloids; second flagellar segment with one tyloid; thirteenth segment not longer than twelfth and not curved; second to thirteenth segments with two tyloids each.

Mesosoma: Hairy; smoothly punctate, rather closer and coarser; no pronotal carinae on side; punctures on mesoscutum and scutellum rugulose; metapleuron densely punctate; metapleuron covered with long hairs; forefemur swollen, not flattened ventrally; first intercubitus usually straight.

Metasoma: Punctures on metasoma closer and coarser; first tergite (Fig. 291) narrowed basally; first metasomal tergite wider than long (44:25); second metasomal tergite also wider than long (53:27) and slightly wider than mesosoma (53:47); second metasomal tergite (53:44) as wide as and (47:27) (Fig. 291) as long as first metasomal tergite; seventh metasomal tergite with a short sharp median apical notch.

Female: Unknown.

Distribution: India (Karnataka, Tamilnadu), Burma, Sri Lanka, Thailand.

Biology: Unknown.

Habitat: Disturbed.

Material examined: ***Plesiotype:*** Male: INDIA: Tamil Nadu: Tirunelveli, Thara Sing.

Discussion: This subspecies comes closer to *Vespa affinis affinis* (Linnaeus) in the key to the subgenera and species occurring in the Indian subregion (Das and Gupta, 1989). However it differs from *Vespa affinis affinis* in following characters: 1. In *Vespa affinis continentalis* first tergite with narrow orange yellow stripe (In *Vespa affinis affinis* first tergite extensively orange-yellow); 2. In *Vespa affinis continentalis* mesoscutum brown with its margins black (In *Vespa affinis affinis* mesoscutum black or marked with reddish brown); 3. in *Vespa affinis continentalis* interantennal space without any markings (In *Vespa affinis affinis* interantennal space with dark patch).

KEY TO THE SUBSPECIES OF *VESPA TROPICA* (LINNAEUS) OCCURING IN THE INDIAN SUBREGION

(Modified from Das & Gupta 1989)

1. Metasoma almost orange-yellow; first tergite black or brownish-black with yellow apical band; head reddish brown; thorax black, marked with reddish-brown patches; India : Andamans .... *V. tropica eulemoides* Buysson

– Metasoma with yellow to reddish-brown stripes or patches 2

2. First metasomal tergite black, rarely with a small yellowish spots or narrow border; second tergite and sternite mostly or wholly orange or orange yellow; wings dark 3

– First metasomal tergite almost marked with orange-yellow; second tergite bicolored, mostly reddish-brown with a broad apical yellow band, rarely with a black line in between; wings rather uniformly yellowish-brown, darker basally and along costa. China, Indochina, Thailand, Sikkim ..... *V. tropica ducalis* Smith

3. Head and antennae dark red or reddish-brown; pronotum and scutellum usually more or less reddish or reddish brown. India (Kerala), Nepal, Burma, Sri Lanka, China ....*V. tropica haematodes* Bequaert

– Head, antennae and thorax wholly to almost wholly black 4

4. Orange band on second sternite deeply emarginate basally, dark basal area extending to or beyond the middle of sternite, band

often divided in the middle by a black line; infuscated area at base of wing relatively small; first discoidal cell almost entirely yellow Java, India ..... *V. tropica tropica* Linnaeus

– Second sternite more extensively orange, the dark area at base not reaching middle of segment; wings more extensively infuscated; first discoidal cell almost entirely infuscated. India, Burma, Thailand, Indochina, Malaysia, Sumathra ....*V. tropica leafmansi* Van der Vecht

Vespa tropica haematodes **Bequaert**

(Fig. 295-299)

Vespas tropica var. *haematodes*, 1936. Treubia, 15: 338. M, F, W. Key, des. Type: F, India: Himachal Pradesh: Kulu (CAMBRIDGE, MASS.). Localities in Burma, China, India, Pakistan, Sri Lanka.

Vespa (V.) tropica haematodes: van der Vecht, 1959. *Zool. Meded.*, 36(13): 223. des., tax., distr. Prev. loc. records + BVurma: (Carin Cheba, Tenasserim); India: Eastern Himalaya, Karnataka (Bangalore), Tamil Nadu: (Madurai, Pondicherry), West Bengal (Calcutta).

Vespa tropica haematodes: Yamane, 1974. *Kontyu, Tokyo*, 42(1): 32, 33. key, tax., distr. Prev. loc. records + India (all over); Nepal: Nepal Himalaya, Kathmandu.

Vespa tropica haematodes Van der Vecht, 1979. *Ent. Berichten* 39: 29.
M, F. W. des Nepal.

Female: Length 35 mm. Black with reddish brown and yellow markings. Reddish brown marking as follows: head, antenna, pronotum dorsally, anteriorly mesoscutum with two reddish line, scutellum and legs partly reddish black. Yellow marking as follows: second tergite and sternite almost entirely, sometimes apex of first tergite narrowly yellow; wings yellowish brown and veins dark brown at base and yellowish at apex.

Head: Width in anterior view 1.08x (79:73) as long as distance between front ocellus and lower labral margin (Fig. 298); head width in dorsal view 3.4x distance between front ocellus and posterior occipital margin, about as wide as or slightly narrower than (48:50) mesosoma, head moderately swollen behind eyes; in profile view upper temple 1.56x the eye width (Fig. 298); vertex posteriorly straight or very slightly emarginate; malar space equal to the length of penultimate antennal segment; basal width of mandible 3.5x (16:5) the malar space; interantennal shield semi-elliptical, its sides more or less carinate; eyes not converging below; ocelli placed close together; interocellar distance 0.34x the ocellocular distance; clypeus about as wide as long (38:35), coarsely punctate towards apex, apical margin hairy with a broad emargination, its apicolateral angles triangular and some what bent upwards; vertex moderately deep punctate; antennae placed farther each other than from the eyes; antennae with scape length 6x length of first flagellar segment; flagellar segment 4x as long as first flagellar segment; second flagellar segment 3x (21:7) (Fig. 297) as long as wide at

apex; last flagellar segment about as long as wide and all other segments subequal.

Mesosoma: With moderately deep and rather sparse punctures; space between punctures more than the diameter of punctures; lower vertical area of pronotum with strong transverse ridges near pronotal pit; mesonotum, scutellum, postscutellum hairy; fore femur swollen, conspicuously flattened or slightly excavated beneath ridged; post scutellum angled; propodeum shiny without striations.

Metasoma: With sparse punctures; first tergite not or very slightly narrowed basally, first metasomal tergite wider than long (44:30); second metasomal tegite also wider than long (46:40) and slightly narrower than mesosoma; second metasomal tergite (44:46) as wide as and (44:30) (Fig. 296) as long as first metasomal tergite.

Male: Unknown.

Distribution: INDIA: West Bengal: Calcutta, Sikkim, Bihar, Himachal Pradesh; Hariyana, Karnataka: Bangalore; Tamilnadu: Akagas Kovil (Madura), Dohavur, Pondicherry; Kerala: Calicut, Trivandrum, Kottayam, Kasarkode, Kannur, Calicut, Malappuram, Idukki.

Biology: Unknown.

Habitat: Disturbed.

Material examined: ***Plesiotype:*** Female: INDIA: Kerala, Calicut, 26-V-1999. L. Kishore. 3 Females: ***Other material examined***: INDIA: Kerla, Trichur, Usha K. 1 Female. INDIA, Kerala, Palayam

Kottam, Trivandrum, 7-VI-98, 3 Females: INDIA, Kerala, Kasarkode, 7-VII-1997. Gopi. 1 Female: INDIA: Kerala, Calicut University Campus, 2-V-1999, Jobiraj (All specimens at DZCU).

Discussion: This subspecies comes closer to *Vespa tropica tropica* (Linnaeus) in the key to the subgenera and species occurring in the Indian subregion (Das and Gupta, 1989). However it differs from *Vespa tropica tropica* in following characters: 1. In *Vespa tropica haematodes* Bequart head and antennae mostly dark red or reddish brown (In *Vespa tropica tropica* head and antennae almost wholly black or reddish). 2. In *Vespa tropica haemotodes* pronotum and scutellum reddish brown (in *Vespa tropica tropica* pronotum and scutellum black. 3. In *Vespa tropica haematodes* yellow or orange yellow colour on second tergite entire (In *Vespa tropica tropica* the second tergite with basally emarginated orange band).

Vespa tropica tropica Linnaeus

(Fig. 300-303)

Spex tropica Linnaeus, 1758. *Systema Naturae*, 10th ed., 1: 571. F. des. Type: F, "in Indiis" (UPPSALA).

Vespa cineta Fabricius, 1775. *Systema Entomologiae*, p.362 India: Malabar (Not of DeGeer, 1773 or Dururu, 1775) misdet.

Vespa tenebrionis Christ, 1791. *Naturg. d. Insect.*, p.216. fig. Type: ? syn. by Dalla Torre, 1904.

Vespa unifasciata Oliver, 1791. *Encycl. Method. Insect.*, 6: 677. Type: ? syn. by Dalla Torre, 1904.

Vespa tropica Schulz, 1912. *Berlin. Ent. Zeitschr.*, 57: 57. (examined type of *Sphex tropica* Linnaeus).

Vespa tropica tropica: Bequest, 1936. *Treubia*, 15: 328, Key, des., fig., Van der Vecht, 1957. 2001. Verch., 34: 5, 16, 21. Key, des., Fig. 1959. 2001. Meded., 36(13): 226.

Vespa tropica tropica: Van der Vecht, 1957. *Zool. Verh.*, 34: 5, 16, 21. key, des., figs., tax., distr. Bali; Bawean Island; Java.

Vespa (V.) tropica tropica: Van der Vecht, 1959: 226. *Bali. Java.* Sumbawa.

Female: Length 23 mm. Black with reddish brown and orange yellow markings. Reddish brown marking as follows: Head almost, antennae, clypeus except a mark on center from base to center and margins, tegula, propodial valvula, tarsi, tibia upper and lower sides, mandible black. Orange yellow markings as follows: Second tergite (except black basal triangular medin emargination, small blackish dot on each side and median black line), second sternite only on apex, first tergite on apex and rarely on apex of third segment. Eyes white. Wings margin and base dark brown, apex brownish yellow, veins yellow.

Head: Width in anterior 1.3x (85:79) as long as distance between front ocellus and lower labral margin (Fig. 301), head width in dorsal view 4.7 x distance between front ocellus and posterior occipital margin, about as wide as mesosoma (44:49), head moderately swollen behind

eyes; in profile view upper temple 1.3x eye width (Fig. 303); vertex posteriorly straight or very slightly emarginate; malar space equal to length of penultimate antennal segment; basal width of mandible 2.5 x (20.8) malar space; interantennal sheild semi-elliptical, its sides more or less carinate; eyes not converging below; ocelli placed close together; interocellar distance 0.33x ocellocular distance; clypeus wider than long (40:32) (Fig. 301), coarsely punctate towards apex, apical margin hairy with a broad emargination, its apicolateral angles triangular and somewhat bent upwards; vertex with punctae moderately deep. Antennae (Fig. 302) placed farther from each other than from eyes; antennae with scape length 5x length of first flagellar segment; second flagellar segment 4x as long as first flagellar segment; second flagellar segment 2.3x (16:7) as long as wide at apex; last flagellar segment as long as wide and all other segments subequal.

Mesosoma: With moderately deep and rather sparse punctures; space between punctures more than the diameter of punctures; lower vertical area of pronotum with strong transverse ridges near pronotal pit; mesonotum, scutellum, postscutellum hairy; forefemur swollen, conspicuously flattened or slightly excavated beneath ridged; post scutellum angled; propodeum without striations and hairy.

Metasoma: With sparse punctures; first tergite not or very slightly narrowed basally and wider than long (41:17); second metasomal tergite also wider than long (49:37) and as wide as mesosoma (49: 49) second metasomal tergite (49:41) (Fig. 300) as wide as and (27:17) as long as first metasomal tergite.

Male: Unknown.

Distribution: INDIA (Kerala: Wayanad, Muthenga, Malappuram, Manjeri), Java, Bali and some surrounding Islands).

Biology: Unknown.

Habitat: Muthenga - Undisturbed forest; Manjeri - disturbed.

Material examined: ***Plesiotype:*** Female: INDIA: Kerala, Wayanad, 1.viii.1998. L. Kishore. ***Other materials examined:*** Female. INDIA: Kerala, Malappuram, Manjeri, 6.xii.98, Fousi K.

Discussion: This subspecies comes closer to *Vespa tropica haematodes* Bequaert in the key to the subgenera and species occuring in the Indian subregion (Das and Gupta 1989). However it differs from *Vespa tropica haematodes* in following characters: 1. In *Vespa tropica tropica* pronotum and scutellum black (In *Vespa tropica haematodes* pronotum and scutellum red); 2. In *Vespa tropica tropica* the yellow colour on second tergite incomplete with basally emarginated black band (In *Vespa tropica haematodes* second tergite entirely yellow) 3 in *Vespa tropica tropica* first tergite with a apical orange yellow band (In *Vespa tropica haematodes* first tergite black) 4. In *Vespa tropica tropica* eyes white (In *Vespa tropica haematodes* eyes black). 5. In *Vespa tropica tropica* second tergite with two black spot on sides and median line (In Vespa *tropica haematodes* second tergite entirely yellow.

CHECK LIST

CHECK LIST OF GENERA AND SPECIES OF FAMILY VESPIDAE OF INDIAN SUBCONTINENT

SUBFAMILY EUMENINAE

Genus 1. ***ALLORHYNCHIUM*** **Van der Vecht, 1963.**

A. argentatum Fabricius, 1804 comb. nov. India: Kerala, Tamil Nadu.

Genus 2. ***ANCISTROCERUS*** **Wesmael, 1836.**

A. tinctipennis Walker, 1806. comb. nov. India: Kerala.

Genus 3. ***ANTEPIPONA*** **de Saussure 1855.**

1. *A. aurantiaca* Soika 1982 - India : Kerala, Tamil Nadu (Sri Lanka)
2. *A. biguttata biguttata* Fabricius 1787 - India: Kerala, Tamil Nadu (China, Vietnam, Malacca)
3. *A. bipustulata* (Saussure) 1955 - India : Kerala, Tamil Nadu, Orissa (Thailand, Malacca, Sumatra, Java)
4. *A. ceylonica* (Saussure) 1867 - India: Kerala, Tamil Nadu Karnataka, Uttar Pradesh (Sri Lanka, Burma)
5. *A. consors* Soika 1982 - India : Tamil Nadu
6. *A. exaltata* Soika 1982 - India : Tamil Nadu
7. *A. excelsa excelsa* Soika 1982 - India : Kerala (Tibet)
8. *A. excelsa malabariensis* subsp. nov. - India : Kerala.
9. *A. frontalis* Soika 1982 - India : Tamil Nadu (Sri Lanka)
10. *A. intricata* (Smith) 1857 - India : Maharashtra
11. *A. keralensis* sp. nov - India : Kerala
12. *A. malabarica* sp. nov - India : Kerala
13. *A. minutissima* Soika - India : Kerala (Sri Lanka)

14. *A. ovalis* (Saussure) 1853 - India : Kerala, Tamil Nadu, Orissa
15. *A. pruthii* Soika 1982 - India : Punjab, Bengal, Kashmir
16. *A. sibilans* (Cameron) 1903 - India : Kerala, Tamil Nadu, Pondichery, Chattisgarh, Maharashtra.
17. *A. sasidharani* sp. nov - India : Kerala
18. *A. tytides* (Cameron) 1904 - India : Sikkim, Assam, Manipur (Nepal)

Genus 4. *ANTERHYNCHIUM* Saussure 1863

1. *A. flavomarginatum* Smith 1852 comb. nov. India: Kerala, Sikkim, Jammu & Kashmir (China).

Genus 5. *ANTODYNERUS* Saussure 1855

1. *A. punctatipennis* Saussure 1852. comb. nov. - India : Kerala, Sikkim, Maharashtra.
2. *A. ornatus* comb. nov. Smith 1852 comb. nov. - India : Kerala, Maharashtra.

Genus 6. *DELTA* Saussure 1855

1. *D. arcuata* (Fabricius) 1793 comb. nov. – India: (Throughout India).
2. *D. conoides* Gmelin 1790 comb. nov - India: (Throughout India) (Burma, Sri Lanka, China)
3. *D. esuriens* Fabricius 1787. comb. nov. - India : (Throughout India) (Burma)
4. *D. petiolata* Fabricius 1793. comb. nov - India : (Throughout India) (Burma) Sri Lanka, Malaysia)

Genus 7. *EUMENES* Latreille 1802

1. *E. architectus* Smith 1859 - India: Kerala (Burma)

2. *E. edwardsii* Saussure 1852 - India: Kerala Maharashtra (Burma)
3. *E. punctata* Saussure 1852 - India: Sikkim (Burma)

Genus 8. ***LABUS*** Saussure 1857

1. *L. humbertianus* Saussure 1857 - India, Kerala (Srilanka, Burma)

Genus 9. ***ODYNERUS*** Latreille, 1802

1. *O. miniatus* Saussure 1852 - India: Kerala.

Genus 10. ORANCISTROCERUS Van der Vecht 1963

1. *O. sichelii* Saussure 1852 comb. nov - India: Kerala, Sikkim (Burma)

Genus 11. ***PARALEPTOMENES*** Giordani Soika, 1970

1. *P.* sp. indet. – India: Kerala.

Genus 12. ***RHYNCHIUM*** Spinola 1806

1. *R. brunneum brunneum* Fabricius 1793 - India: Kerala, Tamil Nadu, W. Bengal. [Bangladesh, Burma, Thailand, Vietnam].
2. *R. carnaticum* Fabricius 1798 - India: Kerala, Pondicherry, Tamil Nadu.

Genus 13. ***XENORHYNCHIUM*** Van der Vecht 1963

1. *X. abdominale* Illiger 1807 comb. nov - India: (Throughout India) (Burma)

SUBFAMILY : POLISTINAE

Genus 1. ***BELONOGASTER*** **Saussure 1853**

1. *B. indica* (Saussure) 1853 - India : Maharashtra
2. *B. juncea juncea* (Fabricius) 1781 - India; Rajastan (Africa, Saudi Arabia)

Genus 2. ***PARAPOLYBIA*** Saussure 1853

1. *P. indica indica* (Saussure) 1853 - India - Assam, Meghalaya (Burma Indonesia, China, Korea, Japan)
2. *P. indica fulvinerva* (Cameron) 1900 India: Meghalaya
3. *P. indica tinctipennis* (Cameron) 1900 - India : Assam, Meghalaya
4. *P. nodosa* Van der Vecht 1966 - India - Haryana, Delhi, Meghalaya (Nepal, Burma, Taiwan, Thailand, China)
5. *P. variata* (Fabricius) 1787 - India: Himachal Pradesh, Punjab, Delhi, Uttar Pradesh, Sikkim, West Bengal, Assam, Meghalaya, Manipur (Nepal, Burma, Lud Island, Philippines, Malaysia, Indonesia, China, Japan)

Genus 3. ***POLISTES*** **Latreille 1802**

1. *P. (Gyrostoma) gigas* (Kirby & Spence) 1826 - India: Sikkim (Taiwan, China)
2. *P. (Megapolistes) wattii* Cameron 1900 - India: Himachal Pradesh, Punjab, Delhi, Uttar Pradesh, West Bengal, Meghalaya, Gujarat, Orissa (Iran, China).
3. *P. (Megapolistes) rothneyi rothneyi* Cameron 1900 India: Delhi, Uttar Pradesh, West Bengal, Meghalaya (Nepal).
4. *P. (Megapolistes) rothneyi sikkimensis* Van der Vecht 1968 - India: Sikkim, Bihar, West Bengal, Assam, Meghalaya (Nepal)
5. *P. (Megapolistes) rothneyi vechti* Das & Gupta 1989 - India : Manipur (Burma)
6. *P. (Megapolistes) rothneyi krombeini* Van der Vecht 1968 - India : Uttar Pradesh, Meghalaya, Karnataka, Tamil Nadu.

7. *P. (Megapolistes) rothneyi carletoni* Van der Vedit. 1968 - India: Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh.
8. *P. (Nygmopolistes) tenebricosus sulcatus* Smith 1852 - India: Jammu & Kashmir, Uttar Pradesh, Sikkim, West Bengal, Assam, Meghalaya (Nepal, Java, China, Japan)
9. *P. (Polistella) adustus* Bingham 1897 - India: Himachal Pradesh, Delhi, Uttarpradesh, Sikkim, Meghalaya, West Bengal (Nepal)
10. *P. (Polistella) assamensis* Bingham 1897 - India: (Sikkim, Assam)
11. *P. (Polistella) ephippium* Cameron 1900 - India Meghalaya
12. *P. (Polistella) latinis* Das & Gupta 1975 - India: Andamans
13. *P. (Polistella) lepcha* Cameron 1900 - India: Haryana, Meghalaya, Manipur
14. *P. (Polistella) sagittarius* Saussure 1853 - India : Himachal Pradesh, Uttar Pradesh, Sikkim, West Bengal, Assam, Nagaland, Manipur, Tripura (Nepal, Burma, Hongkong, Thailand, Malaya, China, Greece)
15. *P. (Polistella) santoshae* Das & Gupta 1989 - India : Sikkim, Meghalaya (Nepal).
16. *P. (Polistella) similis* Das & Gupta 1989 - India: Meghalaya.
17. *P. (Polistella) stigma galatheae* Peterson 1987. India: South Nicobar Island.
18. *P. (Polistella) stigma novavaei* Saussure 1867 - India: Nicobar Island.

19. *P. (Polistella) stigma saulensis* Peterson 1987 - India : Nicobar Island
20. *P. (Polistella) stigma tamula* (Fabricius) 1798 - India : Himachal Pradesh, Delhi, Bihar, West Bengal, Maharashtra, Karnataka, Tamil Nadu, Kerala, (Sri Lanka).
21. *P. (Polistella) stigma stigma* (Fabricius) 1793 - India: Kerala (Thailand)
22. *P. (Polistella) stigma* subsp nov. - India : Kerala.
23. *P. (Polistella) strigosus atatus* Das & Gupta 1989 - India: Delhi, Uttar Pradesh, Sikkim, Bihar, West Bengal, Assam, Manipur, Tripura.
24. *P. (Stenopolistes) dethiensis* Das & Gupta 1975 India: Delhi.
25. *P. (Stenopolistes) khasianus* Cameron 1900 - India: Haryana, Meghalaya.
26. *P. (Stenopolistes) nigritarsis* Cameron 1900 - India : West Bengal, Meghalaya.

Genus 4. ***ROPALIDIA*** Guerin

1. *R. (Anthreneida) andamanensis* Das & Gupta 1989 - India: Andamans.
2. *R. (Anthreneida) artifex artifex* (Saussure) 1953 - India (Burma, Java)
3. *R. (Anthreneida) banglorica* sp. nov. - India: Karnataka.
4. *R. (Anthreneida) brevita* Das & Gupta 1989 - India: Himachal Pradesh, Delhi, Uttar Pradesh, West Bengal, Assam, Orissa, Goa, Karnataka, Kerala.
5. *R. (Anthreneida) colorata colorata* Van der Vecht - 1941 - India : Himachal Pradesh, Uttar Pradesh (Pakistan).

6. *R. (Anthreneida) colorata sordida.* Van der Vecht 1941 - India: Himachal Pradesh.
7. *R. (Anthreneida) cyathiformis* Fabricius 1804 - India: Uttar Pradesh, Bihar, Assam, Madya Pradesh, Arunachal Pradesh, Maharashtra, Karnataka (Nepal, Sri Lanka, Malaya, Sulawesi, Samba).
8. *R. (Anthreneida) fasciata* (Fabricius) 1804 - India: Uttar Pradesh, Sikkim, Arunachal Pradesh, Assam, Tripura, Maharashtra (Nepal, Burma, China, Tuykyus, Philippines, Malaya, Saranak, Sumatra, Kalinantan, Bal, Flores).
9. *R. (Anthreneida) hongkongensis juncta* Van der Vecht 1941 - India: Meghalaya, Manipur (Burma, Bangha Island, Java)
10. *R. (Anthreneida) indica* sp. nov. - India : Kerala
11. *R. (Anthreneida) jacobsoni jacobsoni* (Buysson) 1908 - India: Delhi, Uttar Pradesh, Rajastan, Maharashtra, Karnataka, Kerala, Tamil Nadu.
12. *R. (Anthreneida) jacobsoni flavoscutellata* Das & Gupta (1989) - India - Assam.
13. *R. (Anthreneida) magnanima magnanima* Van der Vecht 1941 - India: Kerala (Burma)
14. *R. (Anthreneida) marginata marginata* (Lepeletier) 1836 - India: Through out India (Pakistan, Sri Lanka)
15. *R. (Anthreneida) mathematica mathematica* (Smith) 1960 - India : Uttar Pradesh, Meghalaya, Tripura.
16. *R. (Anthreneida) nigrita* Das & Gupta 1989 India: Manipur.
17. *R. (Anthreneida) rodiatipa* sp.nov. – India: Kerala.

18. *R. (Anthreneida) rufoplagiata gravelyi* Dorev & Rev. 1922 - India: Uttarpradesh, Karnataka, Kerala (Burma, Thailand, Malaya, Sumatra)
19. *R. (Anthreneida) rufoplagiata nursei* Van der Vecht - India : Maharashtra.
20. *R. (Anthreneida) rufoplagiata rufoplagiata* (Cameron) 1905 - India (Bangla Island, Java, Sumbawa)
21. *R. (Anthreneida) rufocollaris rufocollaris* (Cameron) 1900 - India : Uttar Pradesh, Sikkim, West Bengal, Assam, Tripura (Burma, Tibet, Thailand).
22. *R. (Anthreneida) santoshae* Das & Gupta 1989 - India : Sikkim, Arunachal Pradesh, West Bengal, Meghalaya.
23. *R. (Anthreneida) spatulata* Van der Vecht 1962 - India : Kerala.
24. *R. (Anthreneida) sridharani* sp. nov. - India : Kerala
25. *R. (Anthreneida) stigma rufa* Van der Vecht 1941 - India : Assam, Meghalaya (Nepal, China).
26. *R. (Anthreneida) stigma stigma* (Smith) 1858 - India: Uttar Pradesh, Sikkim, Bihar, West Bengal, Assam, Meghalaya, Manipur, Tripura, Madhyapradesh, Orissa, Maharashtra, Kerala (Burma, Sri Lanka, Philippines, Indochina, Thailand, Malaya, Sarawak, Sumatra, Kalimantan, Java, Bali).
27. *R. (Anthreneida) sumatrae ingubris* (Smith) 1858 - India : West Bengal (Kalimantan).
28. *R. (Anthreneida) varigata varigata* (Smith) 1852 - India: Punjab, Delhi, Uttarpradesh, Bihar, West Bengal, Gujarat,

Madhyapradesh, Maharashtra, Karnataka, Tamil Nadu, (Nepal, East Indies, Malaya, China).

29. *R. (Icarielia) anupalam* sp. nov - India: Kerala.
30. *R. (Icarielia) flavopicta ornaticaps* Cameron 1857. - India : Assam, Tripura (Burma, Indochina, Thailand, Malaya).
31. *R. (Icarielia) montana* Carl 1930 - India : Kerala, Karnataka, Tamil Nadu.
32. *R. (Icarielia) scitula* Bingham 1897 - India : Sikkim, West Bengal, Meghalaya (Burma)
33. *R. (Icarielia) travencorica* sp. nov - India : Kerala
34. *R. (Paraicaria) bicolorata shiva* Das & Gupta 1989 - India : Assam, Manipur, Tripura.

SUBFAMILY : STENOGASTRINAE

Genus 1. *EUSTENOGASTER* Van der Vecht 1969

1. *E. eximia eximioides* (Dover & Rao) 1922. India: Kerala, Tamil Nadu.
2. *E. hauxmellii* (Bingham) 1894 - India: Sikkim (Burma, Thailand, Malaysia, Indonesia)
3. *B. scitula* (Bingham) 1897 - India : Sikkim, Assam, Meghalaya (Burma, Thailand)

Genus 2. *PARISCHNOGASTER* Schuthess 1914

1. *P. mellyi* (Saussure) 1852 - India: Assam, Meghalaya, Sikkim (Burma, Thailand, Vietnam, Malaya, Indonesia).

SUBFAMILY : VESPINAE

Genus 1. *DOLICHOVESPULA* Rohwer 1916

1. *D. asiatica* Archer 1930 - India : Kashmir, (Afghanistan, Western China, USSR).

2. *D. lama* Buysson 1903 - India : Uttar Pradesh, Sikkim.

Genus 2. *PROVESPA* Ashmead 1903

1. *P. anomala* (Saussure) 1853 - India : Sikkim (Burma, Malaysia, Java, Sumatra, Kalimantan, Bangkata, Batuls)
2. *P. barthelemyi* (Buysson) 1905 - India : Sikkim (Bhutan, Burma, Thailand, Laos, Cambodia)

Genus 3. *VESPA* Linnaeus 1758

1. *V. affinis affinis* (Linnaeus) 1764 - India: Tamil Nadu, West Bengal, Bihar, Maharashtra.
2. *V. affinis continentalis* Bequaert 1936 - India: Karnatala, Kerala, Tamil Nadu (Burma, Sri Lanka, Thailand).
3. *V. analis nigrans* Buysson 1903 - India : West Bengal, Assam, Meghalaya, Sikkim (Nepal, Burma, China, Mulaya).
4. *V. basalis* Smith 1852 - India: Assam, Meghalaya, Sikkim, West Bengal (Burma, Nepal, China, Sumatra)
5. *V. bicolor* Fabricius - India : Assam, West Bengal, Uttar Pradesh (Bhutan, Burma, China)
6. *V. binghami* buysson 1903 - India : West Bengal (Burma, China).
7. *V. mandarina magnifica* Smith 1852 - India: Uttar Pradesh, Himachal Pradesh, Simla, Sikkim, West - Bengal, Assam, Meghalaya (Nepal, Burma, Thailand).
8. *V. mocsaryana* Buysson 1905 - India : Meghalaya.)Burma, Malaya, Sumatra, China, Indo-China).
9. *V. orientalis* Linnaeus 1771 - India (Throughout India) (Pakistan, Egypt).

10. *V. tropica eulemoides* Buysson 1905 - India : Andaman Island.
11. *V. tropica ducalis* Smith 1852 - India: Sikkim (China, Indochina, Thailand).
12. *V. tropica haematodes* Bequaert 1936 - India: throughout India (Pakistan, Nepal, Sri Lanka, Burma, China).
13. *V. tropica tropica* Linnaeus 1958 India: Kerala (Java, Bali).
14. *V. variabilis fumida* Van der Vecht. 1959 - India: West Bengal.
15. *V. velutina auraria* Smith 1852 - India: throughout North India (Nepal, Burma).
16. *V. velutina nigrithorac* Buysson 1905 - India : West Bengal, Sikkim (Butan, China).
17. *V. velutina pruthii* Van der Vecht 1959 - India : Kashmir (Pakistan).
18. *V. vivax* Smith 1870 - India: Sikkim, Uttar Pradesh, Himachal Pradesh (Burma, Thailand, China).

Genus 4. ***VESPULA*** Thomson 1869

1. *V. austriaca* Panzer 1799 - India : Kashmir (Europe)
2. *V. germanica* Fabricius 1793 - India : Kashmir (USSR, Korea, China)
3. *V. koreansis stizoides* Buysson 1905 - India : Meghalaya (China)
4. *V. nursei* Archer 1981 - India : Kashmir, Himachal Pradesh (China, Philippines).
5. *V. orbata orbata* (Buysson) 1902 - India: West Bengal, Uttarpradesh, Mussorie Assam (Nepal, Burma)

6. *V. structor* Smith 1872 - India : Kashmir Himachal Pradesh, Uttar Pradesh (Nepal, China).
7. *V. vulgaris* Linnaeus 1758 India: Northern India (USSR, North America, Japan, Mongolia, China).

SUMMARY

SUMMARY

Family Vespidae contain six subfamilies viz., Eumeninae, Polistinae, Stenogastrinae, Vespinae, Masarinae and Eupargiinae. Among these the first mentioned two subfamilies viz., Masarinae and Eupargiinae are not included in this thesis because they do not occur in India. Remaining four subfamilies mentioned above are treated in this thesis.

Vespidae of India consists of twenty one genera and a hundred and five species. Among these seventeen genera, fifty one species and three subspecies are reported from Kerala in this thesis. Among fifty one species three are extralimital viz., *Ropalidia banglorica* sp. nov., *Ropalidia cyanthiformis* (Fabricius), *Antepipona sasidharani* sp. nov. The first two were collected from Banglore and third one from Coimbatore. The extralimital species are also included, since they have been collected from adjacent areas of Kerala state and since they are likely to occur in Kerala.

Among the fifty one species occuring in Kerala, nine are described as new to science, two described as new subspecies to science and eleven new combinations. All the known species are redescribed since their available descriptions are inadequate for easy identification. Dichotomous keys to subfamilies, genera, species and subspecies of India are also provided. An extensive review of past work done have been given. Finally a check list of Indian genera of Vespidae is also provided. The taxa studied are as follows:

Subfamilies	Genera	No. of known species	No. of known sub-species	No. of New species	No. of New sub-species	New combi-nation	Species indet
Eumeninae	*Allorhynchium*	1	0	0	0	1	0
	Ancistrocerus	1	0	0	0	0	0
	Antepipona	9	0	3	1	0	0
	Anterhynchium	1	0	0	0	1	0
	Antodynerus	2	0	0	0	2	0
	Delta	4	0	0	0	3	0
	Eumenes	3	0	0	0	0	0
	Labus	1	0	0	0	0	0
	Odynerus	1	0	0	0	0	0
	Orancistrocerus	1	0	0	0	1	0
	Paraleptomenes	0	0	0	0	0	1
	Rhynchium	2	0	0	0	0	0
	Xenorhynchium	1	0	0	0	1	0
Polistinae	*Polistes*	3	0	0	1	0	0
	Ropalidia	8	0	6	0	0	0
Steno-gastrinae	*Eustenogaster*	1	0	0	0	0	0
Vespinae	*Vespa*	2	1	0	0	0	0

Total

Family : VESPIDAE

Subfamily : Eumeninae

Genus 1 : *Allorhynchium* Van der Vecht

1. *A. argentatum* (Fabricius) comb. nov.

Genus 2 : *Ancistrocerus* Wesmael

1. *A. tinctipennis* (Walker)

Genus: 1 *Antepipona* de Saussure

1. *A. biguttata biguttata* Fabricius
2. *A. bipustulata* (Saussure)
3. *A. ceylonica* (Sassure)
4. *A. excelsa malabariensis* subsp. nov.
5. *A. frontalis* Soika
6. *A. keralensis* sp. nov
7. *A. malabarica* sp. nov
8. *A. minutissima* Soika
9. *A. ovalis* (Saussure)
10. *A. sasidharani* sp. nov.
11. *A. siamensis* Soika
12. *A. sibilans* (Cameron)

Genus 4. *Anterhynchium* Saussure

1. *A. flavomarginatum* (Smith) comb. nov.

Genus 5. *Antodynerus* Saussure

1. *A. punctatipennis* (Saussure) comb. nov.
2. *A. ornatus* (Smith) comb. nov.

Genus 6. *Delta* Saussure

1. *D. arcuata* (Fabricius) comb. nov.
2. *D. conoides* (Fabricius)
3. *D. esuriens* (Fabricius) comb. nov.
4. *D. petiolata* (Fabricius) comb. nov.

Genus 7. *Eumenes* Laterille

1. *E. architectus* Smith
2. *E. edwardsii* Saussure
3. *E. punctata* Saussure

Genus 8. *Labus* Saussure

1. *L. humbertianus* Saussure

Genus 9. *Odynerus* Latreille

1. *O. miniatus* Saussure

Genus 10. *Orancistrocerus* Van der Vecht

1. *O. sighelii* (Saussure) comb. nov.

Genus 11. *Paraleptomenes* Soika

1. *P.* sps. indet.

Genus 12. *Rhynchium* Spinola

1. *R. bruhneum bruhneum* Fabricius
2. *R. carnaticum* Fabricius

Genus 13. *Xenorhynchium* Van der Vecht

1. *X. abdominalae* (Illiger) comb. nov.

Subfamily : Polistinae

Genus 1. *Polistes* Latrelle

1. *P.* (*Polistella*) *stigma nigra* subsp. nov.
2. *P.* (*Polistella*) *stigma sauiensis* (Peterson)
3. *P.* (*Polistella*) *strigosus atratus* Das & Gupta
4. *P.* (*Stenopolites*) *nigritarsis* Cameron

Genus 2. *Ropalidia* Guerin

1. *R.* (*Anthreneida*) *banglorica* sp. nov.
2. *R.* (*Anthereneida*) *cyathiformis* Fabricius
3. *R.* (*Anthreneida*) *indica* sp. nov.
4. *R.* (*Anthreneida*) *jacobsoni jacobsoni* (Buysson)
5. *R.* (*Anthreneida*) *magnanima magnanima* van der Vecht
6. *R.* (*Anthreneida*) *marginata marginata* (Lepeletier)
7. *R.* (*Anthreneida*) *rodiatipa* sp. nov.
8. *R. (Anthreneida) rufoplagiata gravelyi* (Dover & Rao)
9. *R.* (*Anthreneida*) *spatulata* Van der Vecht
10. *R.* (*Anthreneida*) *sridharani* sp. nov.
11. *R.* (*Anthreneida*) *stigma stigma* Smith

12. *R.* (*Icarielia*) *anupama* sp. nov.
13. *R.* (*Icarielia*) *montana* Carl
14. *R.* (*Icarielia*) *travencorica* sp. nov.

SUBFAMILY : STENOGASTRINAE

Genus 1. Eustenogaster Van der Vecht

1. *E. eximia eximioides* (Dover & Rao)

SUBFAMILY : VESPINAE

Genus 1. *Vespa* Linnaeus

1. *V. affinis continentalis* Linnaeus
2. *V. tropica haemotodes* Bequert
3. *V. tropica tropica* Linnaeus

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PLATE I

Collection Localities

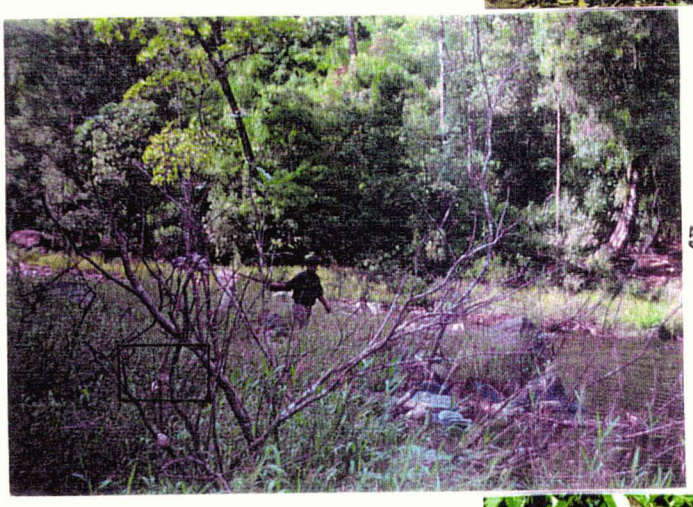
1. Sulthan Bathery

2. Munnar

3. Semideciduous forest Muthanga

PLATE II

4. Calicut University Campus



5. Parambikulam wild life sanctuary

6. Tevara, Ernakulam

7. Mangroves, Kozhikode

PLATE III

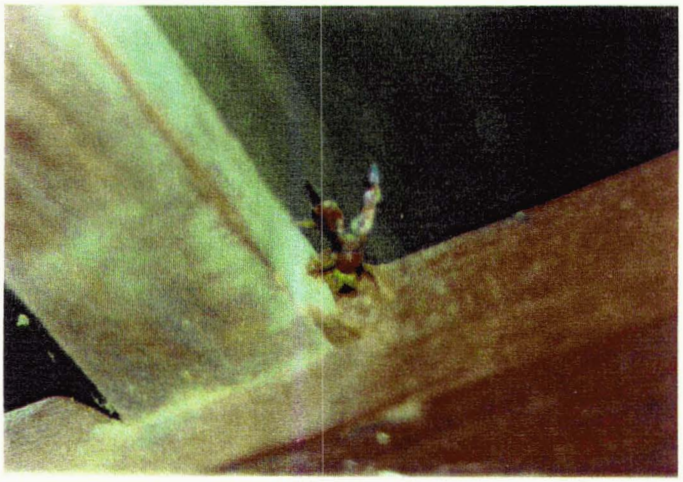
8. Evergreen forest, Silent Valley

9. Grassland, Tirunelli

10. Deciduous forest, Tunnakadavu

PLATE IV

11. *Delta conoideus* (Gmelin) constructing nest



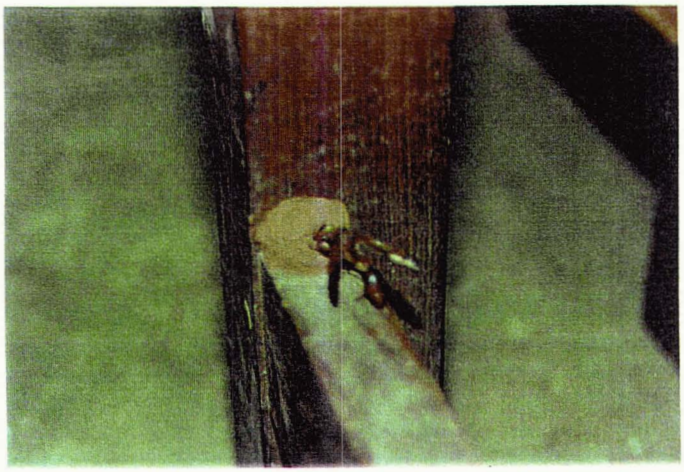
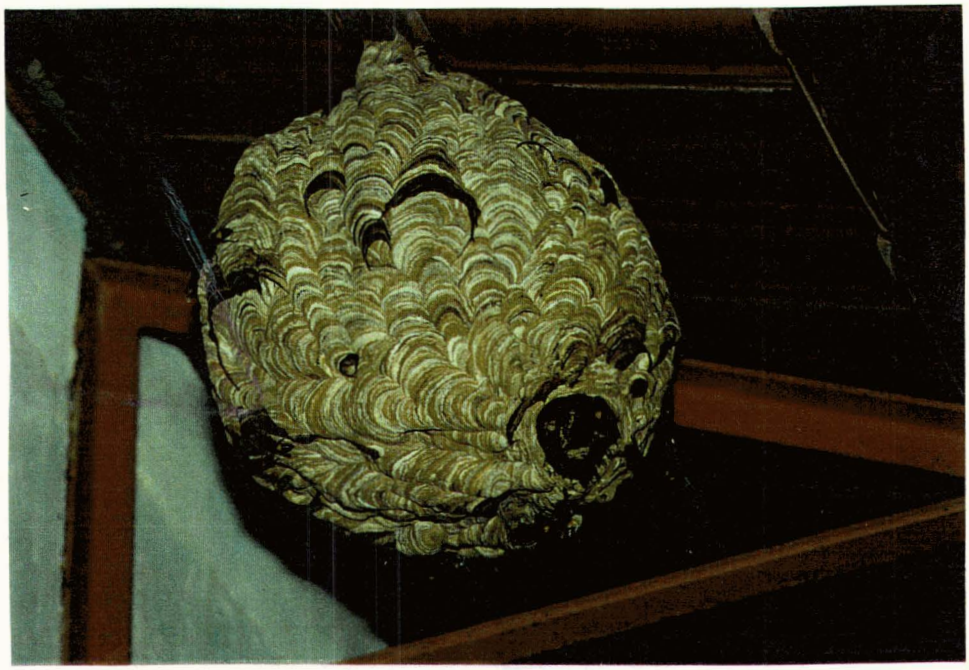


PLATE V

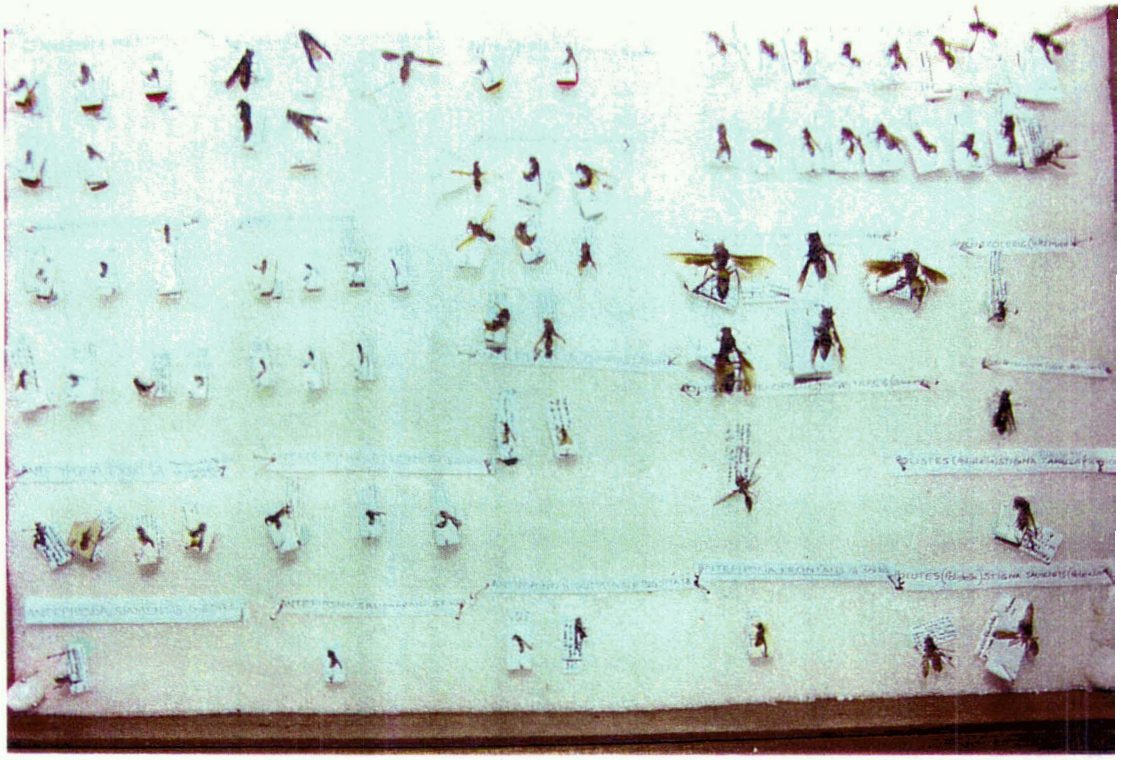
12. *Delta conoideus* (Gmelin) with its nest



13. *Vespa tropica haematodeus* Bequaert with its nest

PLATE VI

14. *Rhynchium brunneum brunneum* (Fabricius)



15. Insects arranged in box

PLATE VII

16. *Delta arcuata* (Fabricius)

17. *Delta petiolata* Fabricius

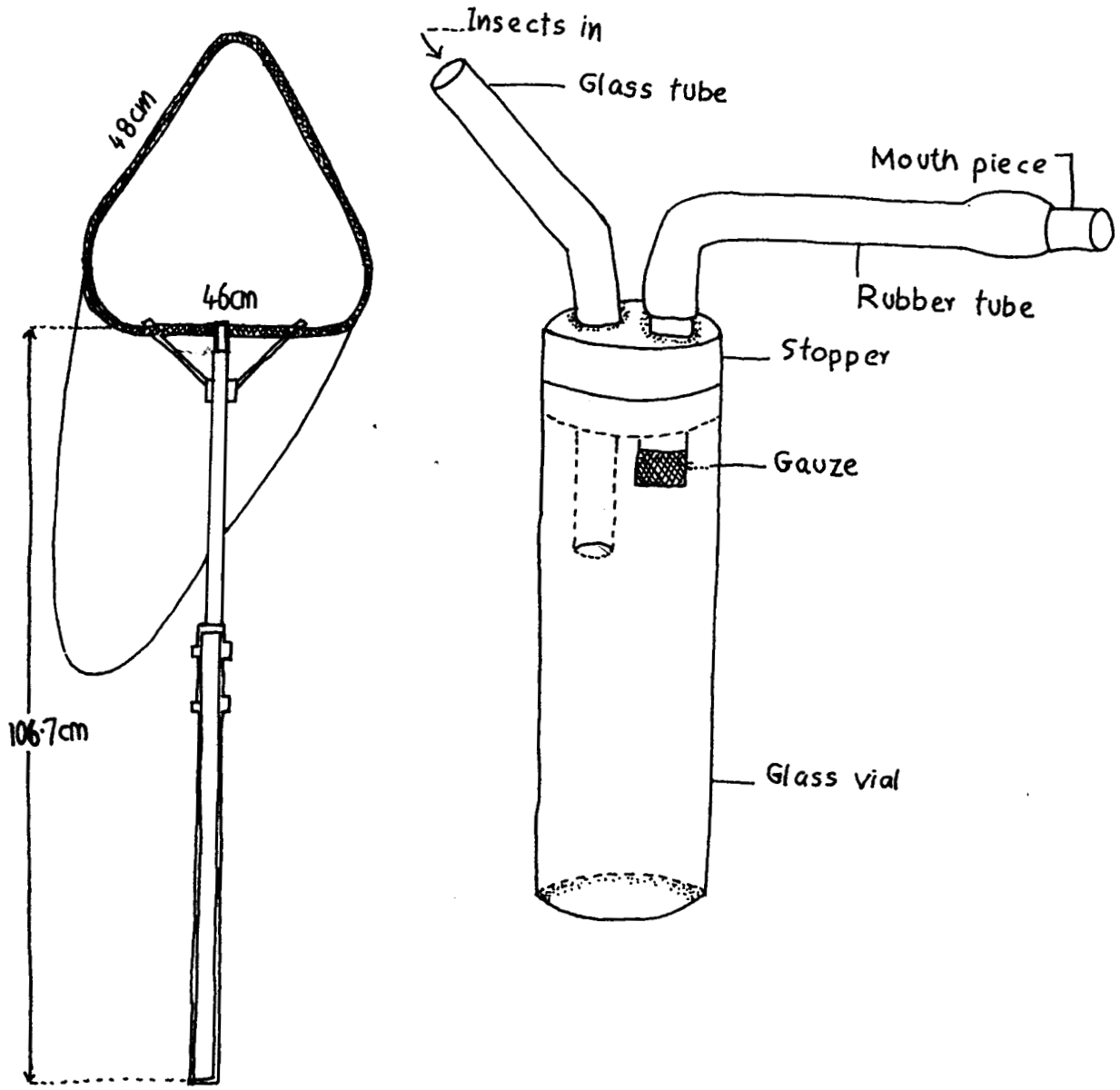


Fig. 1. Sweep net

Fig. 2. Aspirator

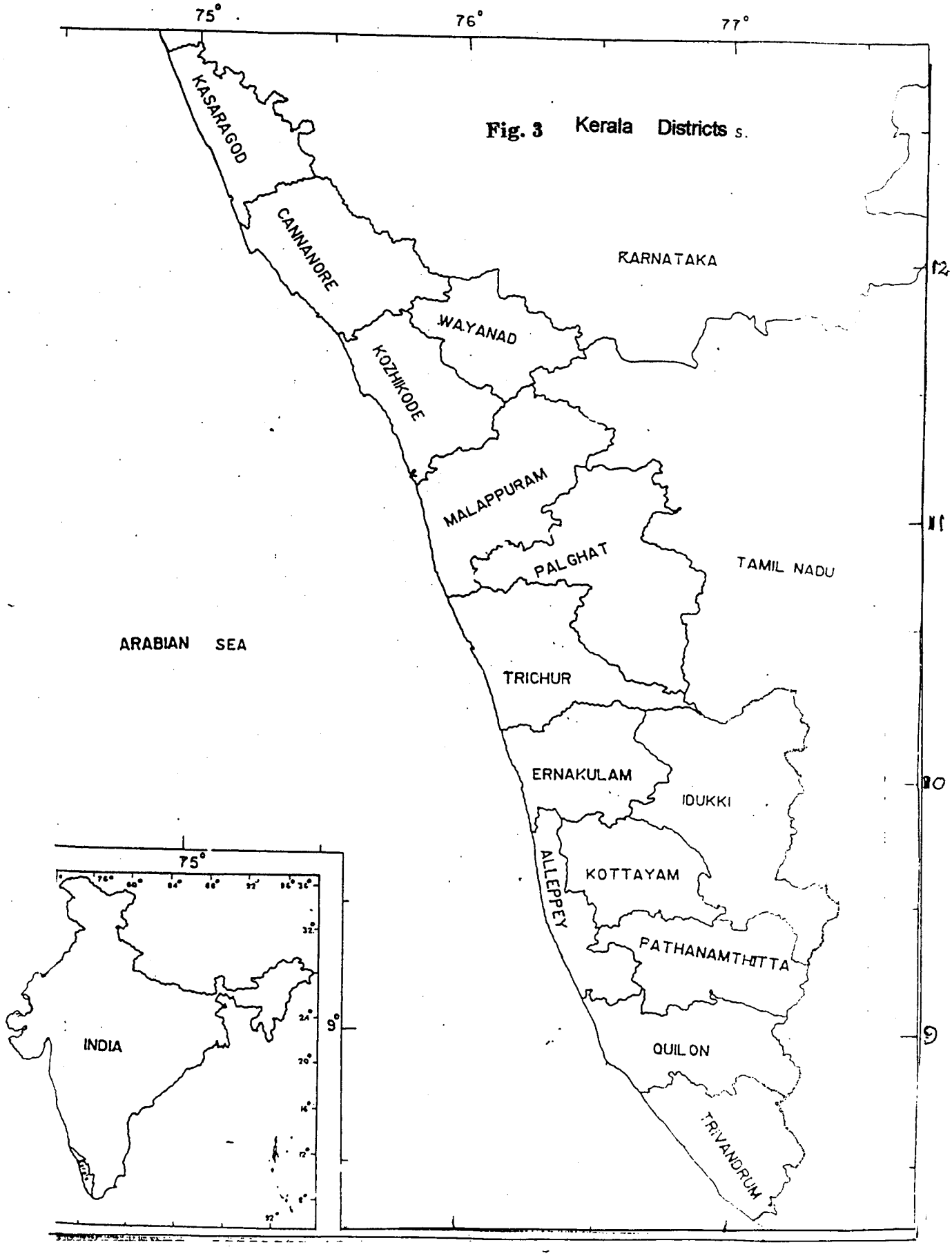


Fig. 3 Kerala Districts s.

General Diagrams

Fig. 4. **Head in Front view**

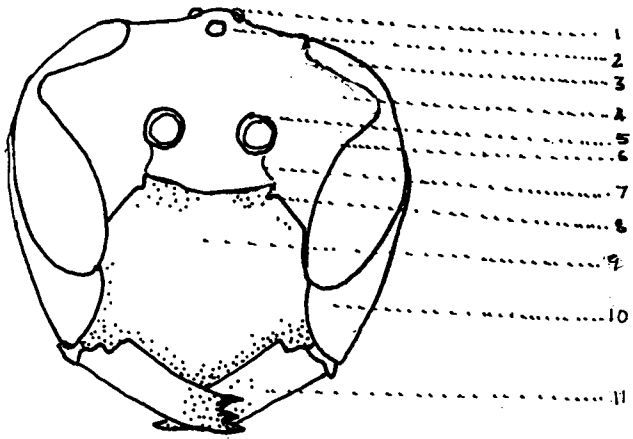
1. Posterior ocellus
2. Median ocellus
3. Frons
4. Ocular sinus
5. Antennal suture
6. Inner orbit
7. Subantennal suture
8. Anterior tentorial pit
9. Clypeus
10. Malar space
11. Mandible

Fig. 5. Head in dorsal view

1. Antenna
2. Vertex
3. Occipital carina

Fig. 6. Head in posterior view

1. Vertex
2. Occiput
3. Temple
4. Maxillary palp
5. Mandible
6. Labial palps
7. Maxilla



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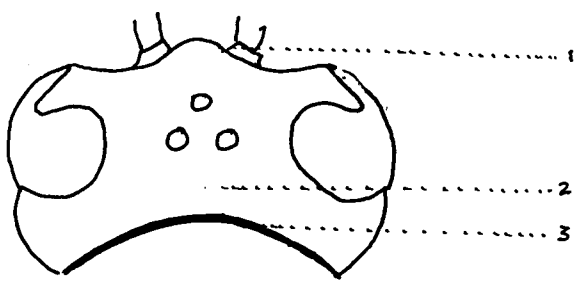

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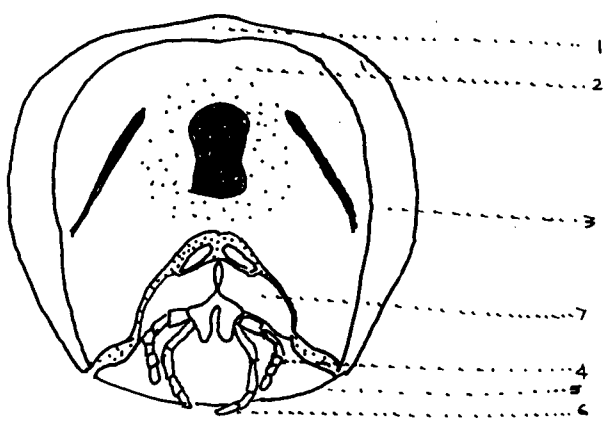

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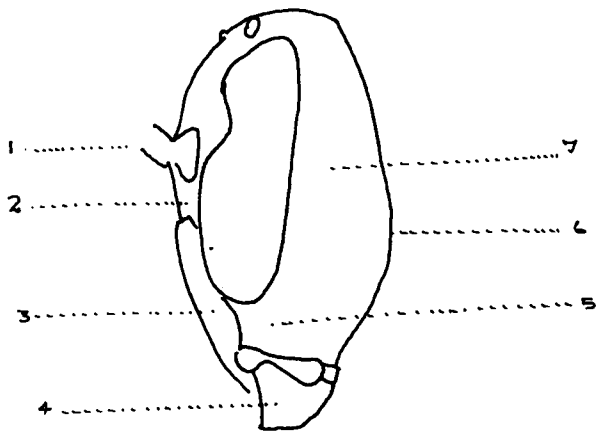
Fig. 7. Head in profile view

1. Antenna
2. Supraclypeal area
3. Clypeus
4. Mandible
5. Malar space
6. Occipital carina
7. Temple

Fig. 8. Antenna

1. Scape
2. Pedicel
3. Flagellum



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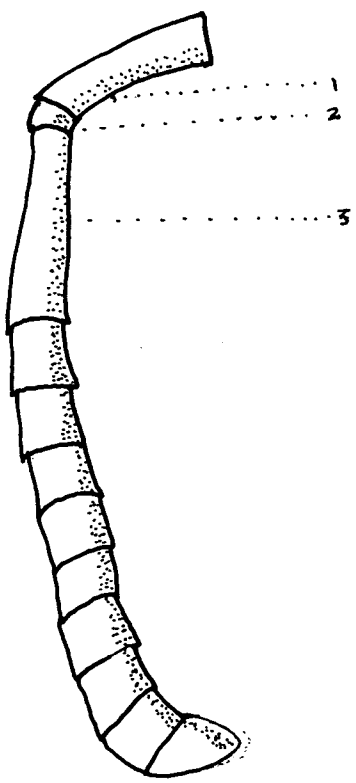

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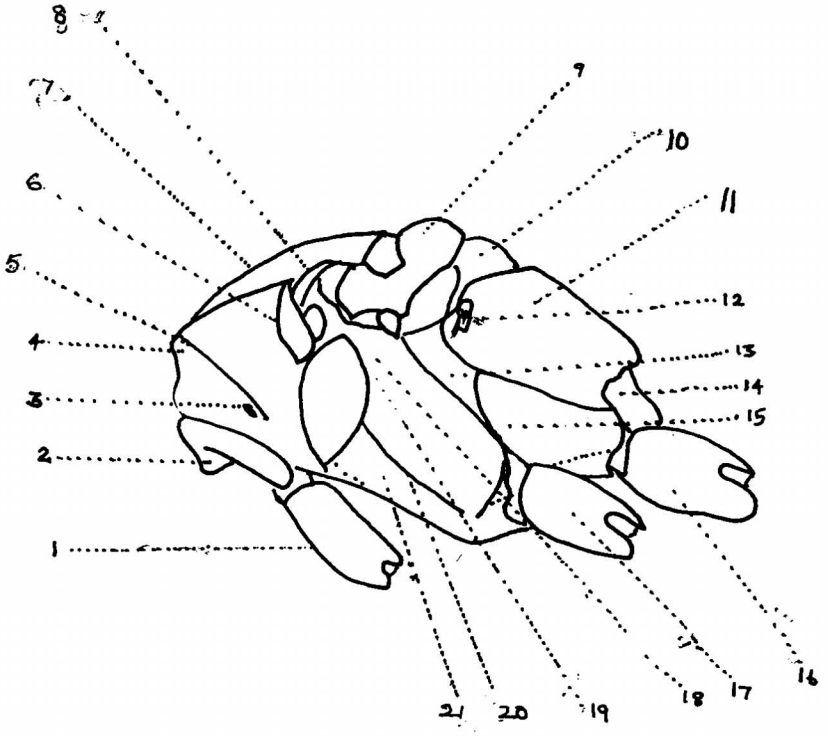
9. Mesosoma in profile view

1. Fore coxa
2. Propleuron
3. Pronotal forea
4. Pronotal ocellar
5. Pronotal carina
6. Pronotal lobe
7. Mesoscutum
8. Tegula
9. Scutellum
10. Postscutellum
11. Propodeum
12. Propodeal spiracle
13. Dorsal metapleuron
14. Propodeal valvula
15. Ventral metapleuron
16. Hind coxa
17. Mid coxa
18. Mesepisternum
19. Mesepimeron
20. Epinemial carina
21. Epinemium
22. Axilla

Fig. 10. Leg

1. Coxa
2. Trochanther
3. Femur
4. Tibia
5. Tibial spines
6. Tarsus
7. Claw
8. Arolium



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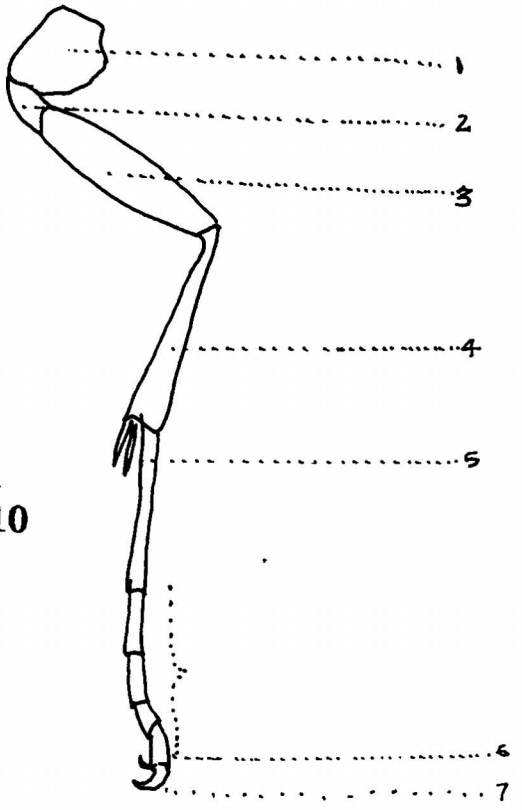

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11. Forewing

1. Median cell
2. Discoidal cell
3. Cubital cell
4. Radical cell
5. Second cubital cell
6. Third cubital cell
7. Submedian cell
8. Anal cell
9. Brachial cell
10. Second discoidal cell
11. Second brachial cell
12. Third discoidal cell

Forewing Veins:

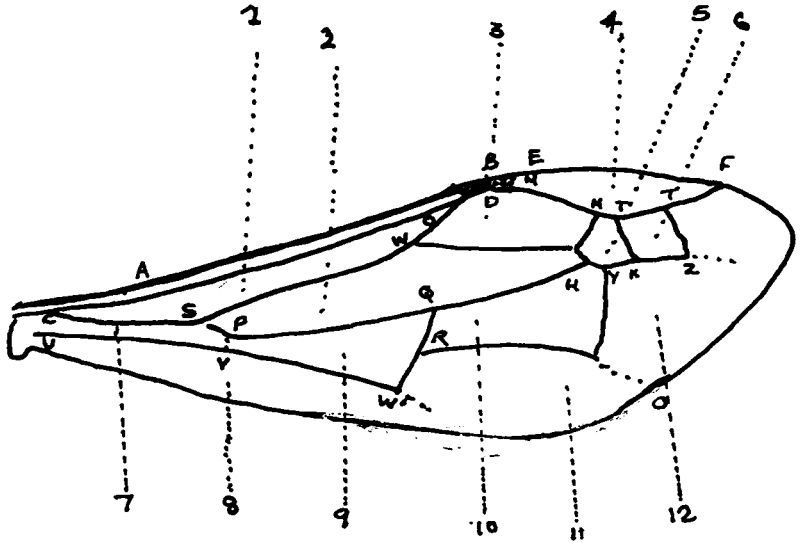
AB	:	costa
CD	:	subcosta
EFG	:	metacacarpus
WKHYXZ	:	cubitus
MNTTF	:	radius
PQRW	:	discoideus
RLO	:	subdiscoides
CS	:	medius
UV	:	submedius
VW	:	brachius
BME	:	stigma
SWD	:	brachius
KN	:	first intercubitus
XT	:	Second intercubitus
ZT	:	Third intercubitus
QH	:	First recurrent vein
YL	:	Second recurrent vein
PV	:	nervulus
QRW	:	postnervulus
MN	:	first abscissa of radius
Nt	:	second abscissa of radius

12. Hindwing

1. Mediellan cell
2. Radiellan cell
3. Cubitellan cell
4. Discoidellan cell
5. Anellan cell
6. Anal lobe

Hind wing Veins

ab	:	costella
cde	:	subcostella
ef	:	metacarpella
dgh	:	radiella
jkl	:	cubitella
mn	:	discoidella
pq	:	brachiella
ij	:	mediella
op	:	submediella
kg	:	intercubitella
dmp	:	nervellus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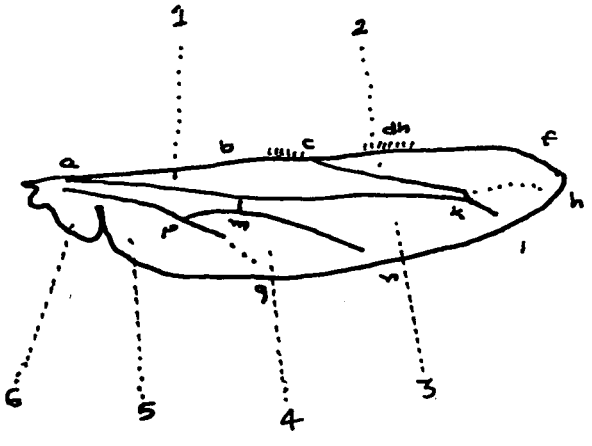
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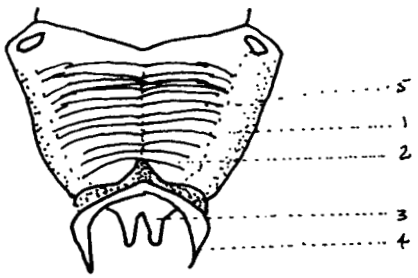


Fig. 13. Propodeum

1. Lateral edge
2. Median groove
3. Tooth
4. Valve
5. Carinae

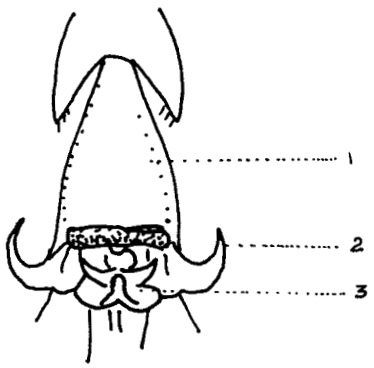


Fig. 14. Claw

1. Fifth tarsus
2. Claw
3. Arolium

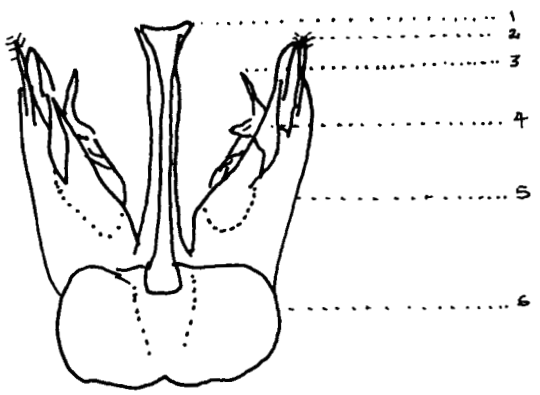


Fig. 15. Male genitalia

1. Aedeagus
2. Parameral spine
3. Digitus
4. Cuspis
5. Paramere
6. Basel wing

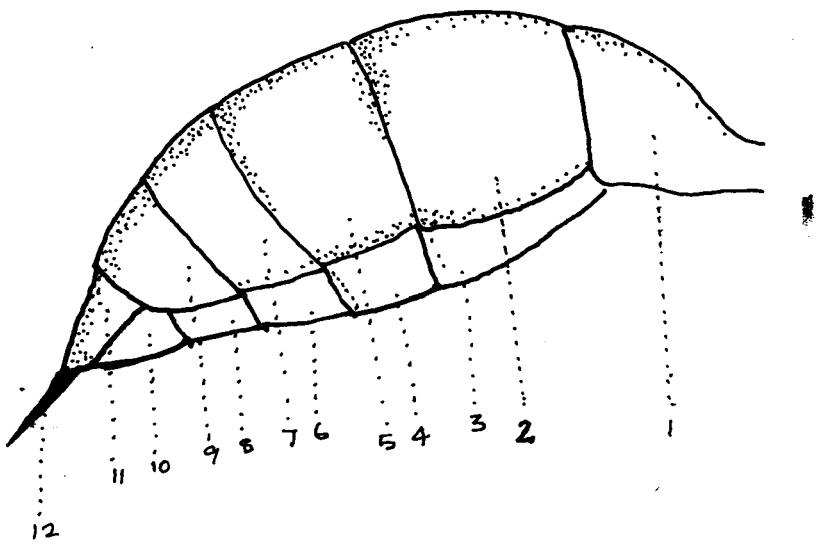
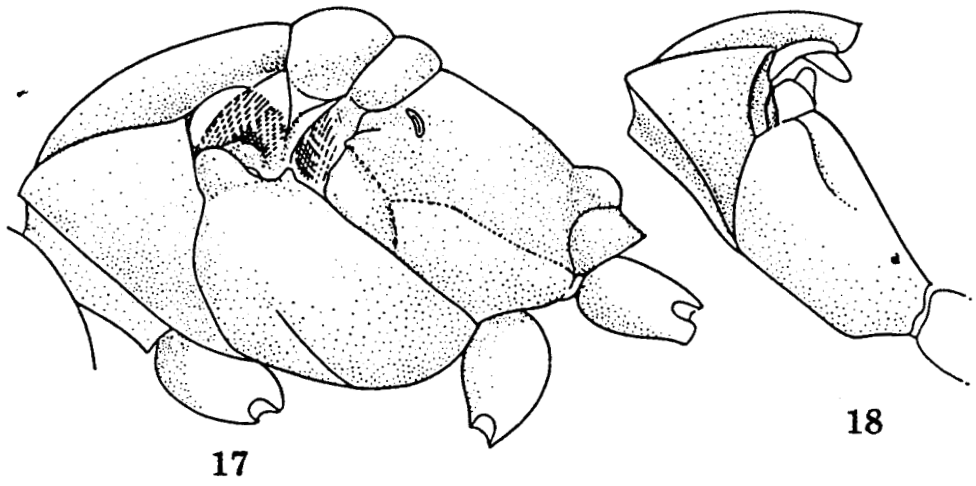


Fig. 16. Metasoma

1. Petiole
2. Second tergite
3. Second sternite
4. Third sternite
5. Third tergite
6. Fourth sternite
7. Fourth stergite
8. Fifth sternite
9. Fifth tergite
10. Sixth sternite
11. Sixth tergite
12. Ovipositor



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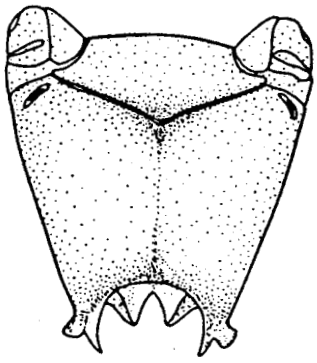

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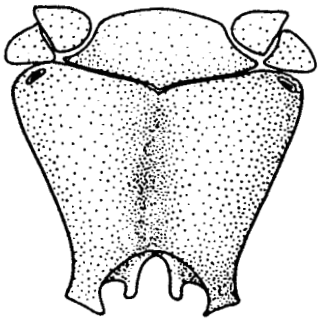

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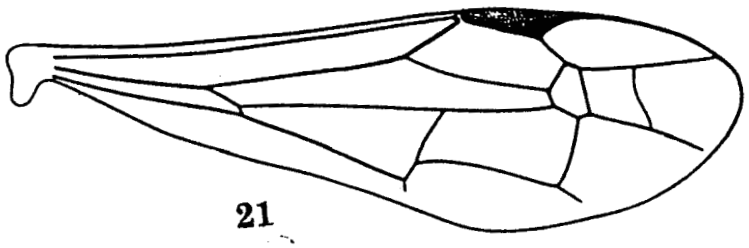

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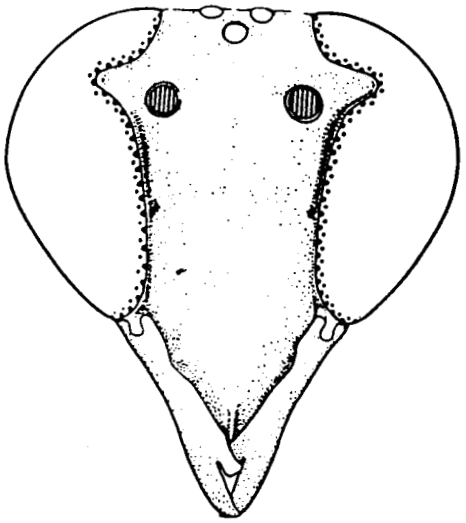
Fig. 17. Mesosoma of *Ropalidia marginata* profile.

Fig. 18. Mesosoma of *Polistes stigma* basal part, Profile

Fig. 19. Postscutellum and propodeum of *Parapolybia varigata*

Fig. 20. Postsctellum and propodeum of *Polybioides gracilis*

Fig. 21. Forewing of *Parapolybia varia*



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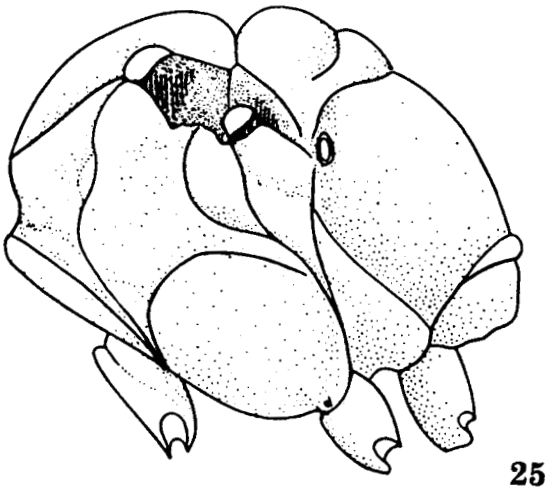

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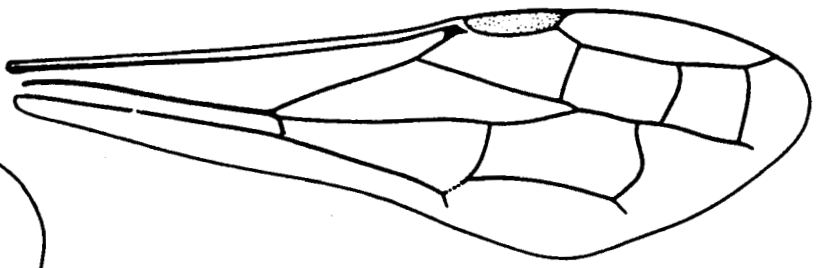

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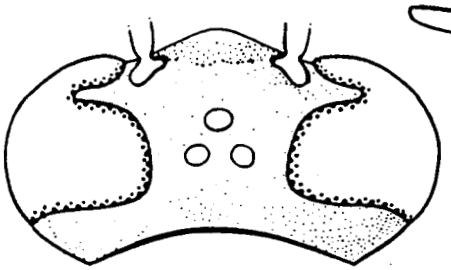

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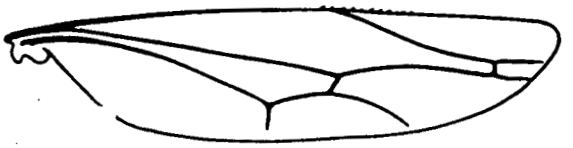

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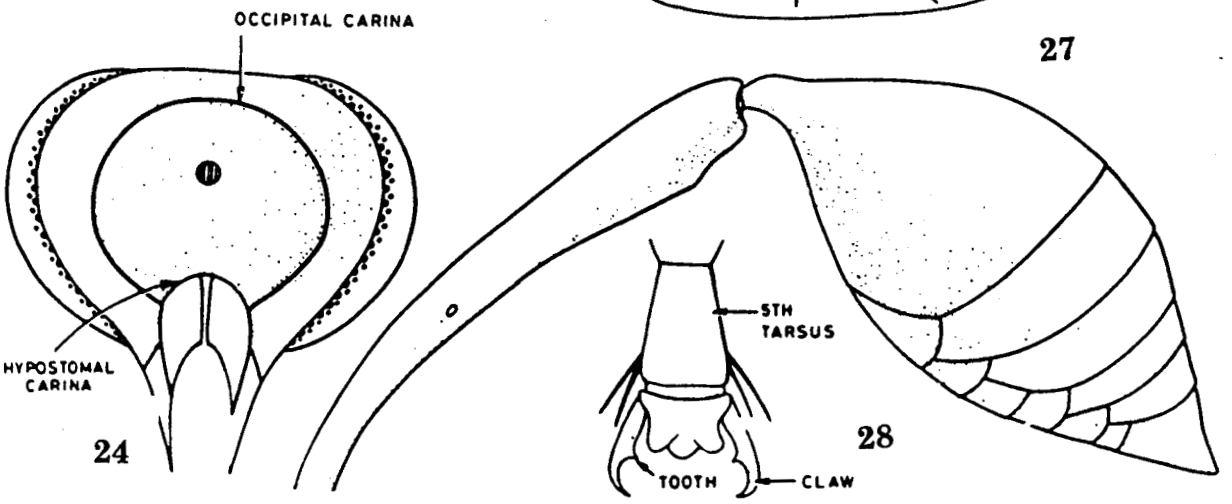

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Fig. 22. Head front view *Eustenogaster*

Fig. 23. Head dorsal view *Eustenogaster*

Fig. 24. Head posterior view *Eustenogaster*

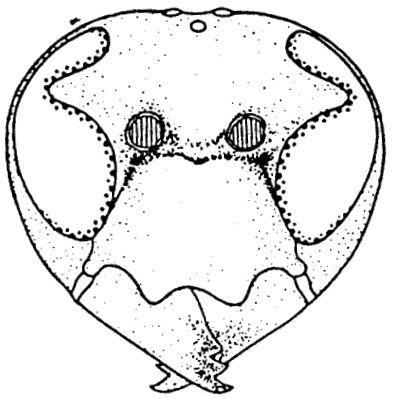
Fig. 25. Mesosoma profile *Eustenogaster*

Fig. 26. Forewig *Eustenogaster*

Fig. 27. Hindwing *Eustenogaster*

Fig. 28. Metasoma *Eustenogaster*

Fig. 29. Fifth tarsal segment *Eustenogaster*



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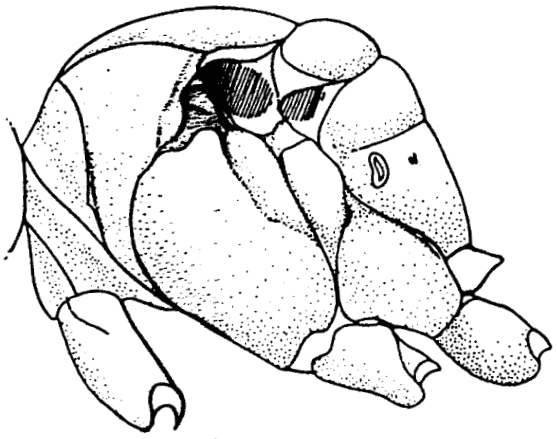

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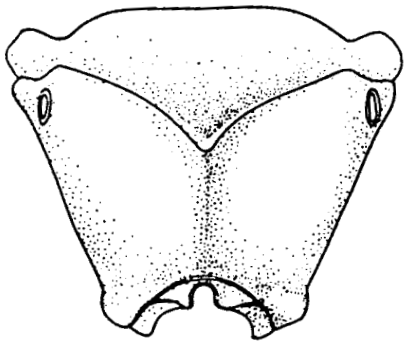

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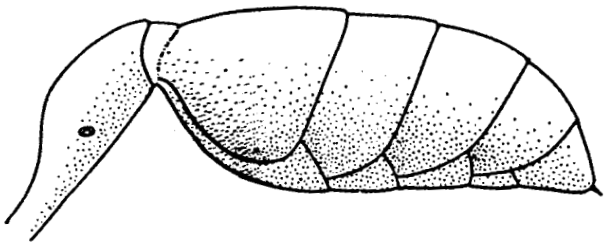

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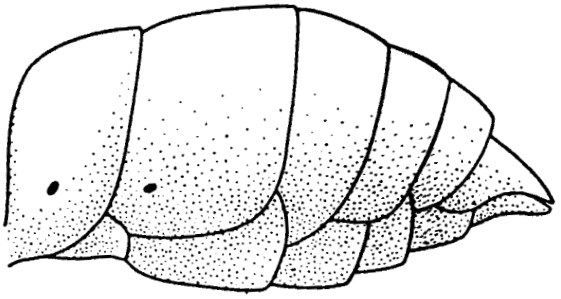

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Fig. 30. Head front view of Vespinae

Fig. 31. Mesosoma profile of Vespinae

Fig. 32. Postscutellum and propodeum of Vespinae

Fig. 33. Metasoma of Polistinae

Fig. 34. Metasoma of Vespinae

Fig. 35. Head front view *Polistes (Megapolistes)* (F)

Fig. 36. Head front view *Polistes (Megapolistes)* (M)

Fig. 37. Head front view *Polistes (Stenopolistes)* (F)

Fig. 38. Head front view *Polistes (Polistes)* (M)

Fig. 39. Mesosoma of *Polistes (Megapolistes)*

Fig. 40. First sternite of *Polistes (Megapolistes)*

Fig. 41. Male antenna of *Plistes (Polistes)*

Fig. 42. First metasomal sternite *Polistes (Polistella)*

Fig. 43. Vertex of *Polistes (Polistella)*

Fig. 44. Mesopleuron of *Polistes* (Gyrostoma)

Fig. 45. Mandible of *Polistes (Gyrostoma)*

Fig. 46. Vertex of *Polistes (Stenopolistes)*

Fig. 47. Mesopleuron *Polistes (Nymopolistes)*

Fig. 48. First metasomal tergite *Polistes (Polistella)*

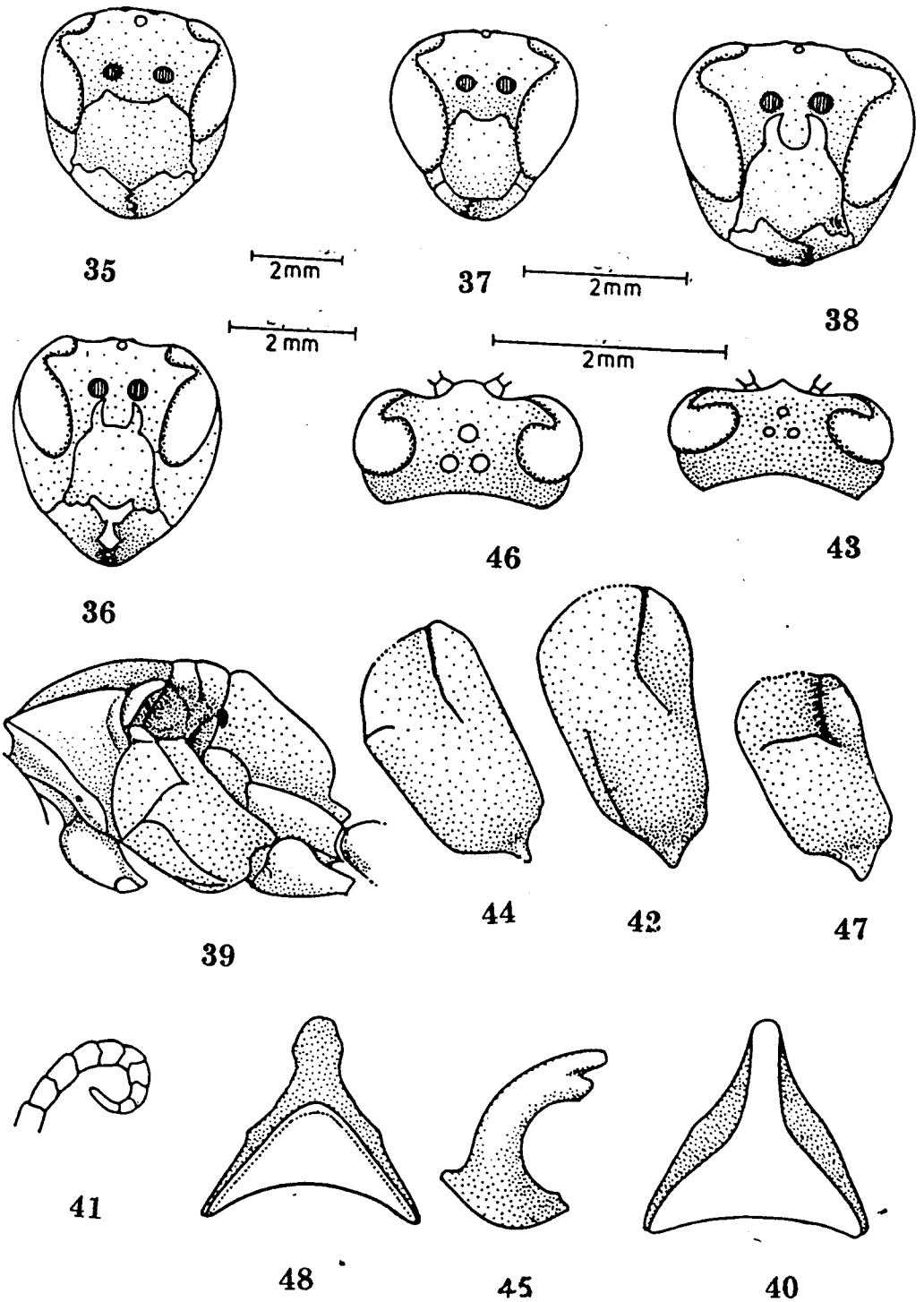
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Fig. 49. Propodeum of *Ropalidia brevita*

Fig. 50. Propodeum of *Ropalidia stigma stigma*

Fig. 51. Propodeum of *Ropalidia rufoplagiata gravelyi*

Fig. 52. Propodeum of *Ropalidia andamanensis*

Fig. 53. Propodeum of *Ropalidia variegata variegata*

Fig. 54. Propodeum of *Ropalidia bicolocrata shiva*

Fig. 55. Male genitalia of *Ropalidia magnanima anthracina*

Fig. 56. Male genitalia of *Ropalidia marginata marginata*

Fig. 57. Male genitalia of *Ropalidia spatulata*

Fig. 58. Male genitalia of *Ropalidia brevita*

Fig. 59. Male genitalia of *Ropalidia stigma stigma*

Fig. 60. Male genitalia of *Ropalidia santoshae*

Fig. 61. Male genitalia of *Ropalidia ruffocollaris ruffocollaris*

Fig. 62. Male genitalia of *Ropalidia nigrita*

Fig. 63. Male genitalia of *Ropalidia nigrita*

Fig. 64. Male genitalia of *Ropalidia jacobsoni jacobsoni*

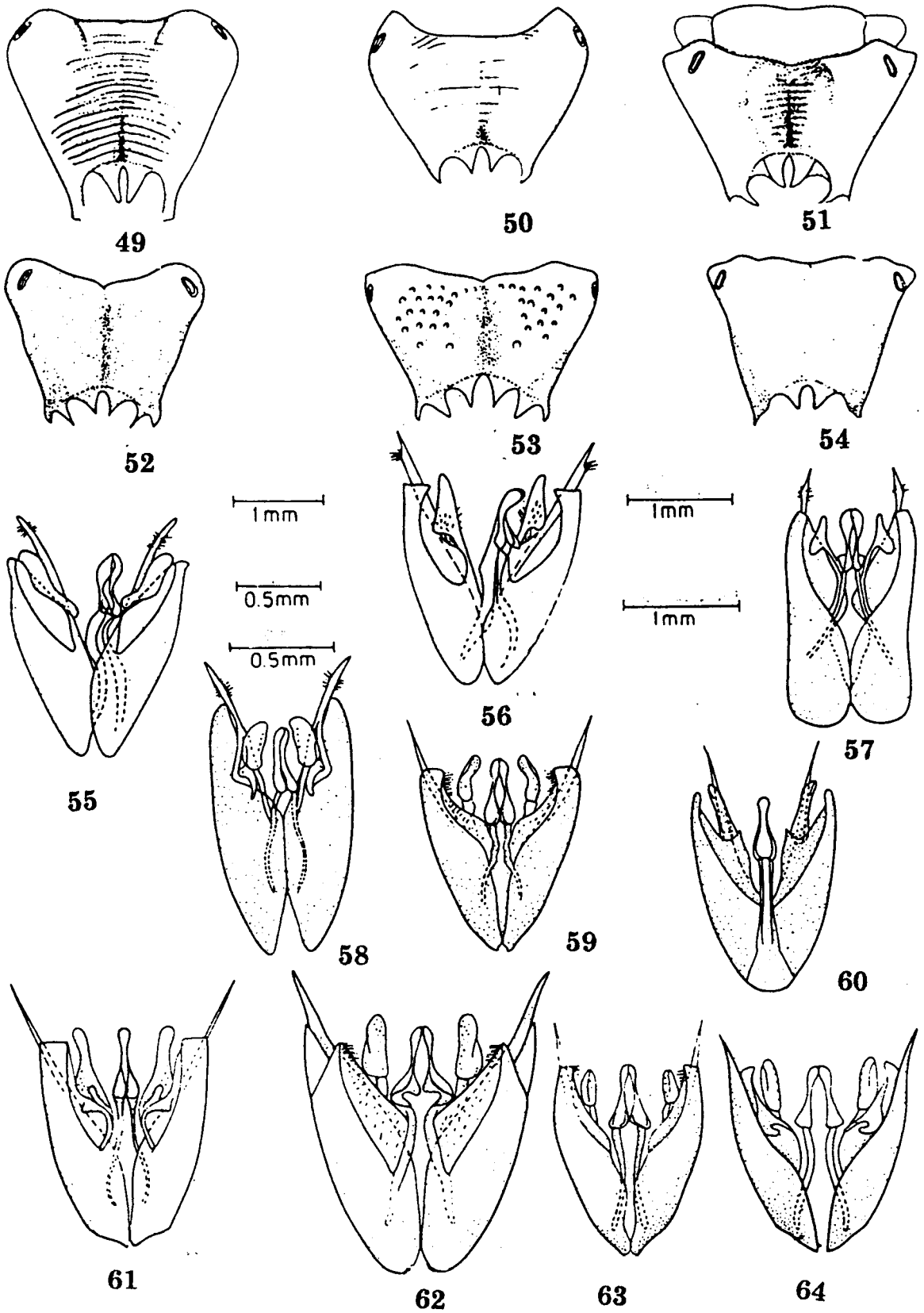

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Fig. 65. Vertex of Vespula / Dolicovespula

Fig. 66. Vertex of *Vespa*

Fig. 67, 68, 69. Colour variation of *Vespa bicolor citriventris*

Fig. 70. Head of female *Vespa affinis*

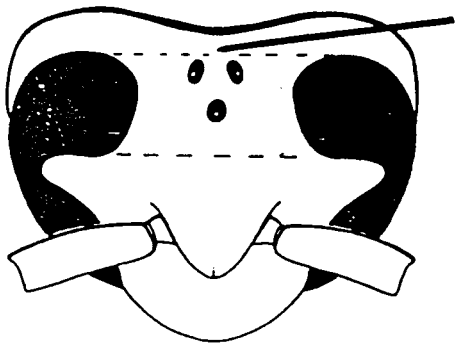
Fig. 71. Head of male *Vespa affinis*

Fig. 72. Sixth and seventh sternite of male *Vespa affinis*

Fig. 73. Male genitalia of *Vespa affinis*

Fig. 74. Head of *Vespa dybowskii* (F)

Fig. 75. Head of *Vespa basalis* (F)



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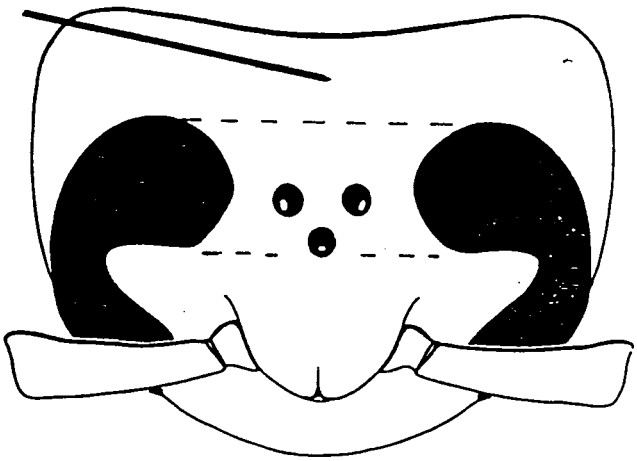

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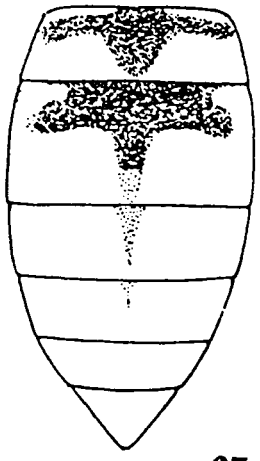

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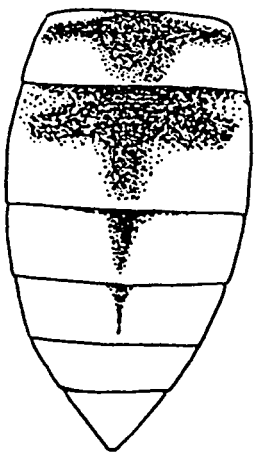

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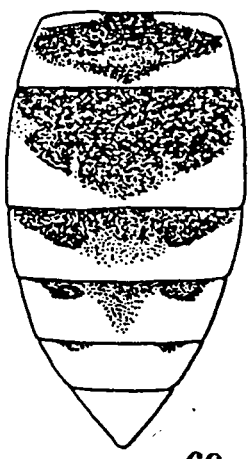

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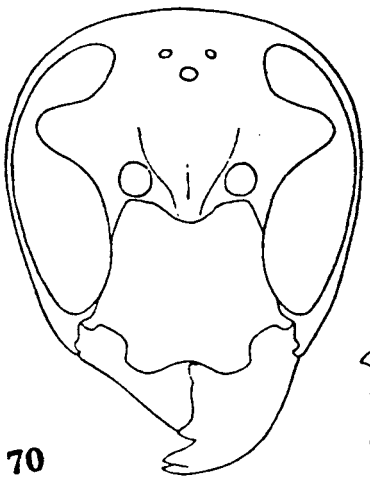

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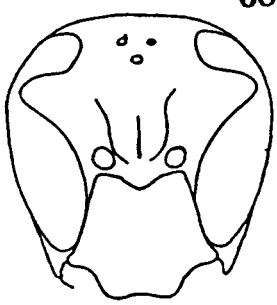

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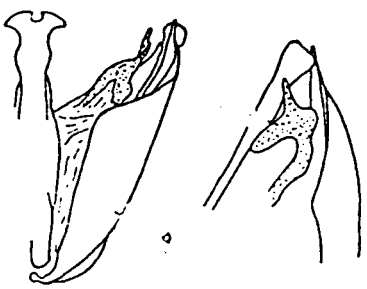

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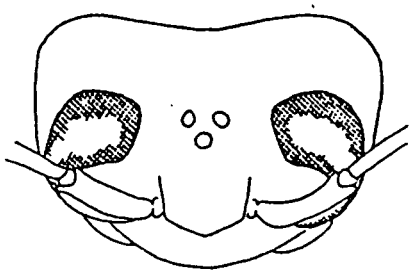

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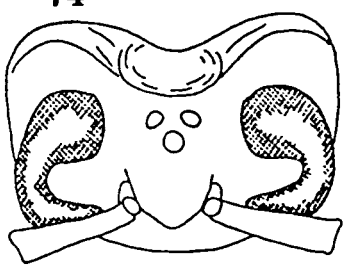


75

25

Blackish-brown and yellow colour patterns of mesosoma and metasoma of

Fig. 76. *Vespa analis nigricans*

Fig. 77. *Vespa velutina auraria*

Fig. 78. *Vespa basalis* (W)

Fig. 79. *Vespa basalis* (F)

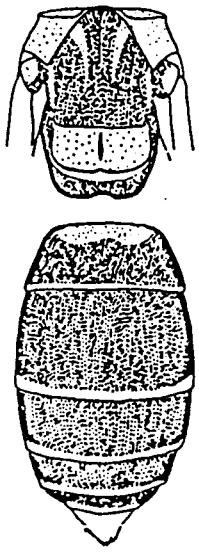
Fig. 80. *Vespa mandarina magnifica*

Fig. 81. Head of *Vespa orientalis*

Fig. 82. Vertex of *Vespa orientalis*

Fig. 83. Mesosoma of *Vespa orientalis*

Fig. 84. Metasoma of *Vespa orientalis*



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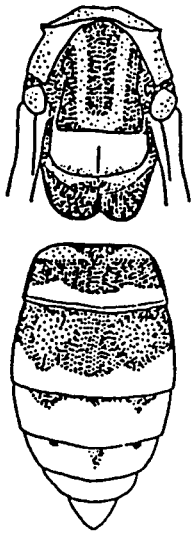

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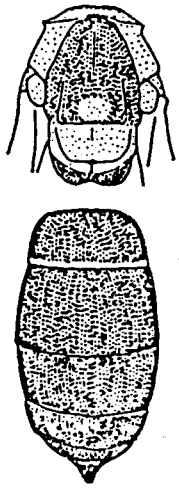

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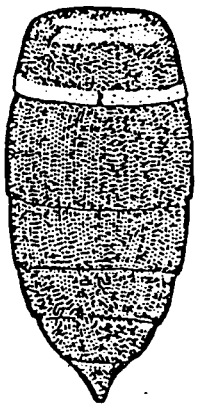

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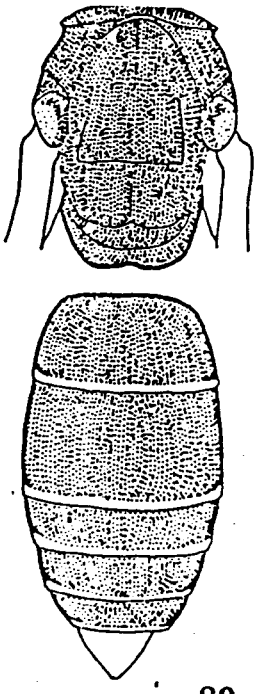

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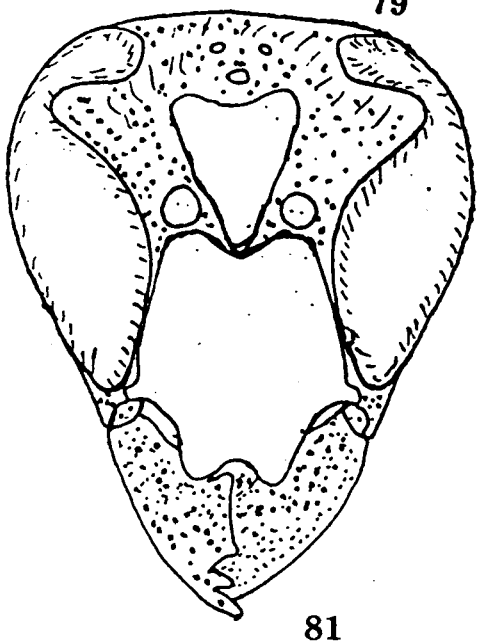

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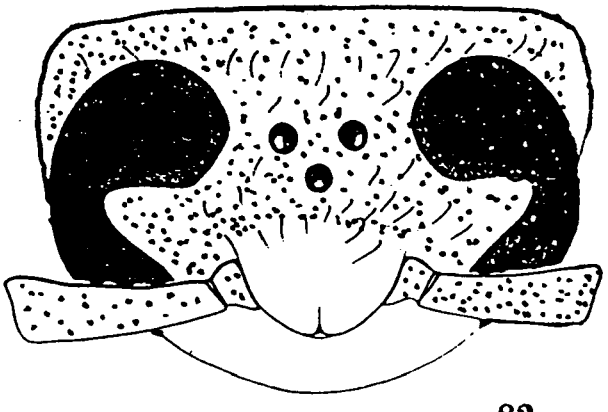

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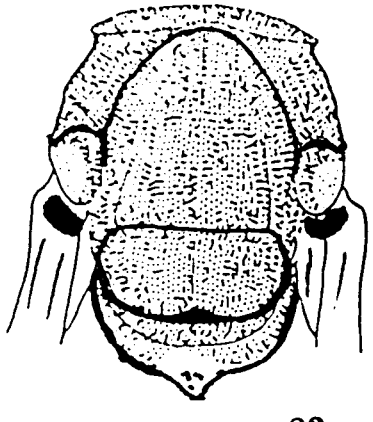

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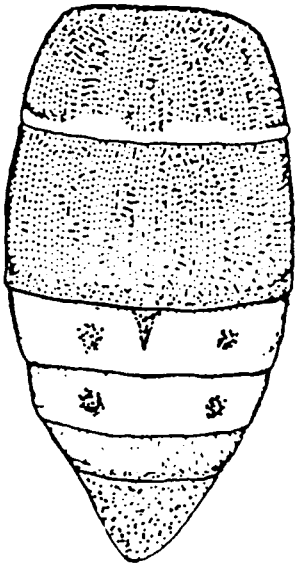

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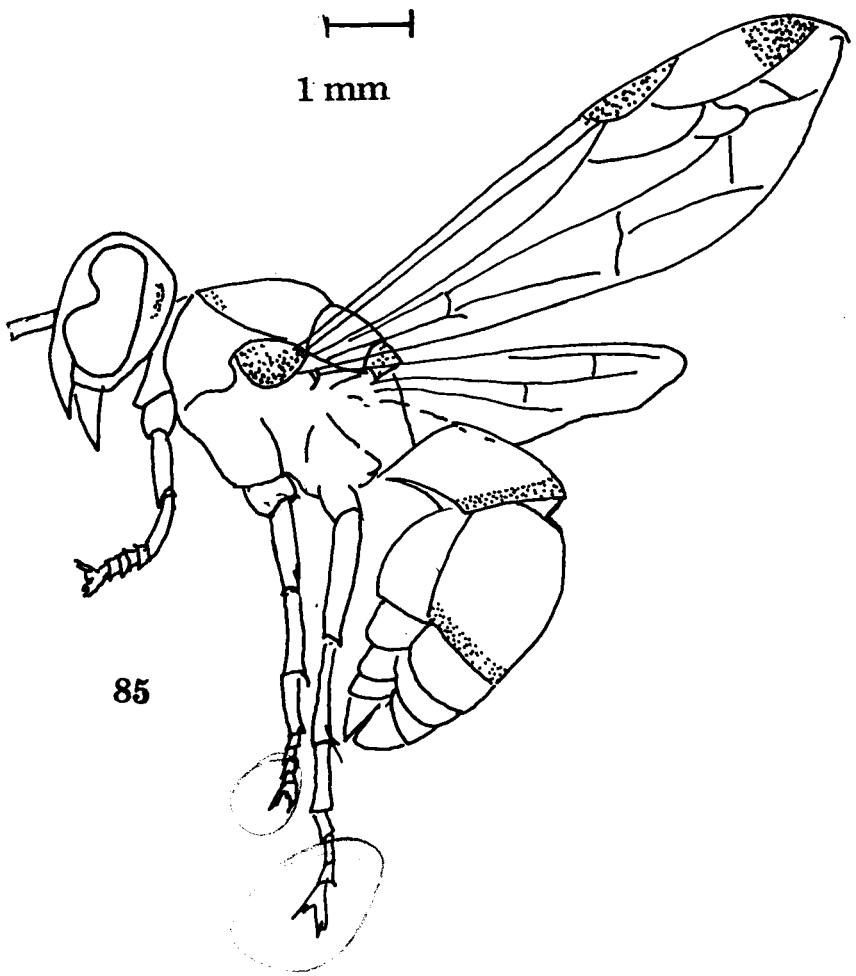
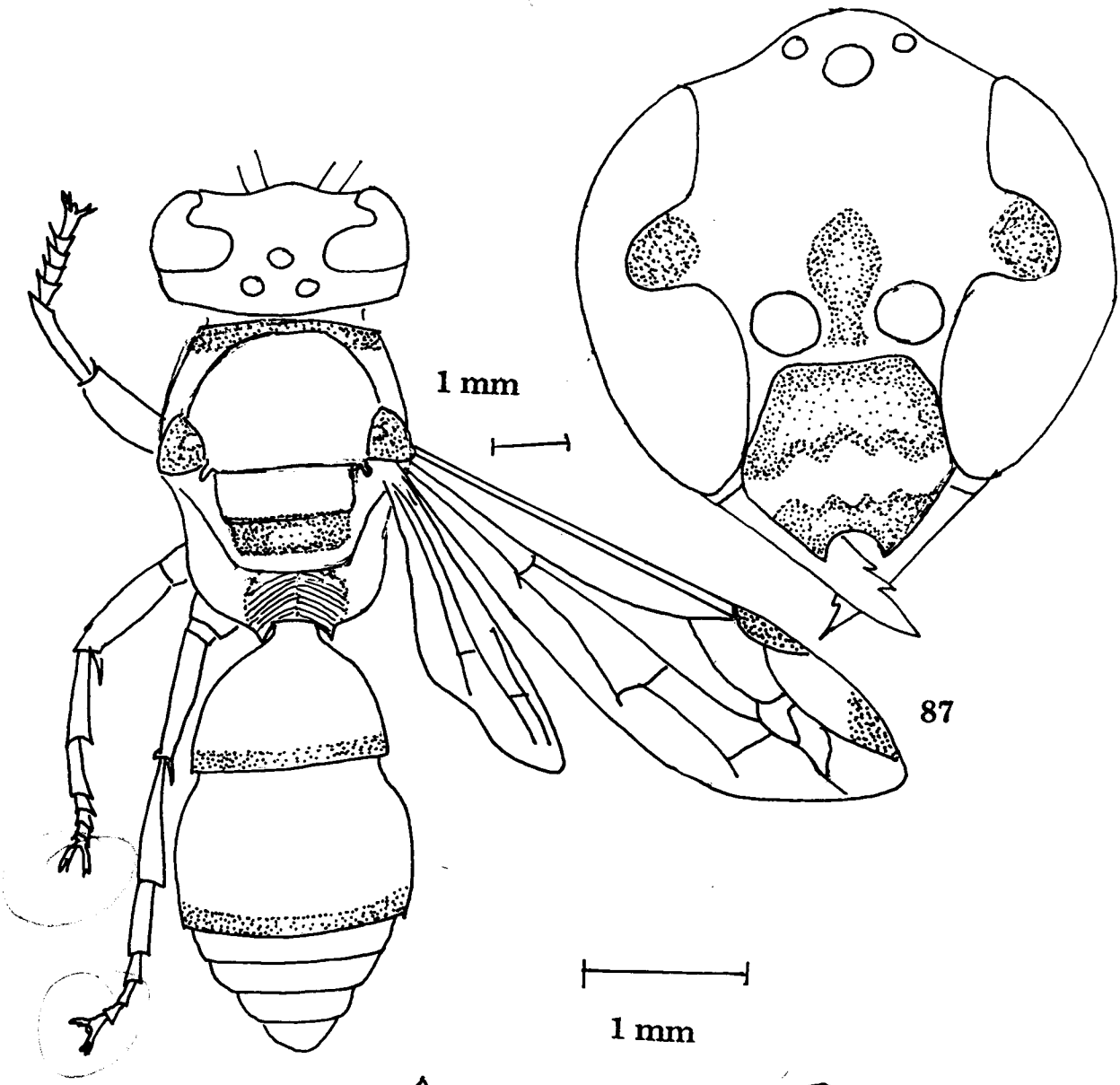
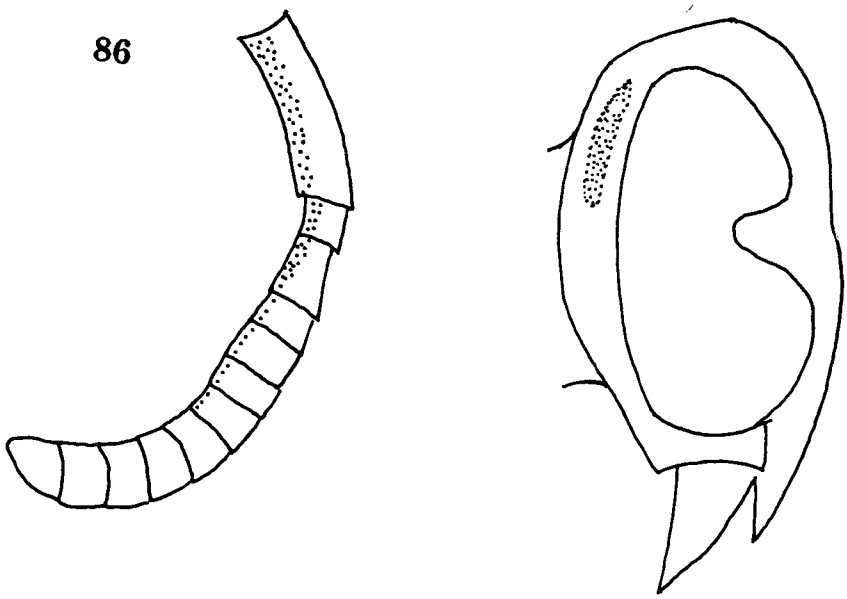


Fig. 85-89. ***Ancistrocerus tinctipennis*** **(Walker) comb. nov. Female**

Fig. 85. Body Profile
Fig. 86. Body Dorsal view
Fig. 87. Head front view
Fig. 88. Antenna
Fig. 89. Head Profile





88

89

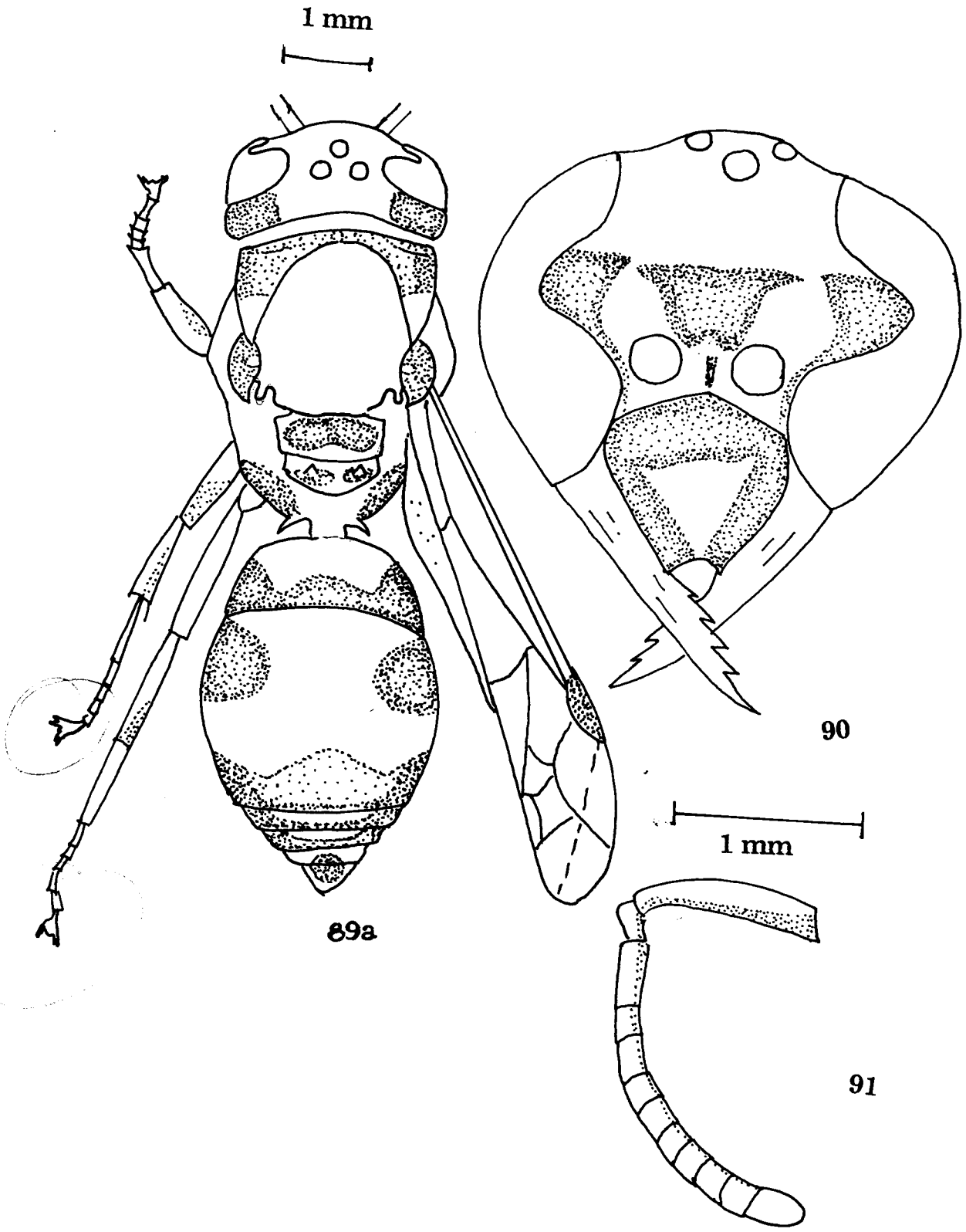


Fig. 89a-91. ***Antepipona biguttata biguttata*** **(Fabricius) Female**

Fig. 89a. Body Dorsal view
Fig. 90. Head front view
Fig. 91. Antenna

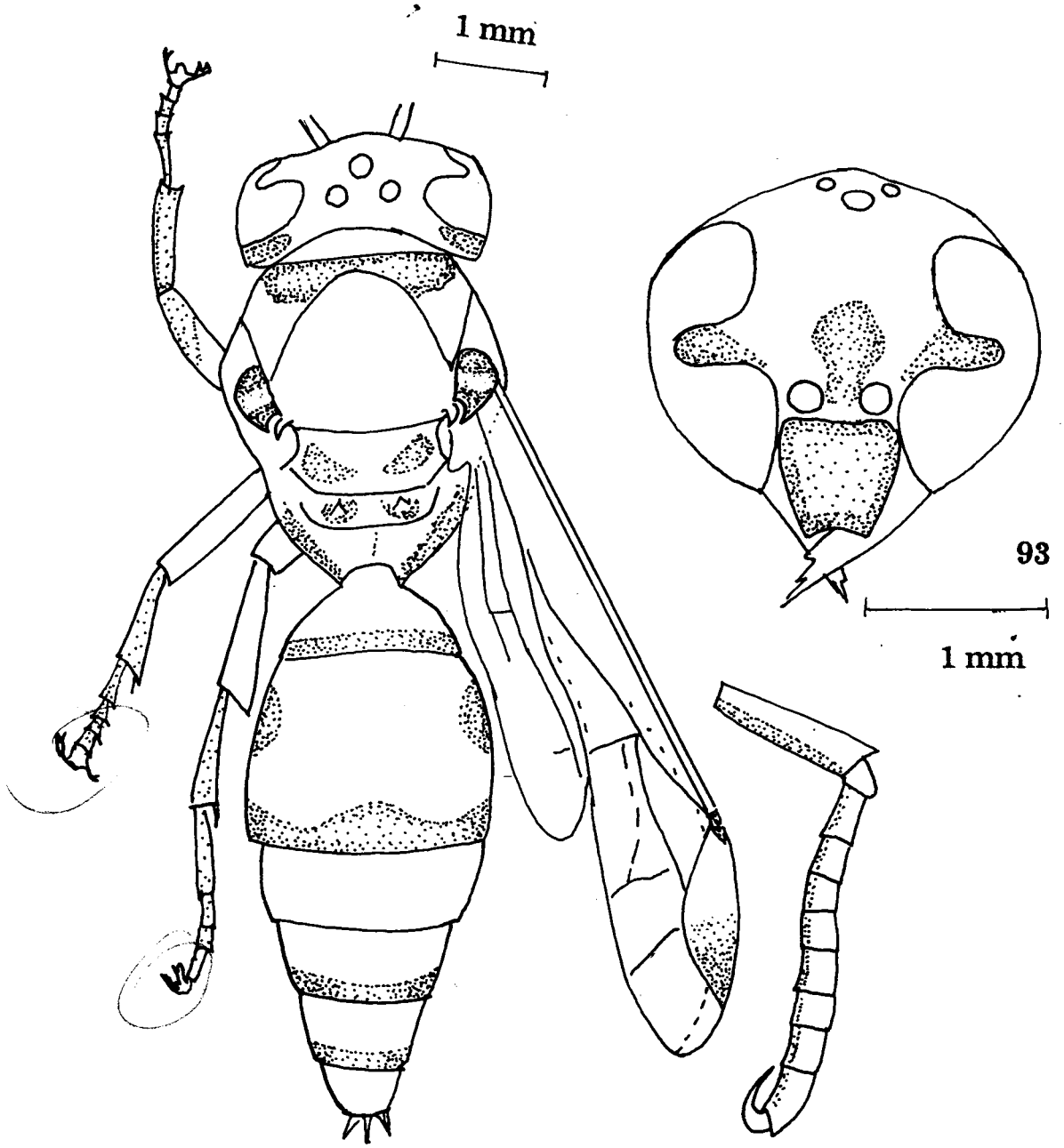


Fig. 92-94. ***Antepipona bipustulata*** **(Saussure) Male**

Fig. 92. Body Dorsal view
Fig. 93. Head front view
Fig. 94. Antenna

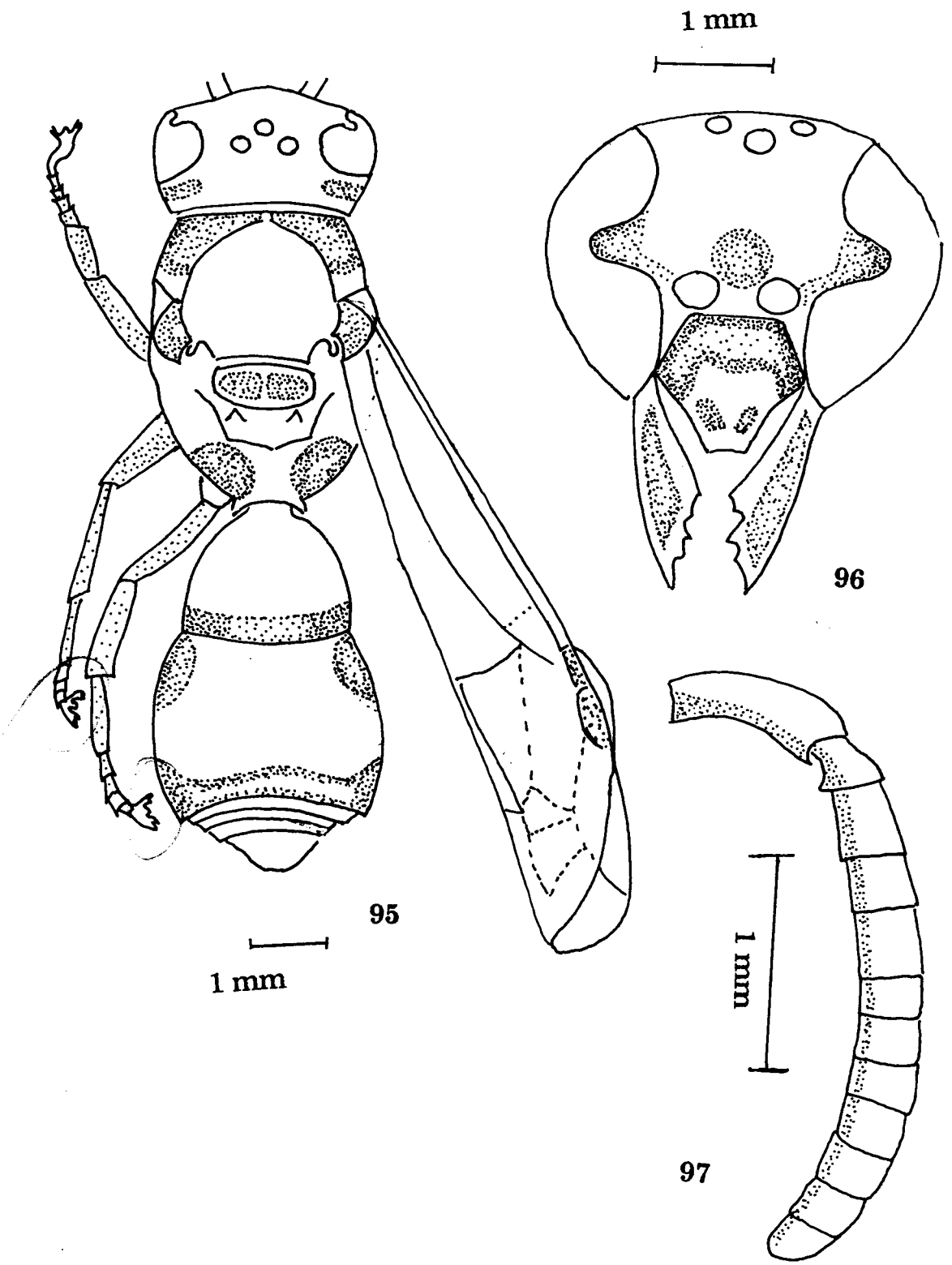


Fig. 95-97. ***Antepipona ceylonica*** **(Saussure) Female**

Fig. 95. Body Dorsal view
Fig. 96. Head front view
Fig. 97. Antenna

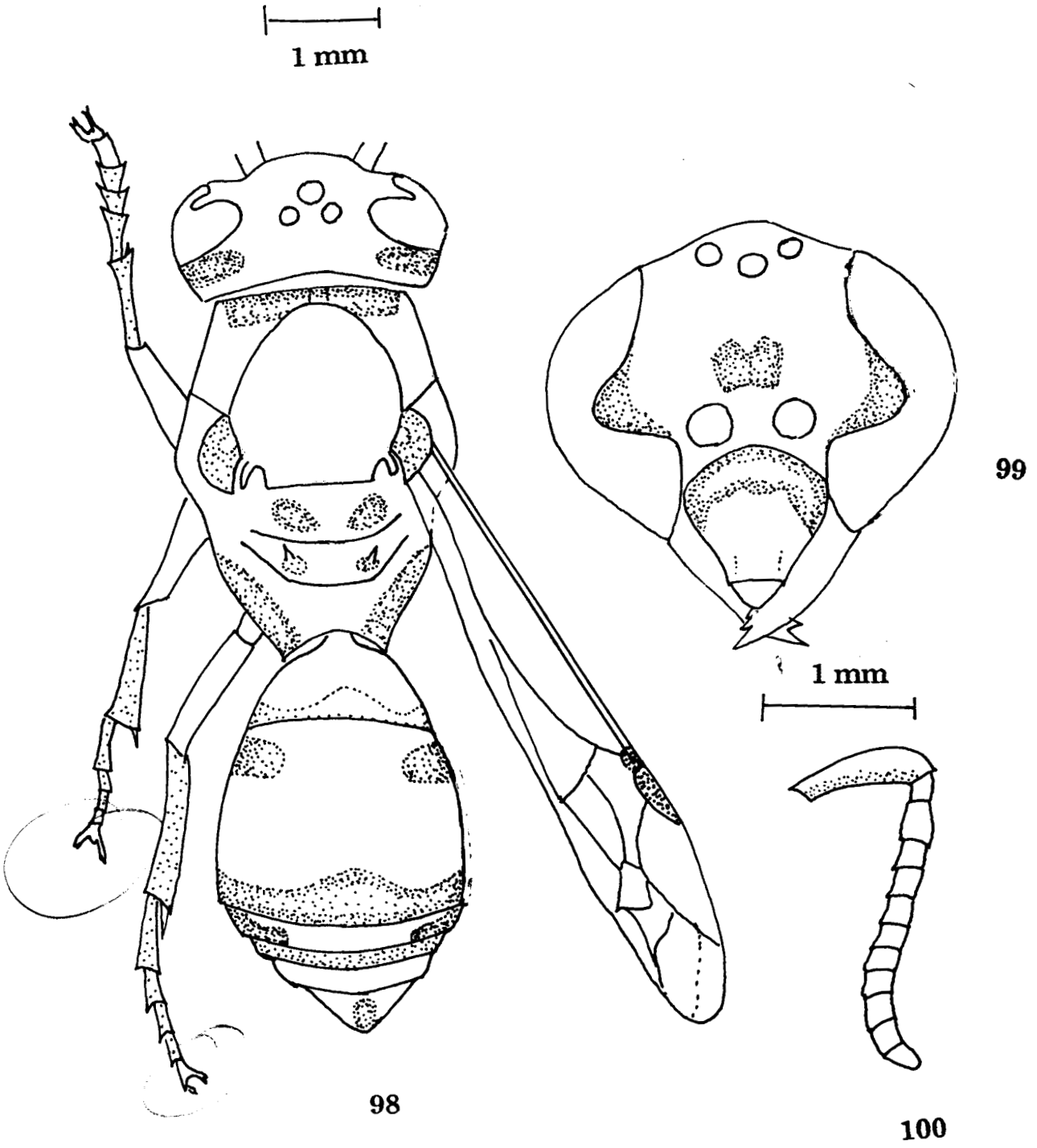


Fig. 98-100. ***Antepipona excelsa malabariensis*** **subsp. nov. Female**

Fig. 98. Body dorsal view
Fig. 99. Head front view
Fig. 100. Antenna

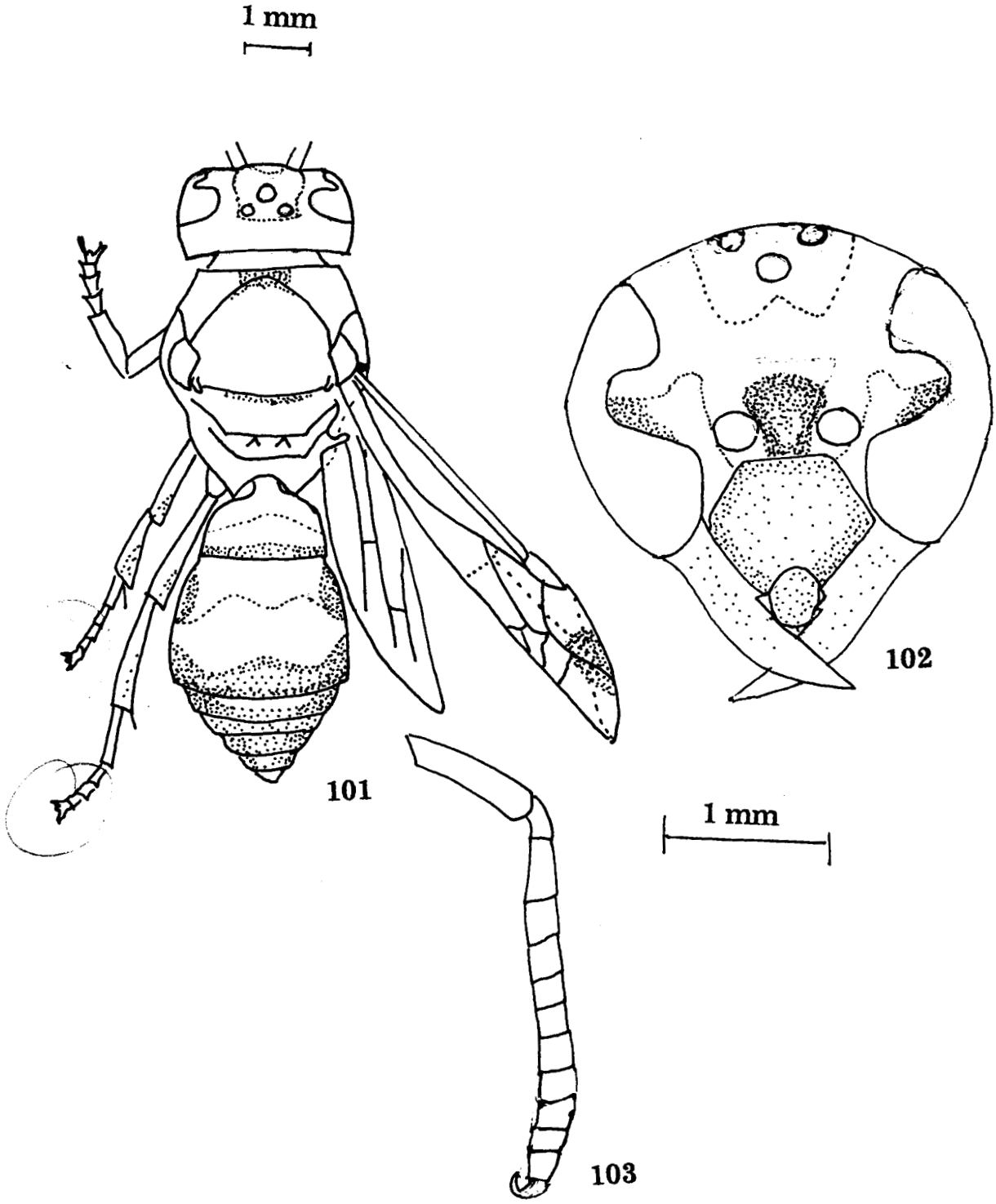


Fig. 101-103. ***Antepipona frontalis*** **Soika Male**

Fig. 101. Body dorsal view
Fig. 102. Head front view
Fig. 103. Antenna

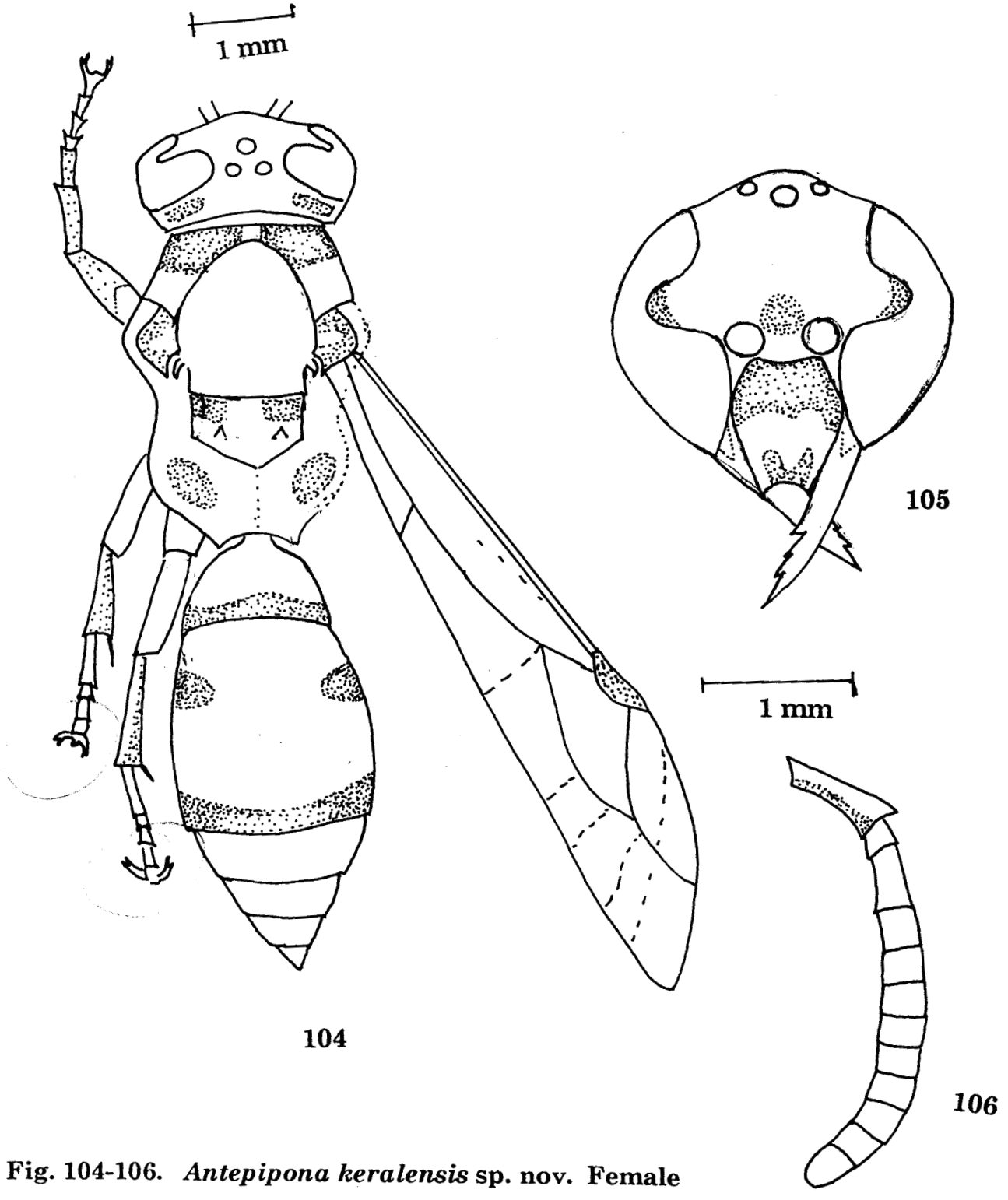


Fig. 104-106. ***Antepipona keralensis*** **sp. nov. Female**

104. Body dorsal view
105. Head front view
106. Antenna

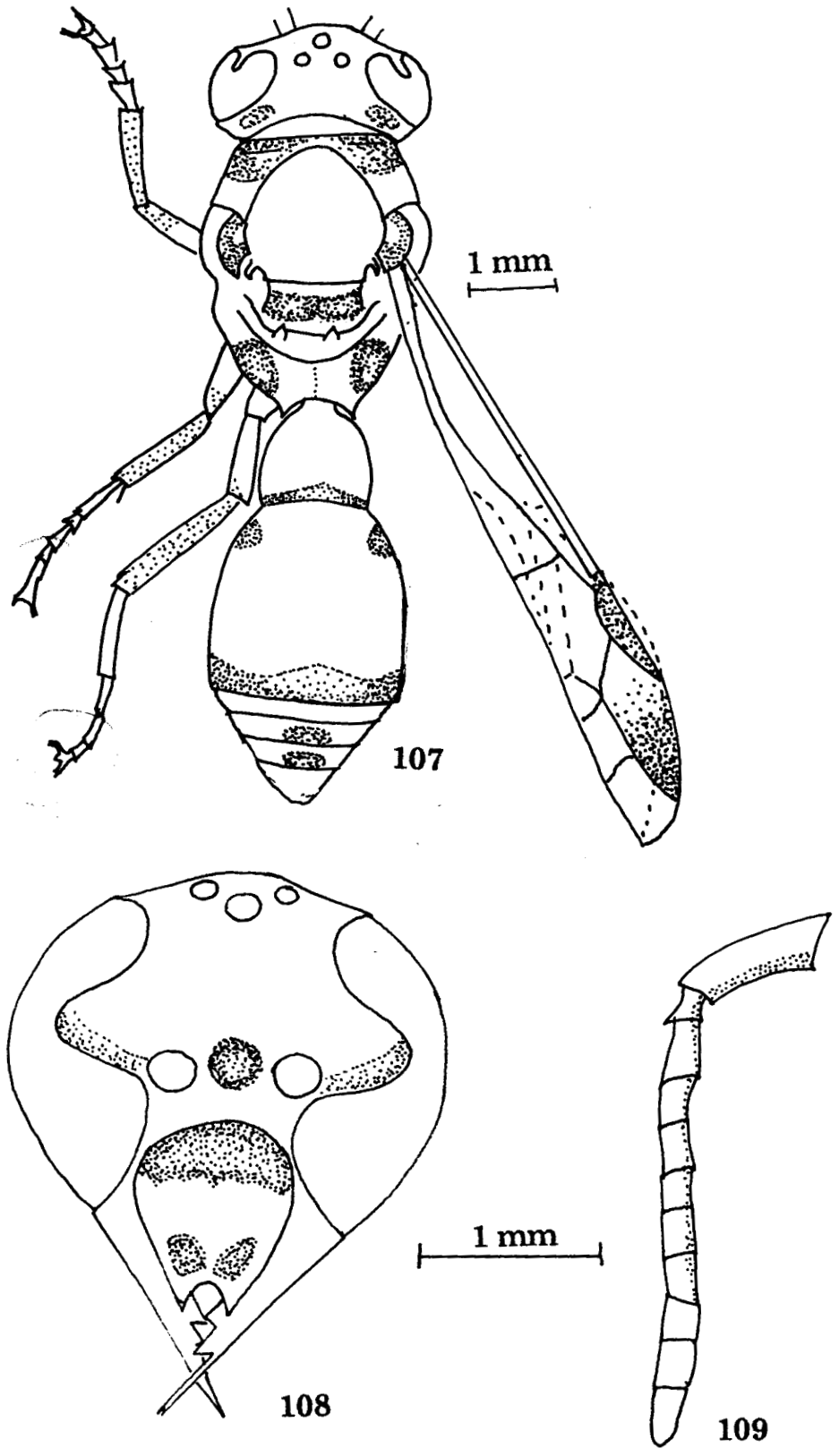


Fig. 107-109. ***Antepipona malabarica*** **sp. nov. Female**

Fig. 107. Body dorsal view
Fig. 108. Head front view
Fig. 109. Antenna

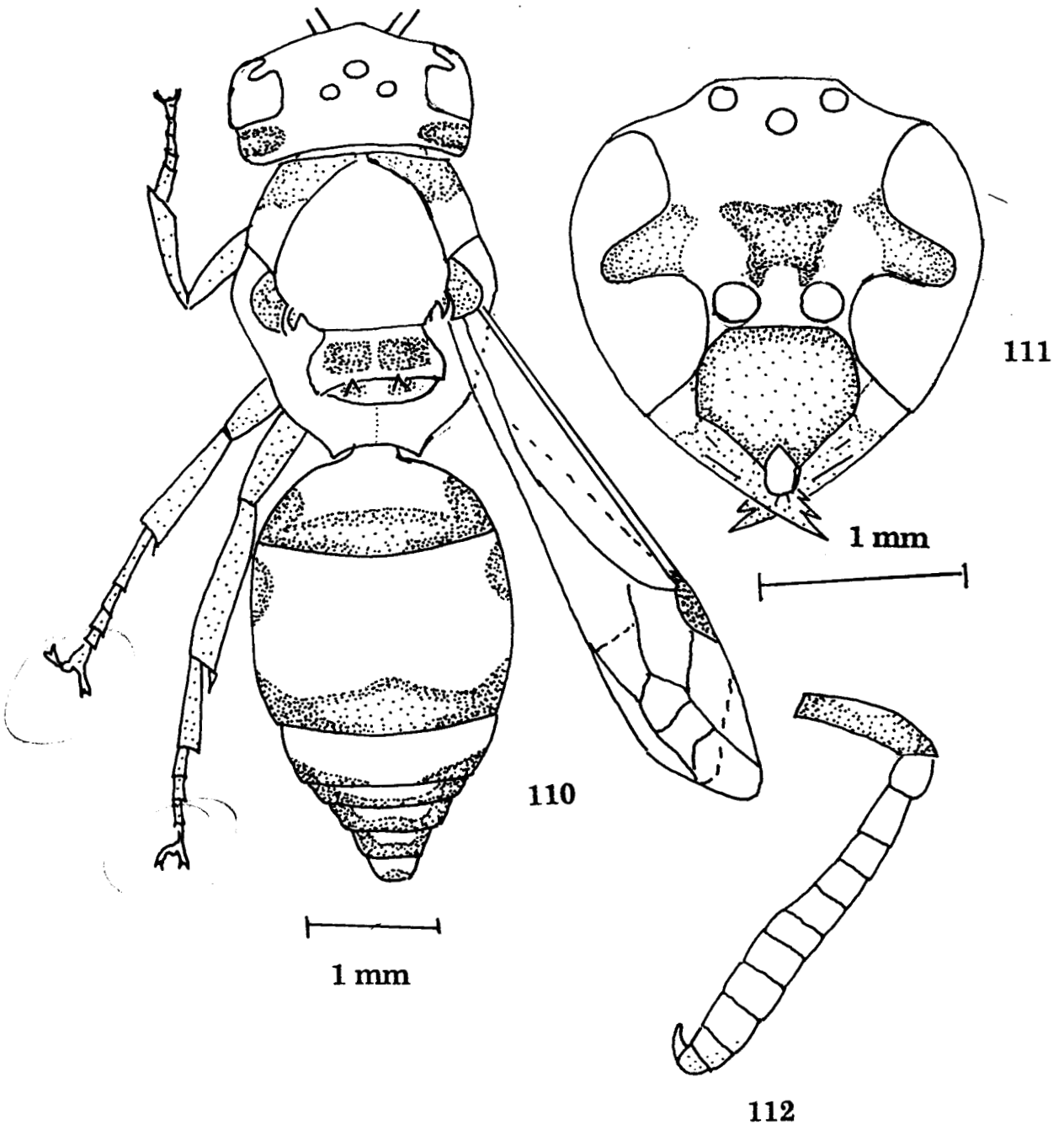
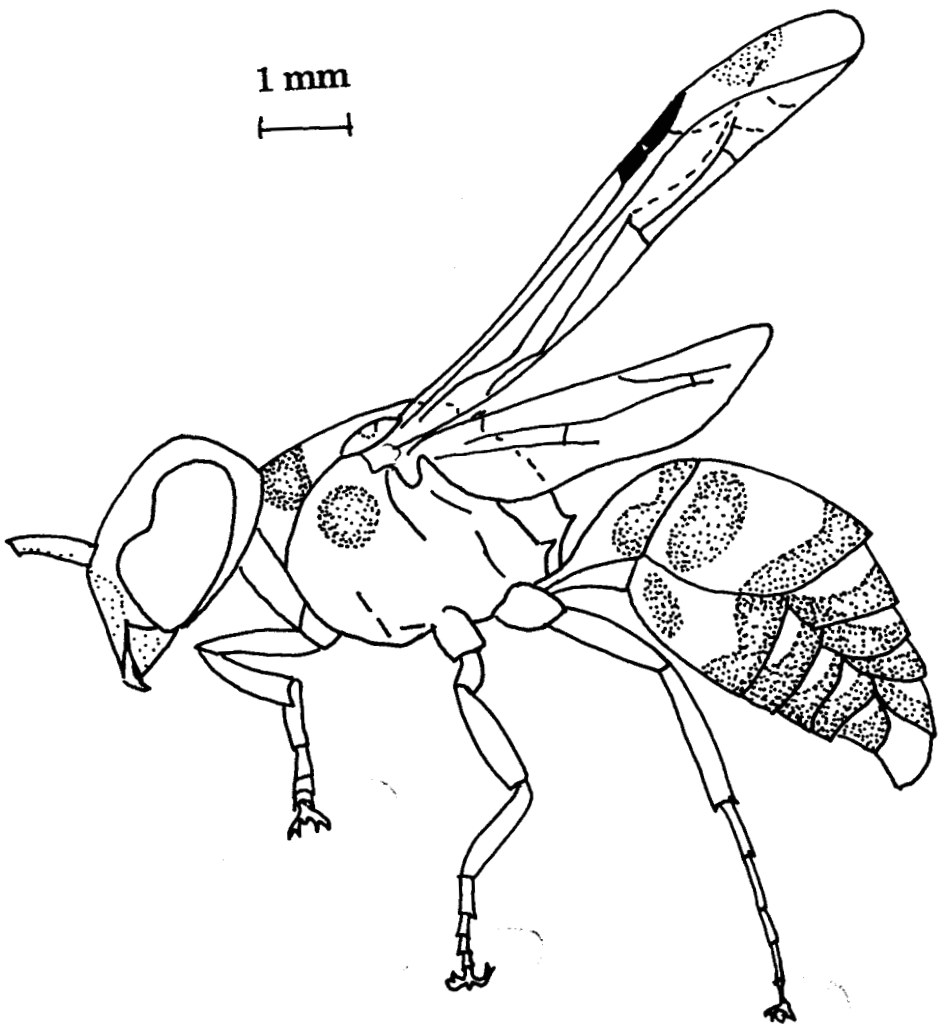


Fig. 110-112. ***Antepipona minutissima*** **Soika Male**

Fig. 110. Body dorsal view
Fig. 111. Head front view
Fig. 112. Antenna

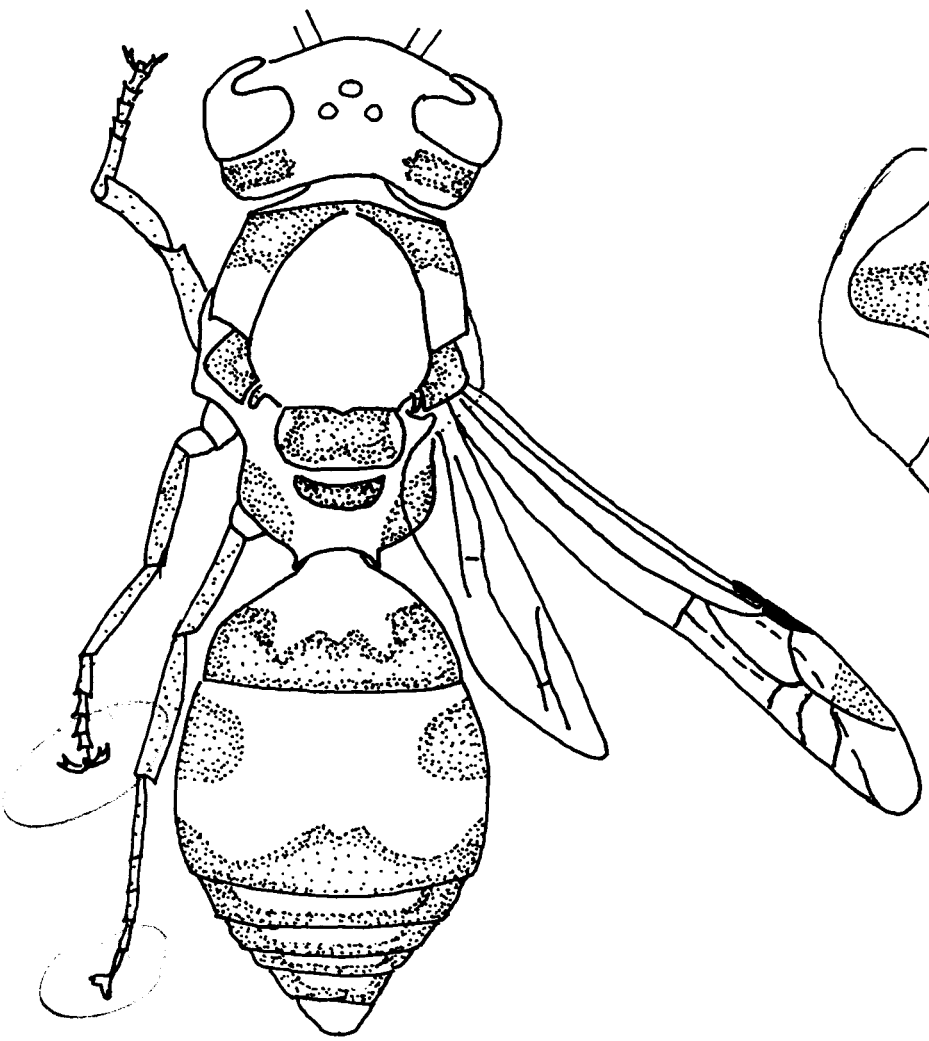


113

Fig. 113-116. ***Antepipona ovalis*** **(Saussure) Male**

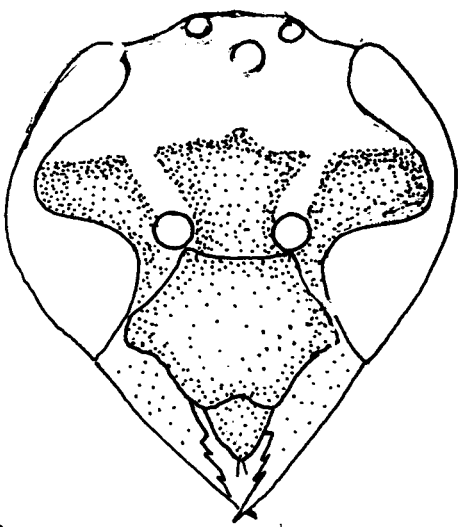
Fig. 113. Body profile
Fig. 114. Body dorsal view
Fig. 115. Head front view
Fig. 116. Antenna

1 mm



114

1 mm



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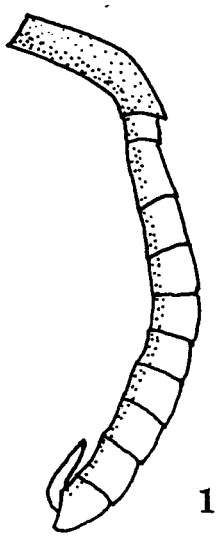

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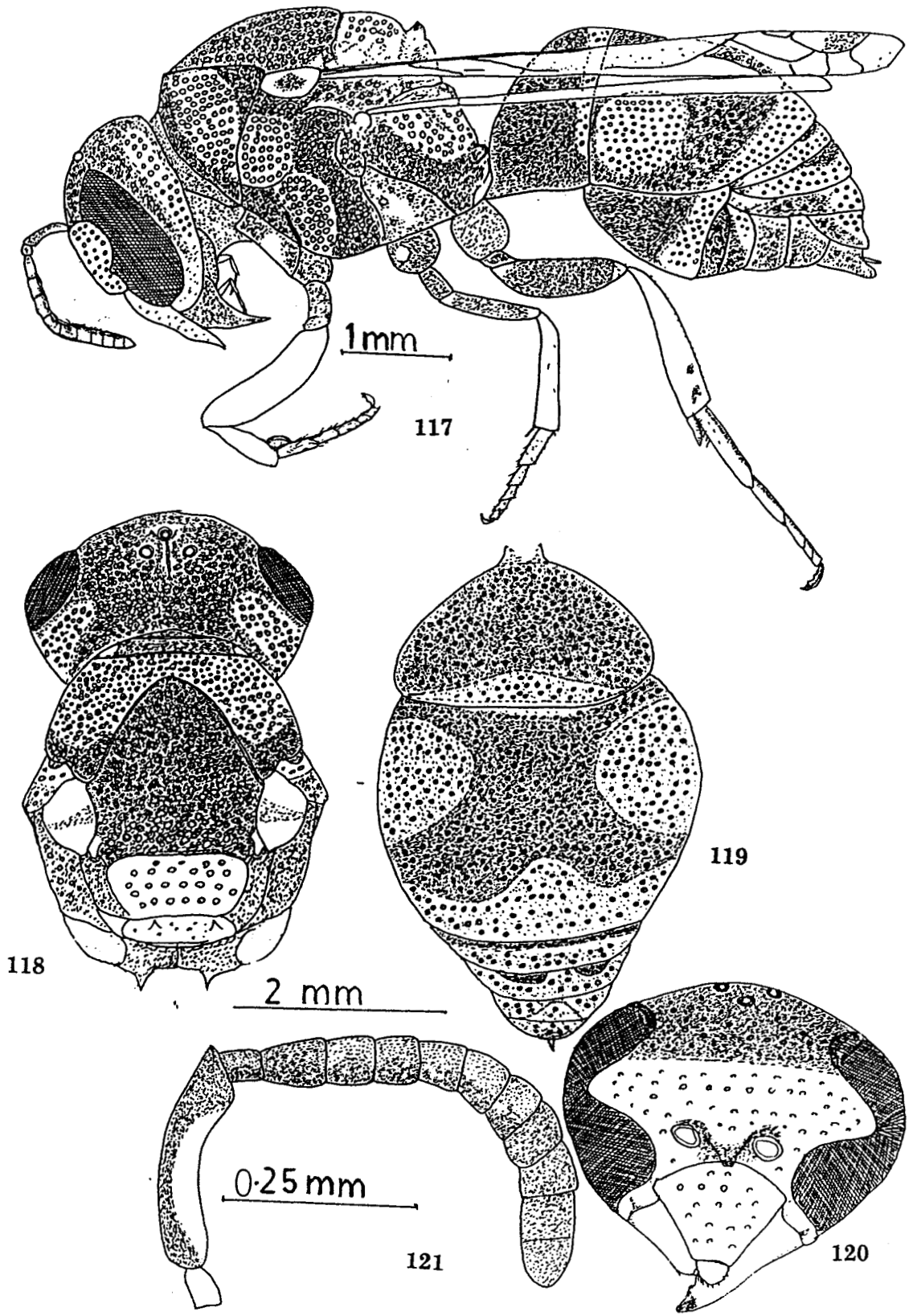


Fig. 117-121. ***Antepipona sasidharani*** **sp. nov. Female**

Fig. 117. Body profile
Fig. 118. Head and metasoma dorsal view
Fig. 119. Metasoma dorsal view
Fig. 120. Head front view
Fig. 121. Antenna

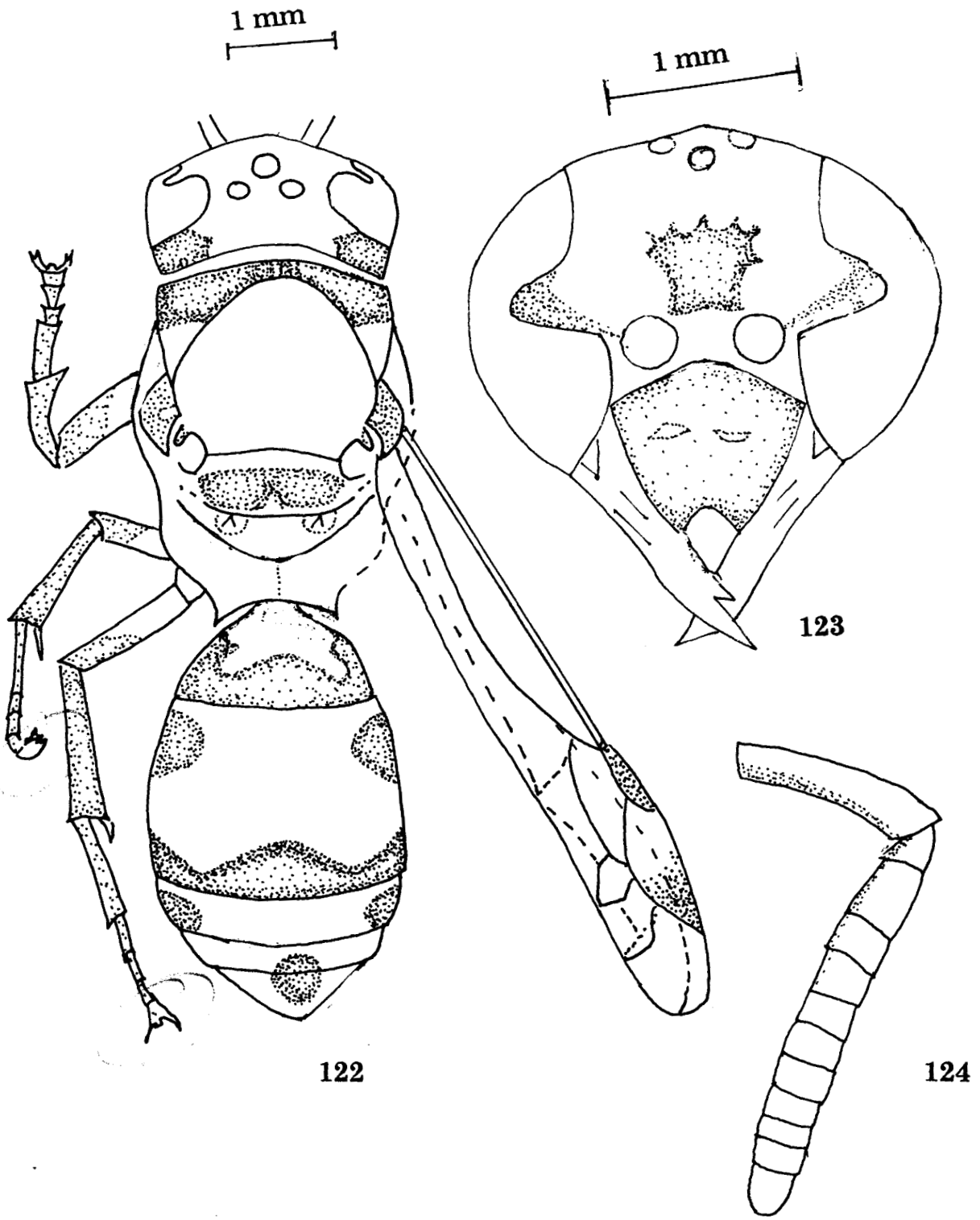
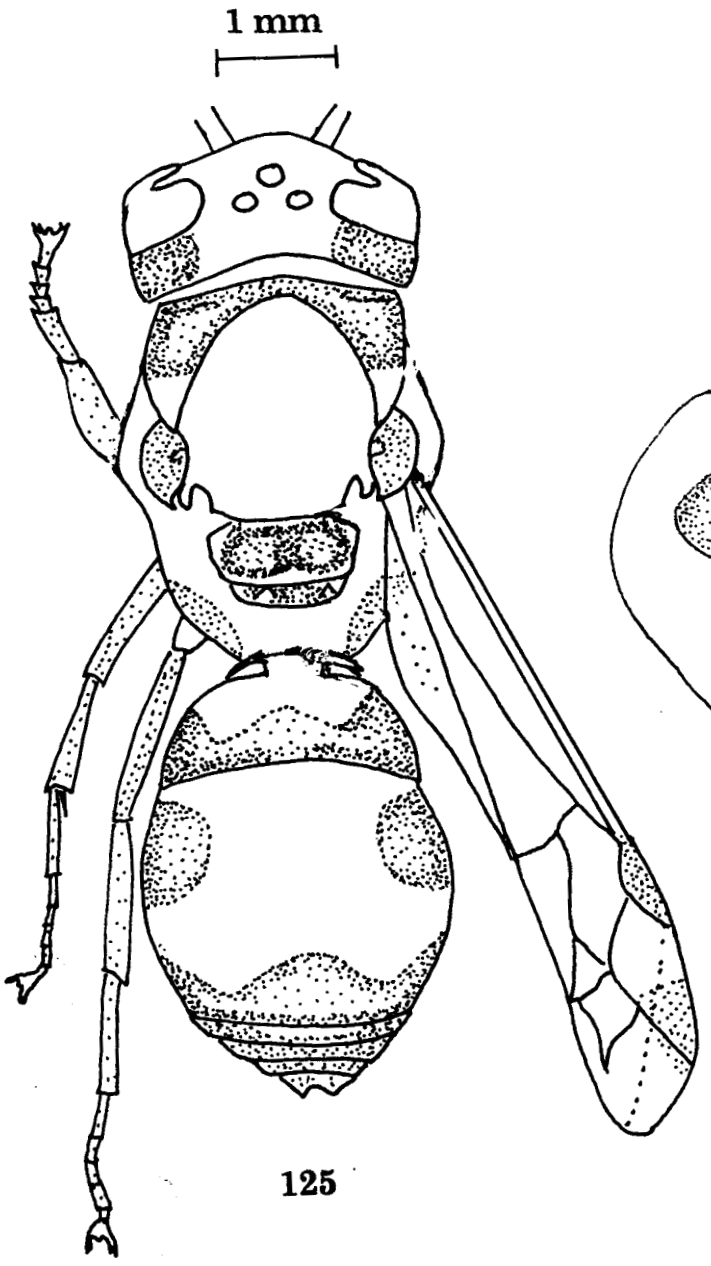


Fig. 122-124. ***Antepipona siamensis*** **Soika Female**

Fig. 122. Body dorsal view
Fig. 123. Head front view
Fig. 124. Antenna



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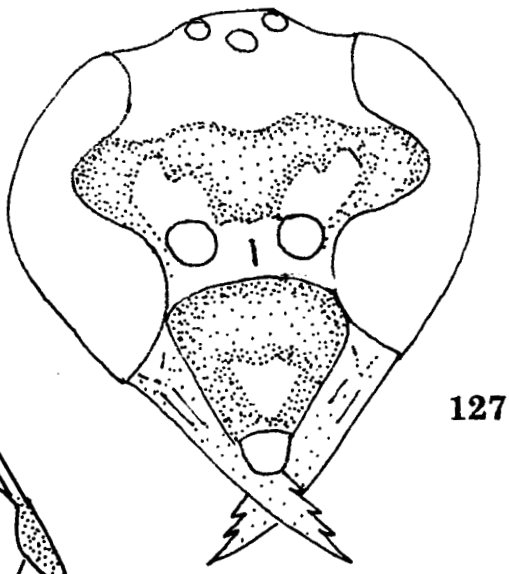

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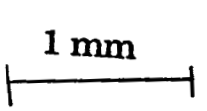
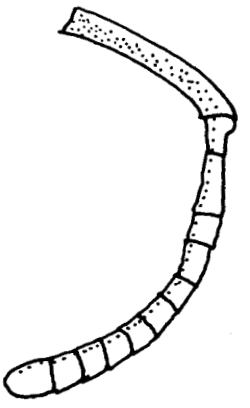
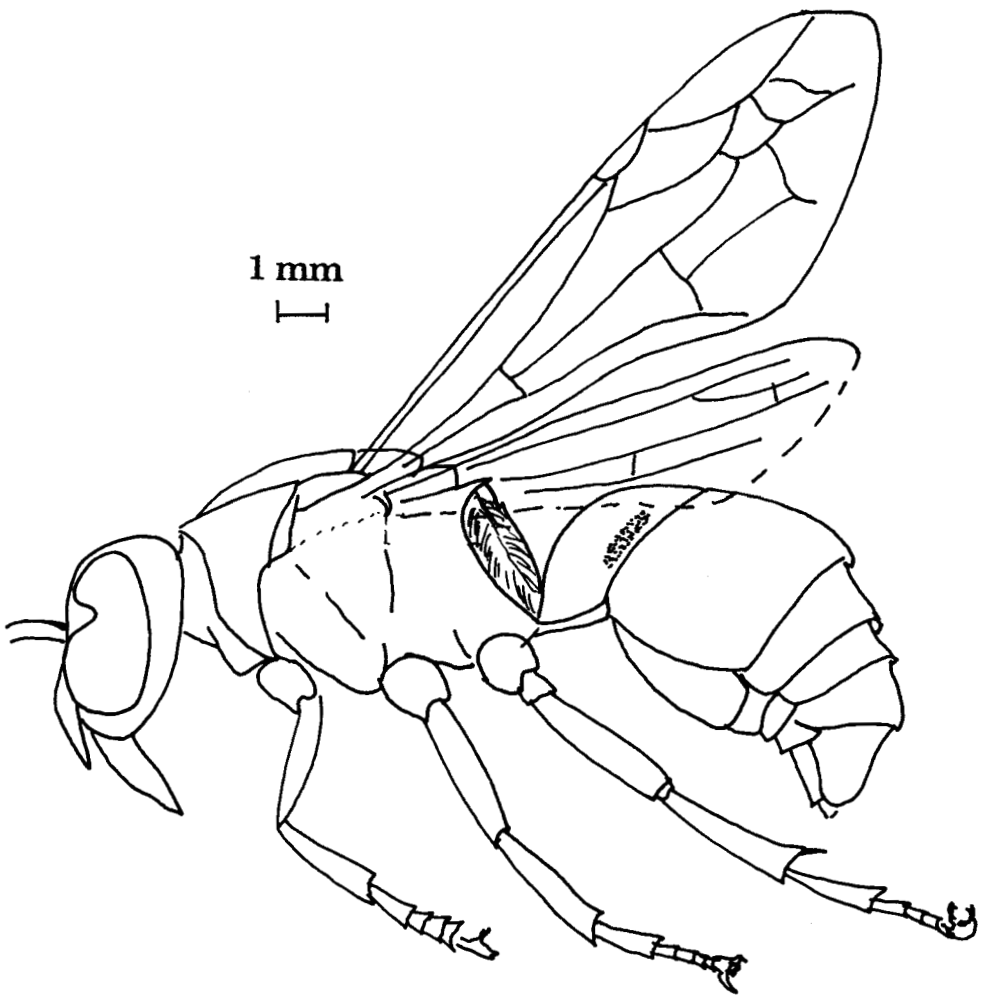




126

Fig. 125-127. ***Antepipona sibilans*** **(Cameron) Female**

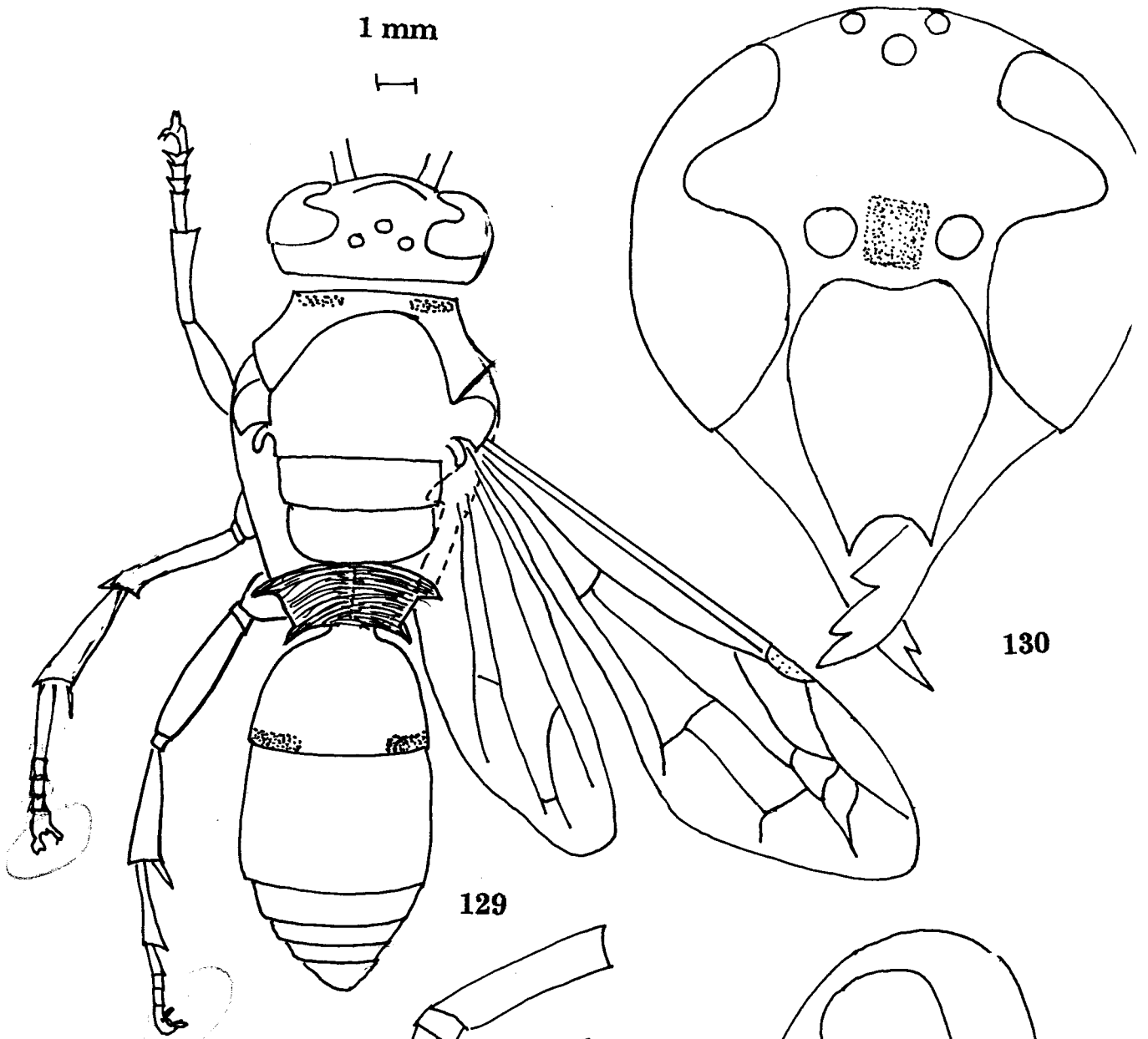
Fig. 125. Body dorsal view
Fig. 126. Head front view
Fig. 127. Antenna



128

Fig. 128-132. ***Anterhynchium flavomarginatum*** **(Smith) comb. nov. Female**

Fig. 128. Body profile
Fig. 129. Body dorsal view
Fig. 130. Head front view
Fig. 131. Antenna
Fig. 132. Head profile



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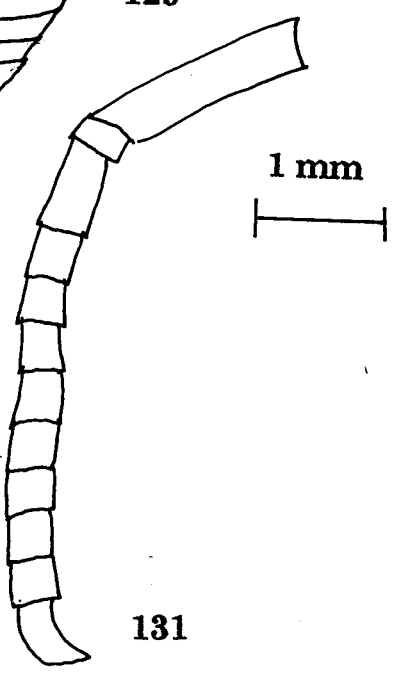
130



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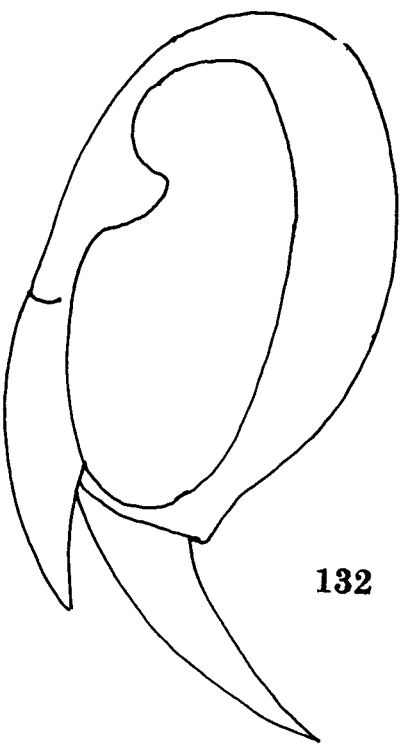

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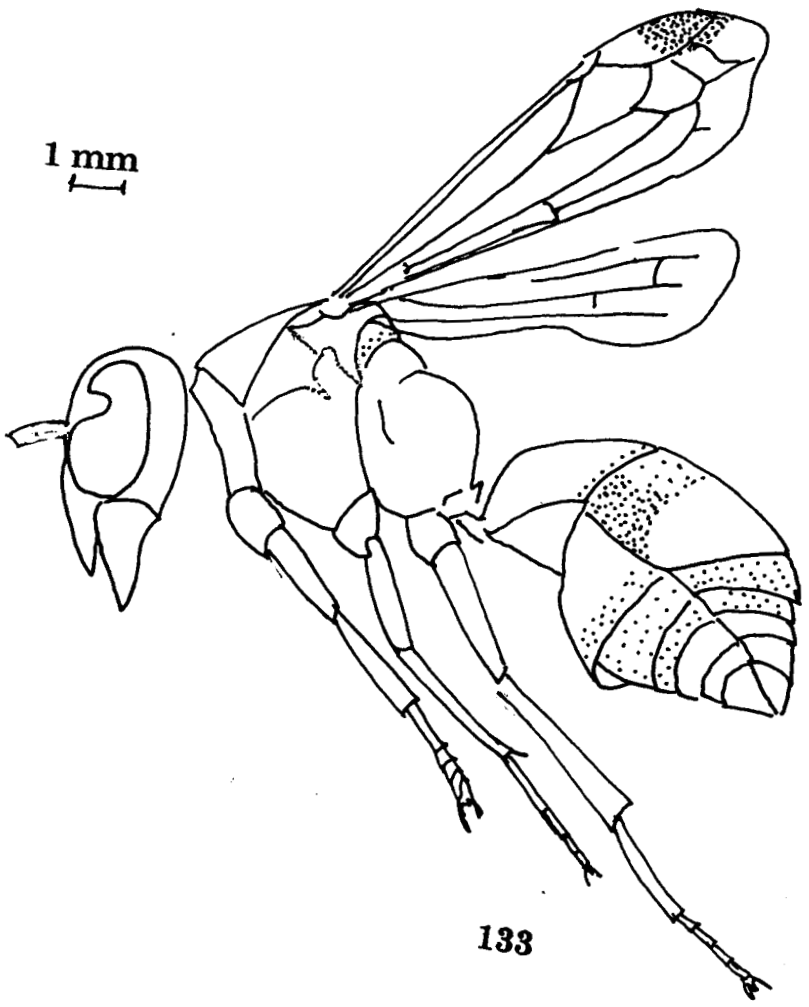
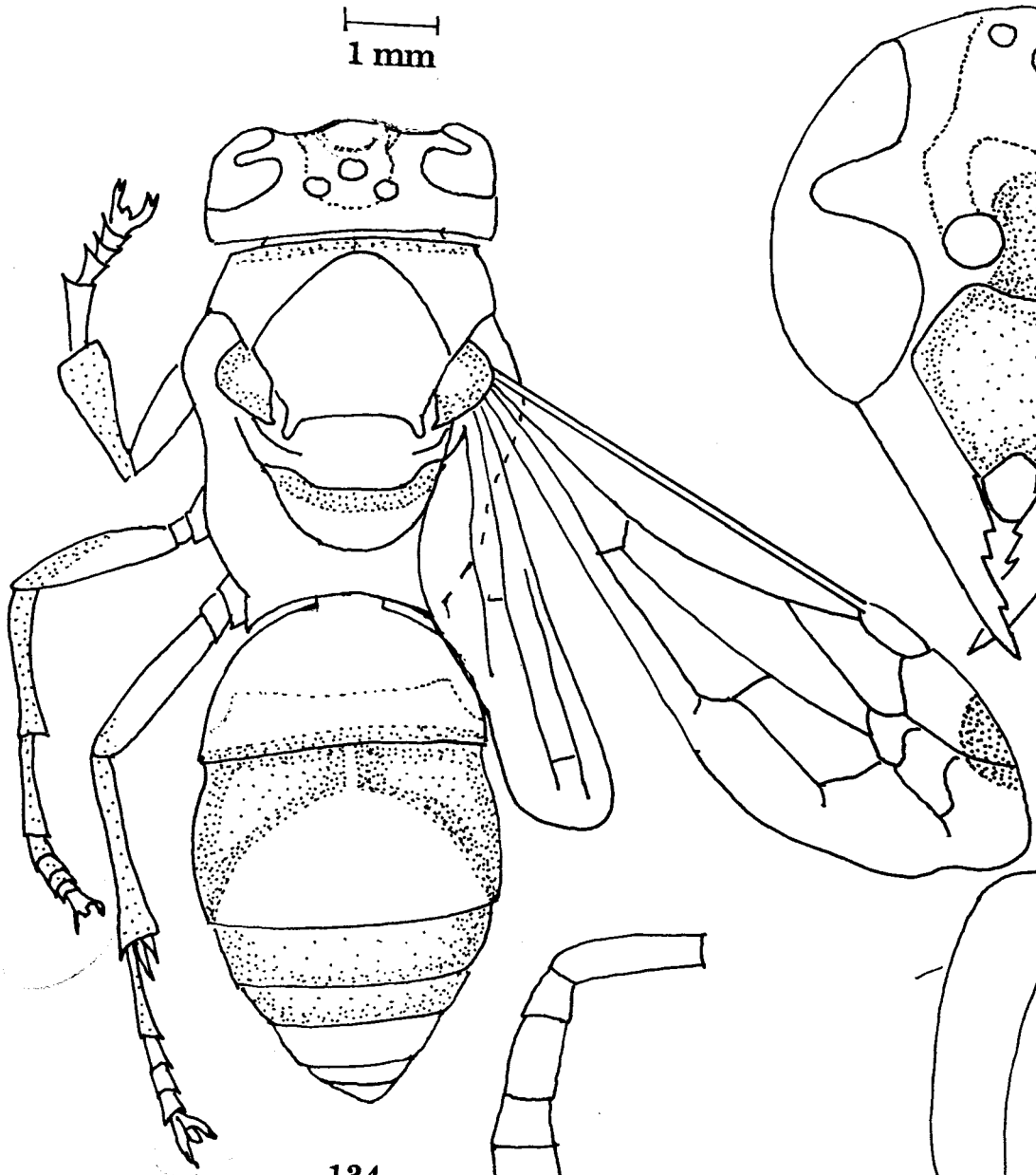


Fig. 133-137. ***Antodynerus punctatipennis*** **Saussure comb. nov. Male**

Fig. 133. Body profile
Fig. 134. Body dorsal view
Fig. 135. Head front view
Fig. 136. Antenna
Fig. 137. Head profile



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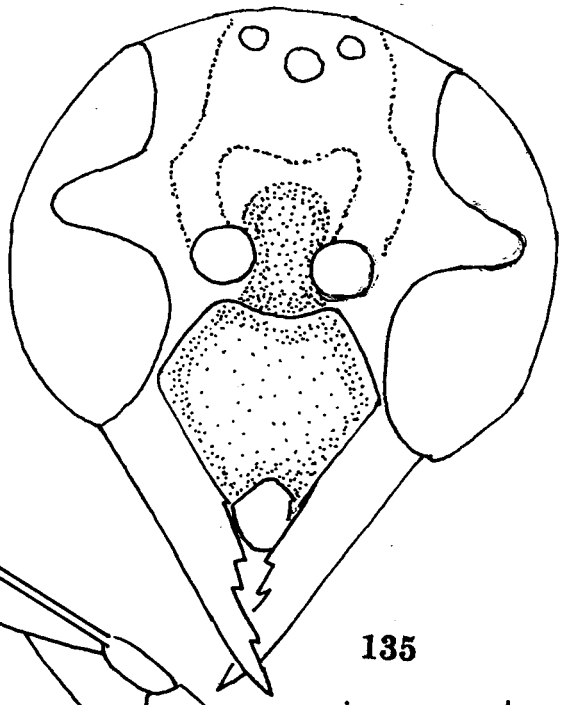

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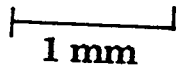

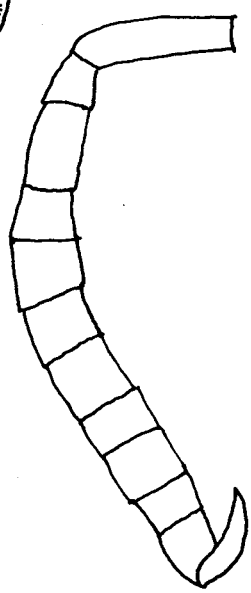

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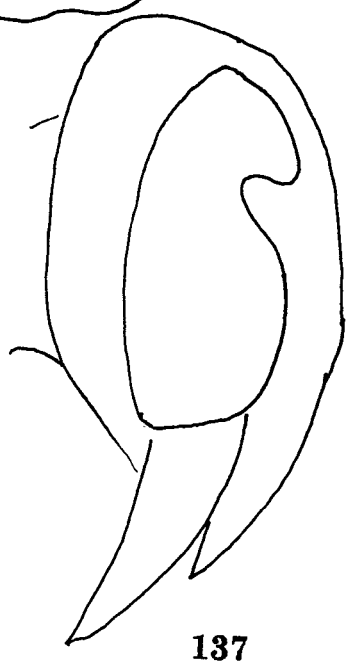

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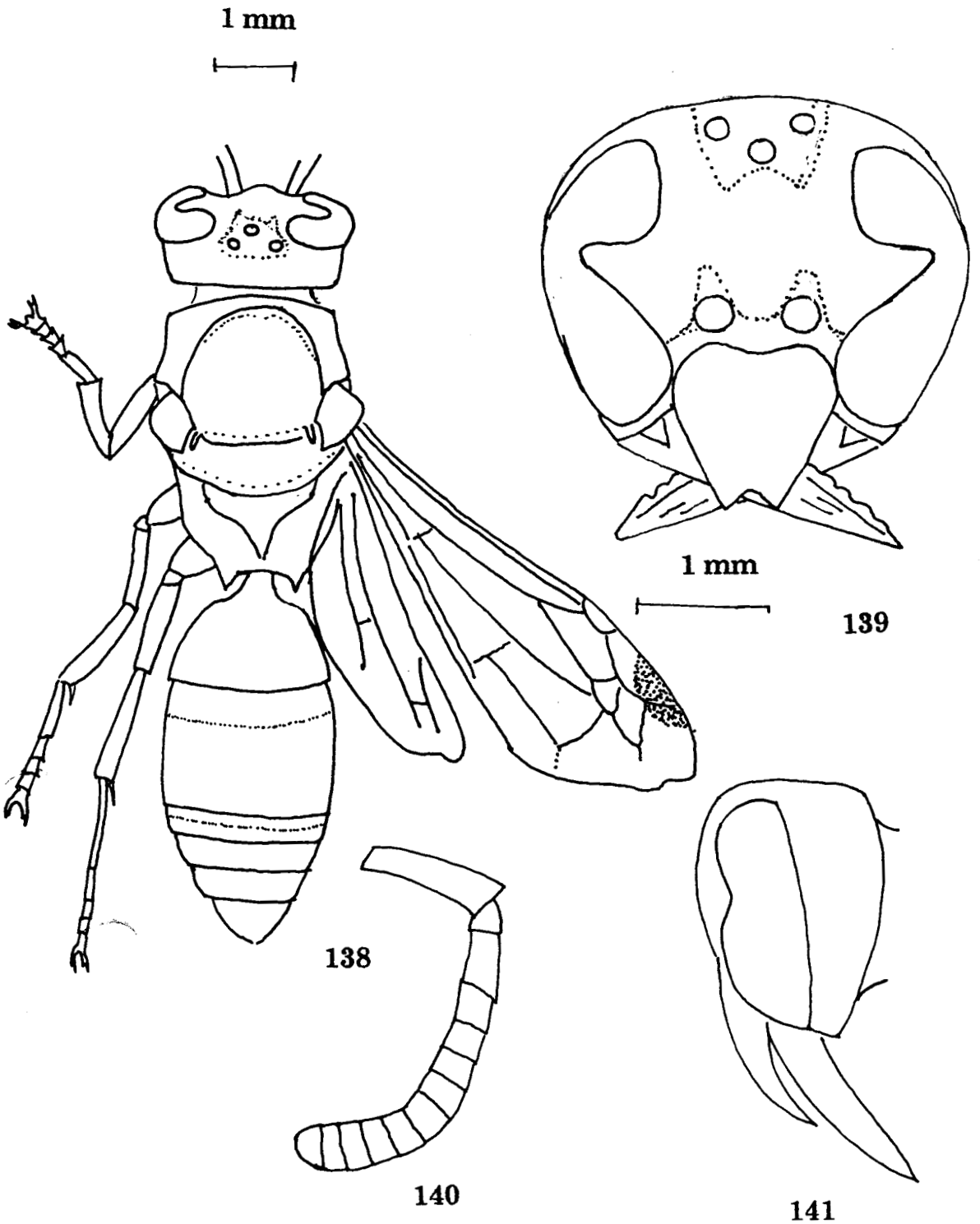


Fig. 138-141. ***Antodynerus ornatus*** **(Smith) comb. nov. Female**

Fig. 138. Body dorsal view
Fig. 139. Head front view
Fig. 140. Antenna
Fig. 141. Head profile

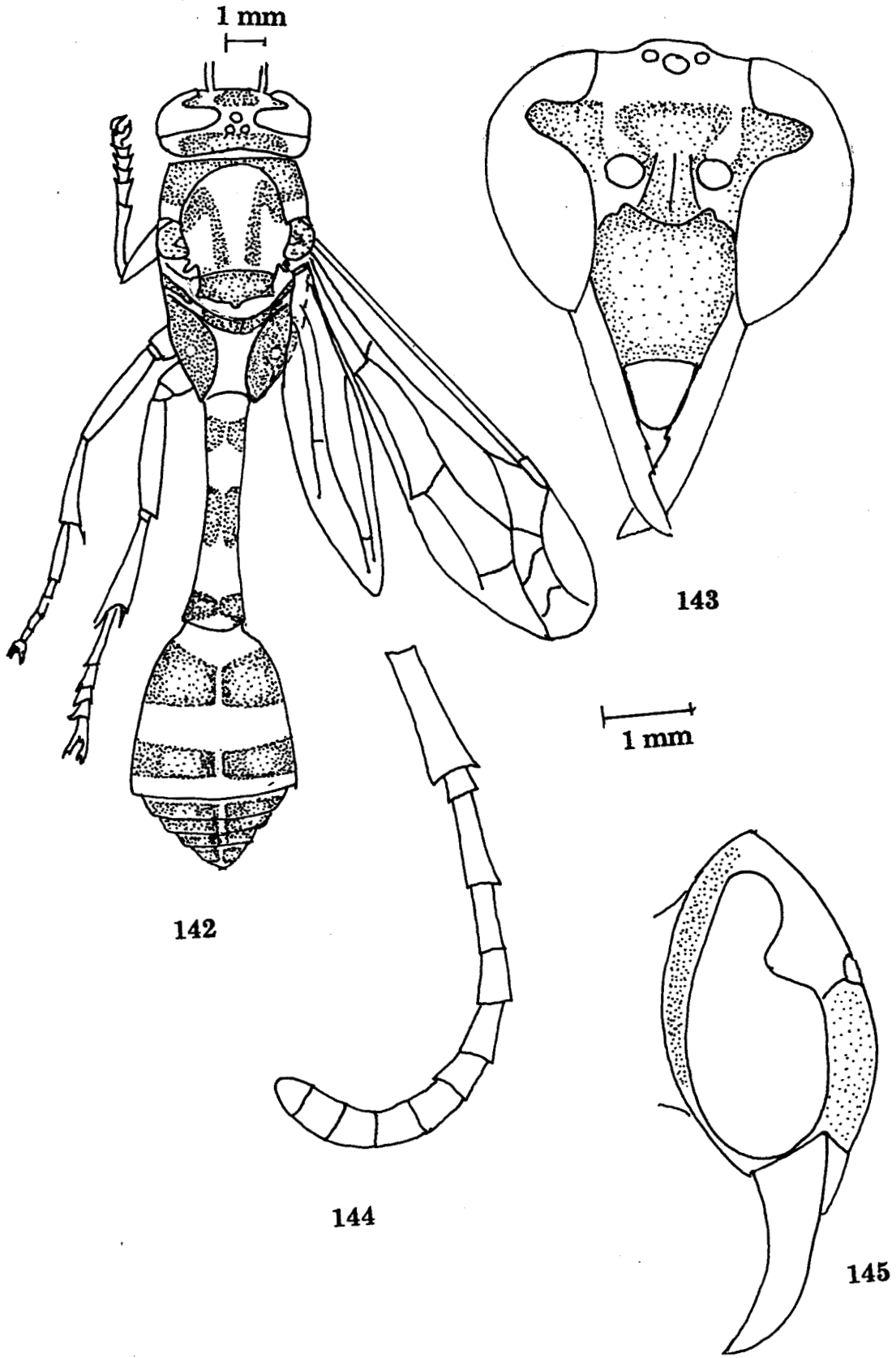


Fig. 142-145. ***Delta arcuata*** **(Fabricius) comb. nov. Female**

Fig. 142. Body dorsal view
Fig. 143. Head front view
Fig. 144. Antenna
Fig. 145. Head profile

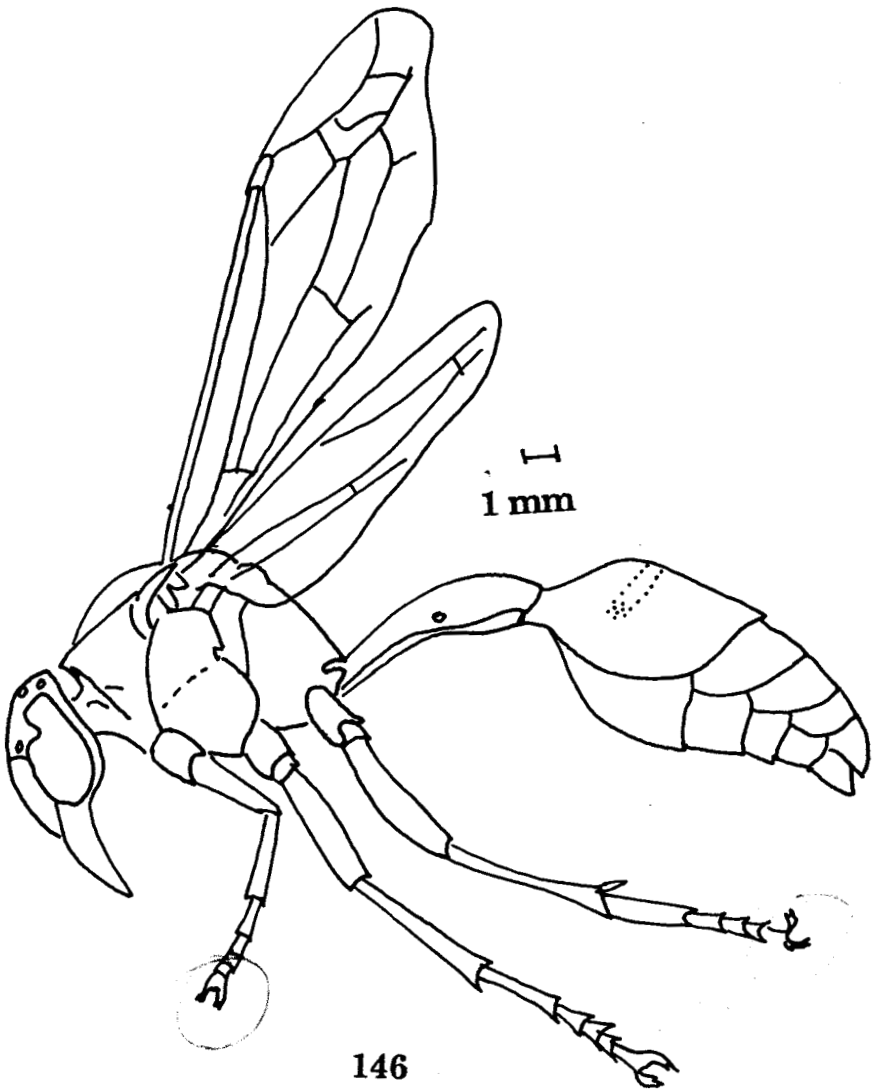
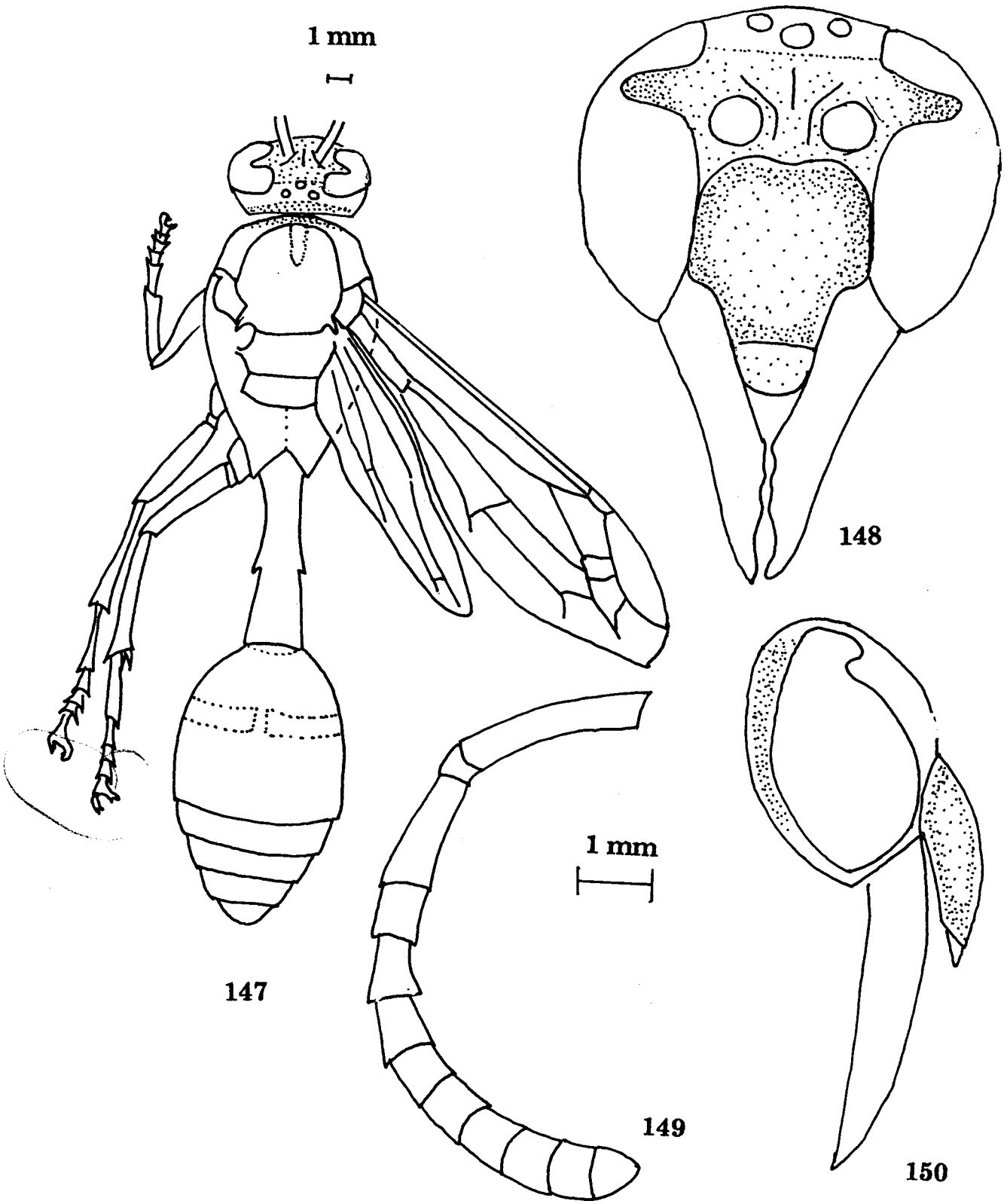


Fig. 146-150. ***Delta conoideus*** **(Gmelin) comb. nov. Female**

Fig. 146. Body profile
Fig. 147. Body dorsal view
Fig. 148. Head front view
Fig. 149. Antenna
Fig. 150. Head profile


1 mm
147
148
1 mm
149
150

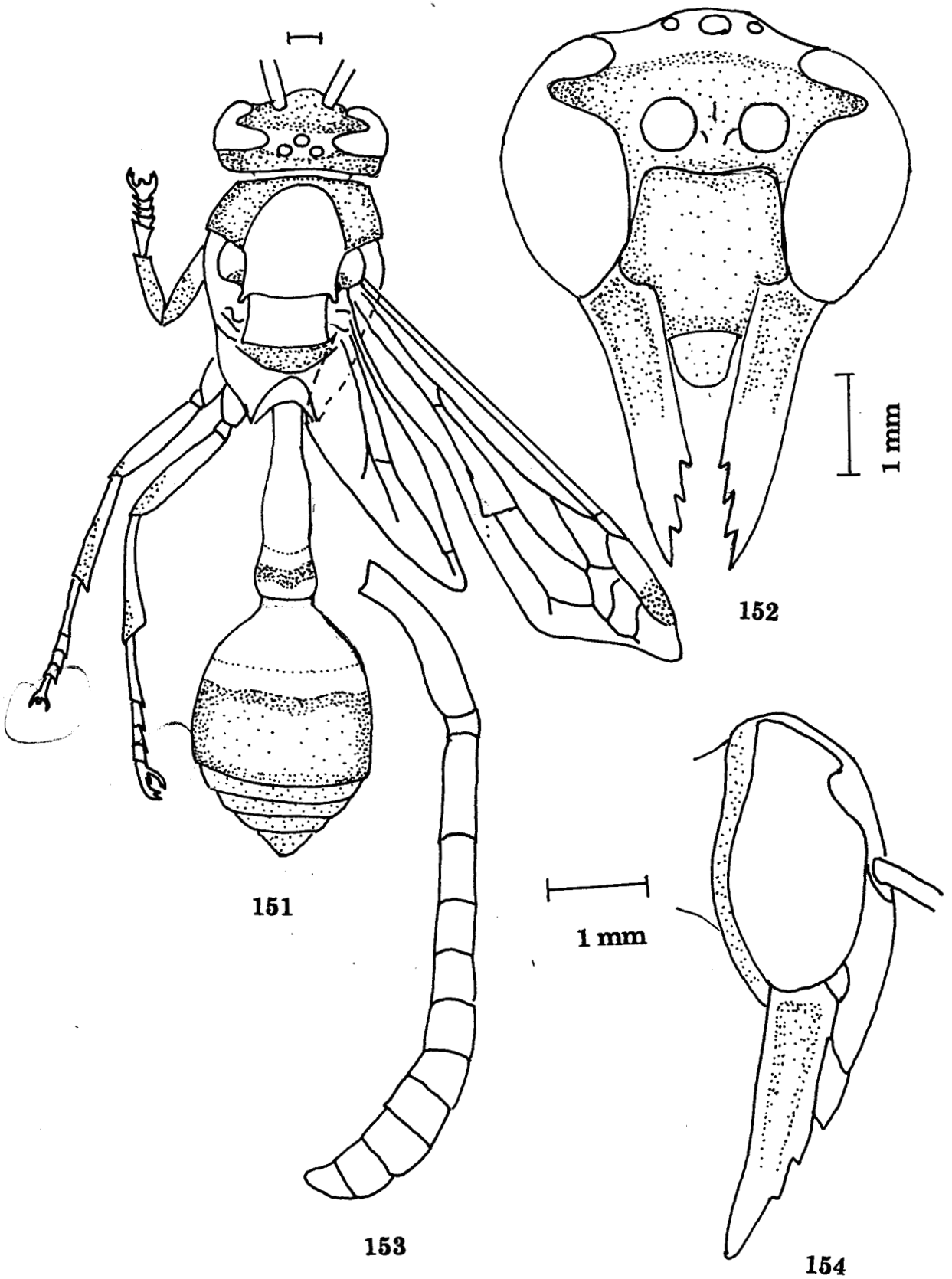


Fig. 151-154. ***Delta esuriens*** **(Fabricius) comb. nov. Female**

Fig. 151. Body dorsal view
Fig. 152. Head front view
Fig. 153. Antenna
Fig. 154. Head profile

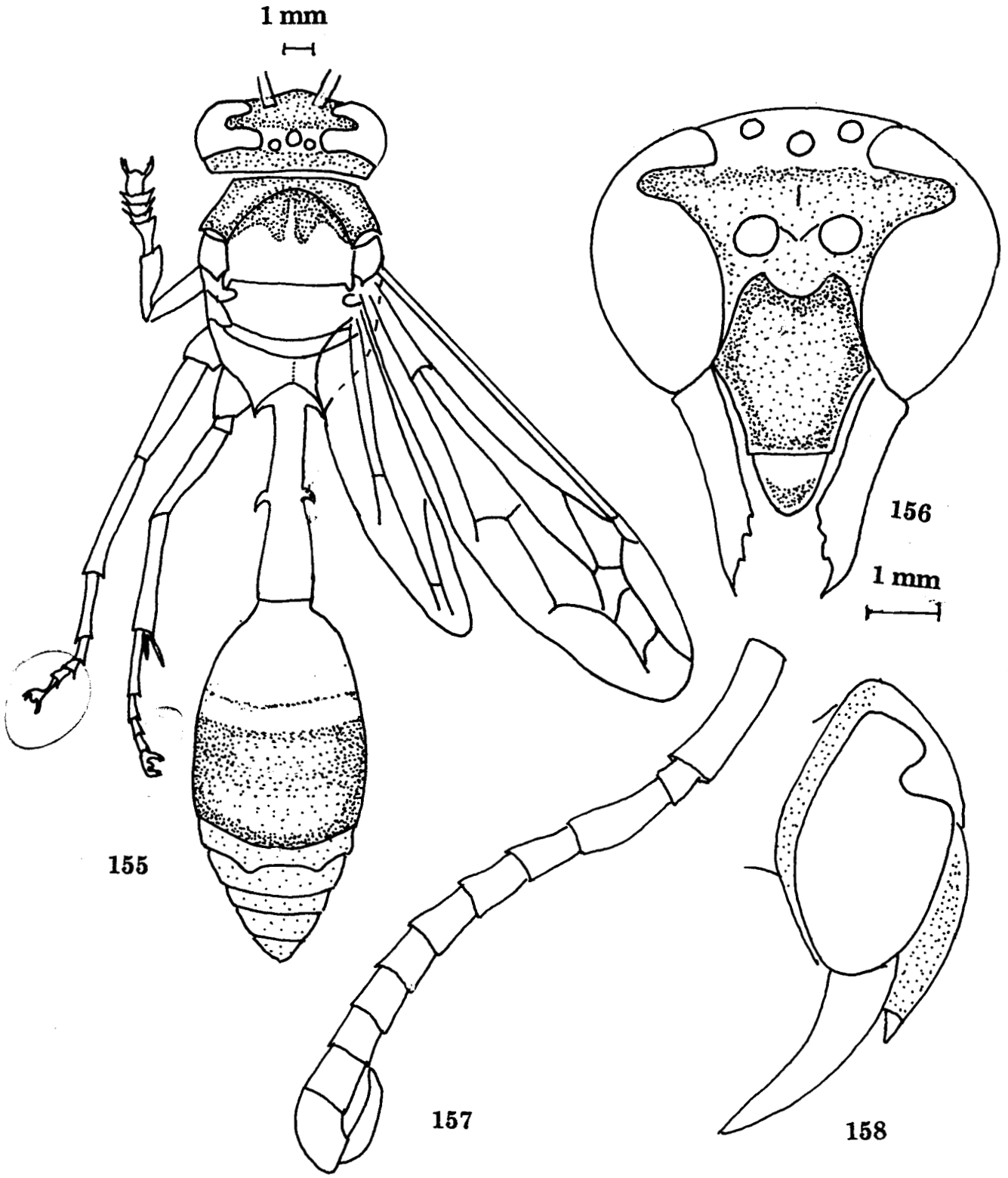
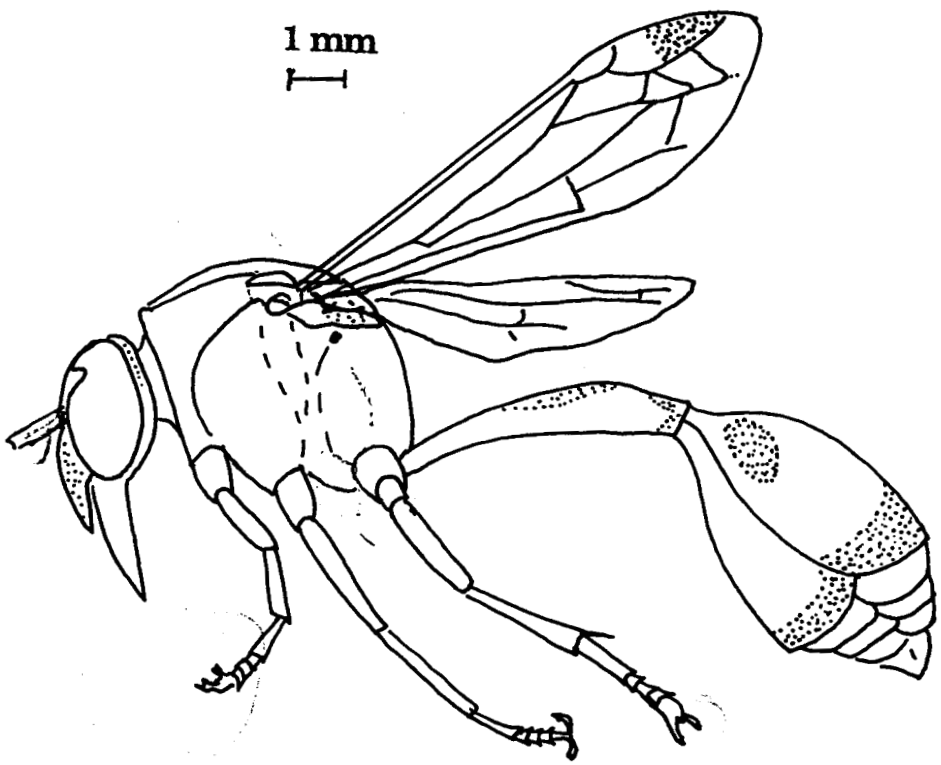


Fig. 155-158. ***Delta petiolata*** **Fabricius comb. nov. Male**

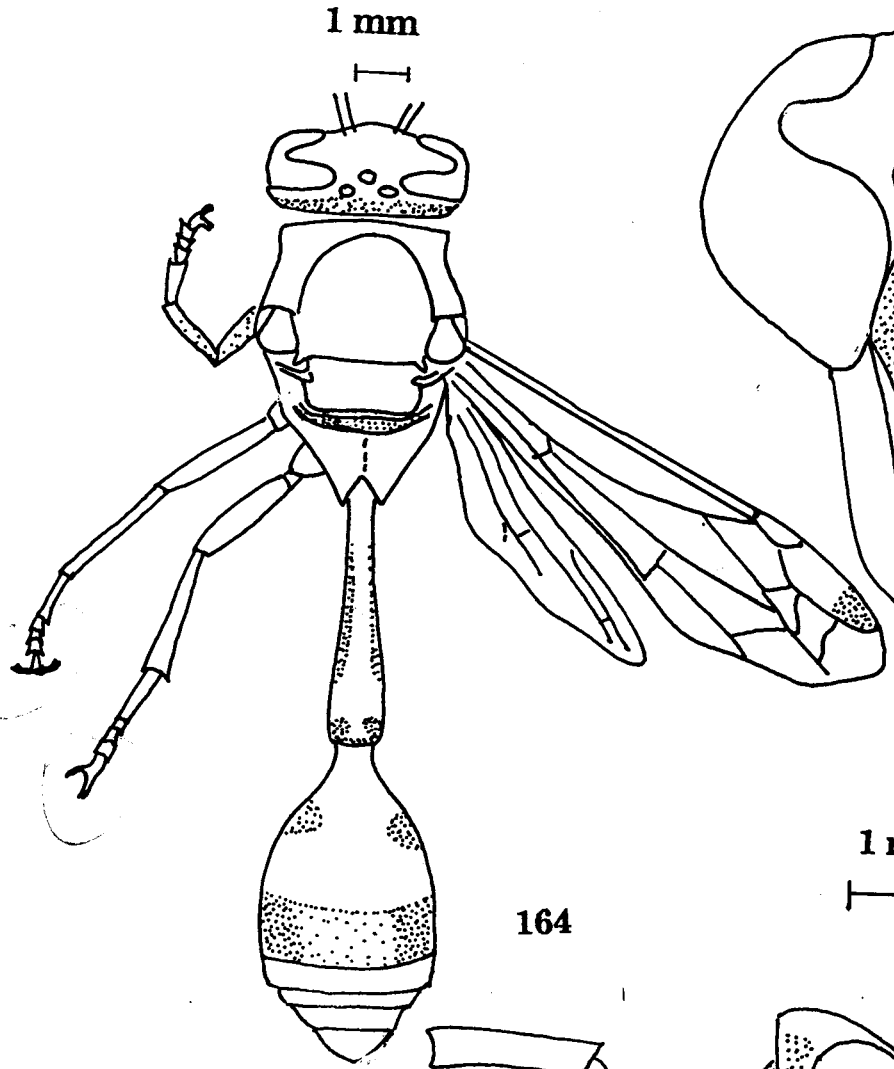
Fig. 155. Body dorsal view
Fig. 156. Head front view
Fig. 157. Antenna
Fig. 158. Head Profile



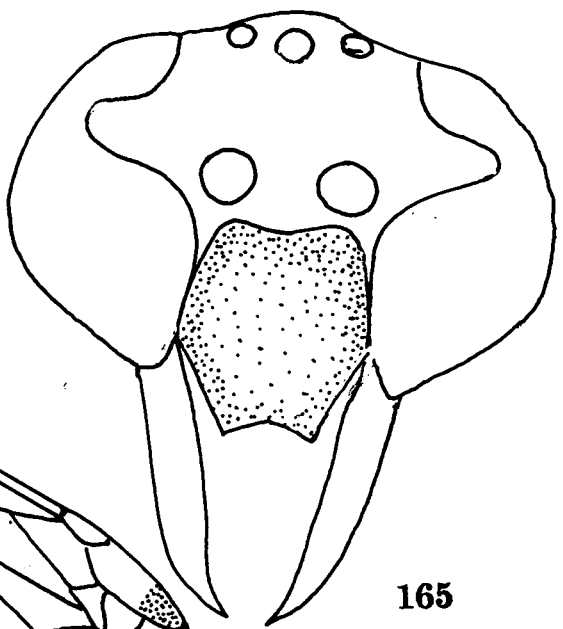
163

Fig. 163-167. ***Eumenes edwardsii*** **Saussure Female**

Fig. 163. Body profile
Fig. 164. Body dorsal view
Fig. 165. Head front view
Fig. 166. Antenna
Fig. 167. Head profile

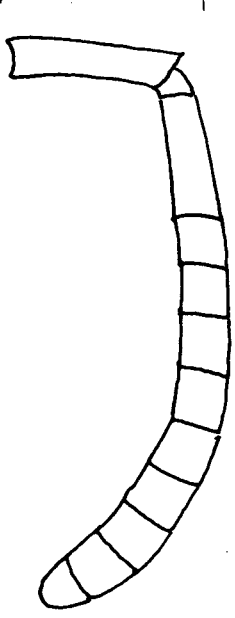


164

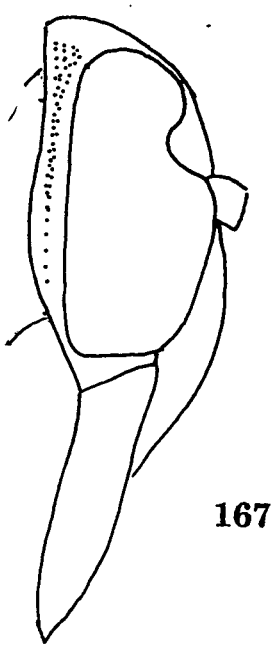


165

1 mm



166



167

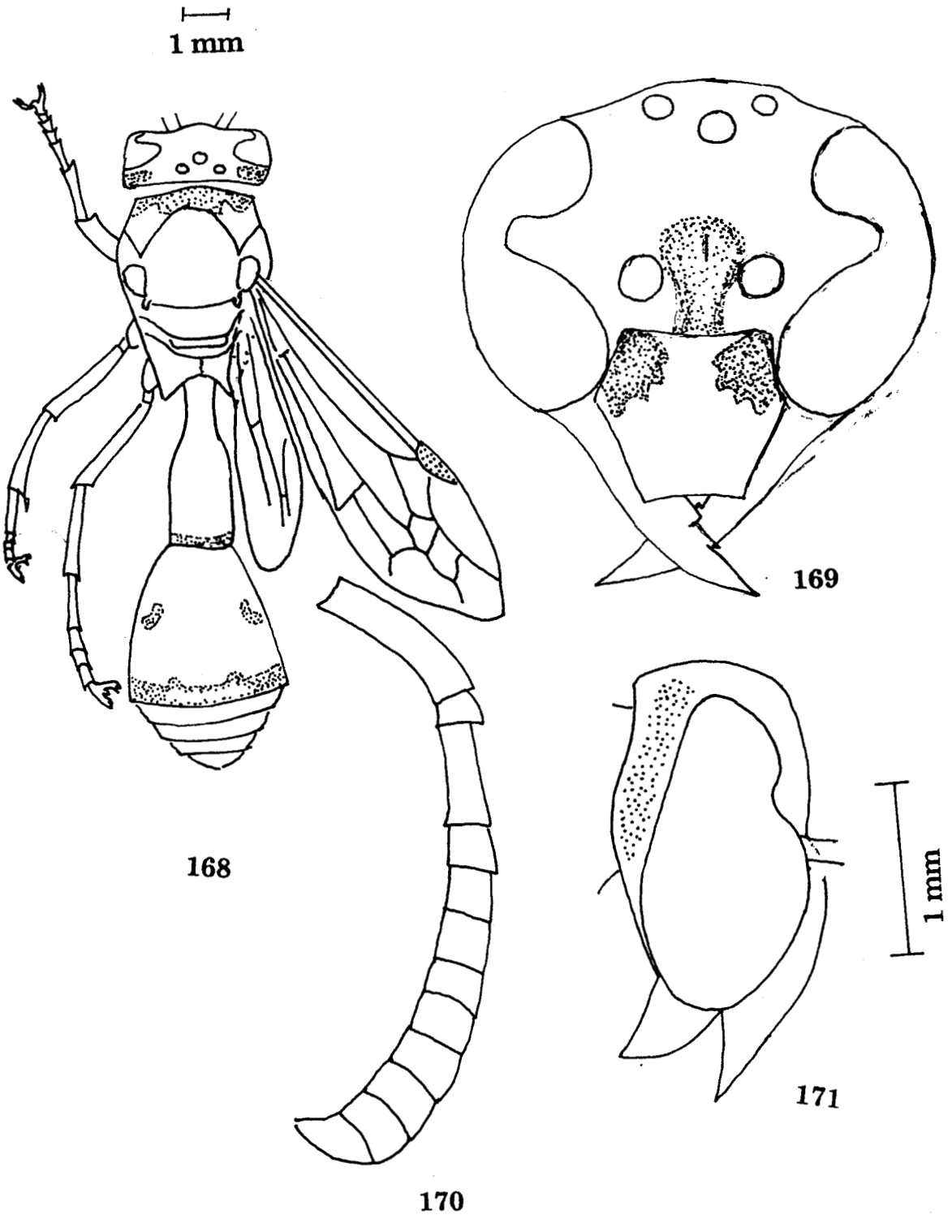
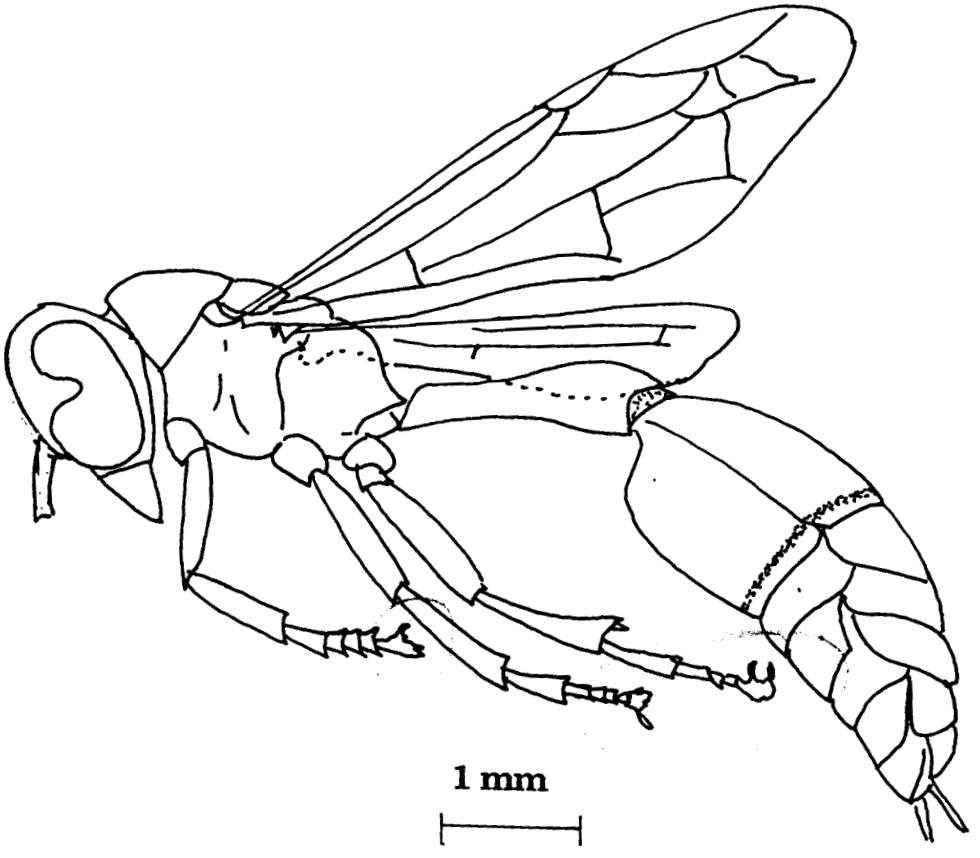


Fig. 168-171. ***Eumenes punctata*** **Saussure Female**

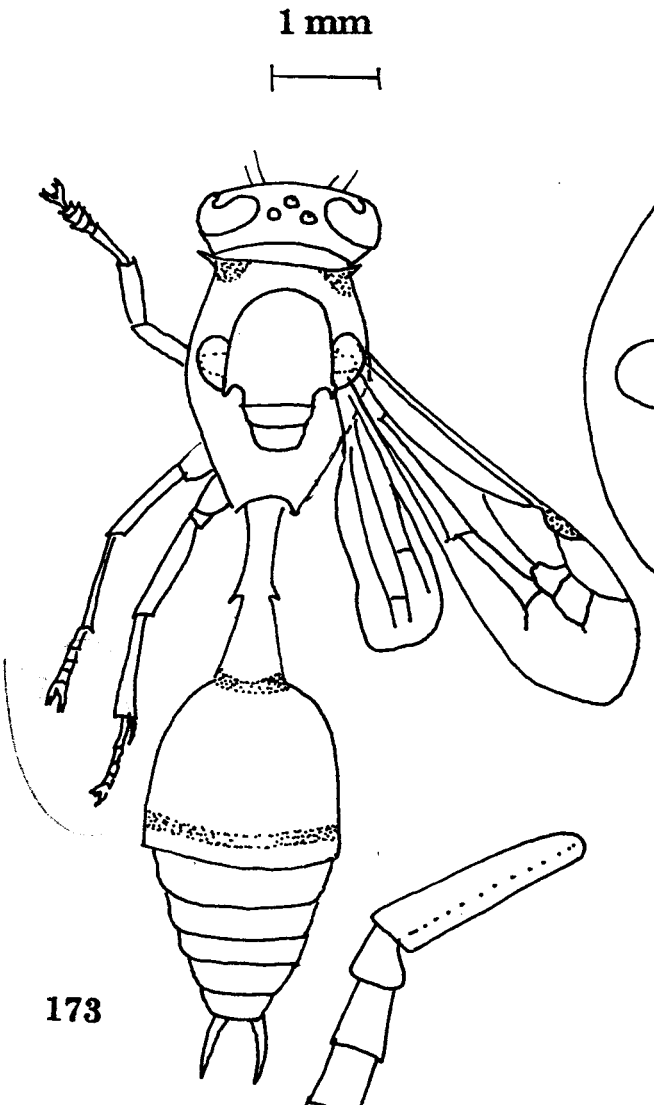
Fig. 168. Body dorsal view
Fig. 169. Head front view
Fig. 170. Antenna
Fig. 171. Head profile



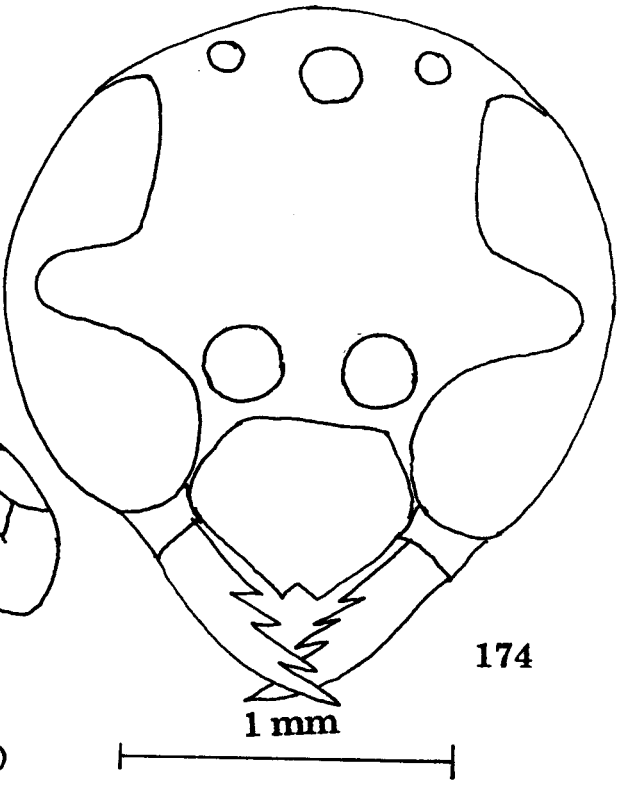
172

Fig. 172-176. ***Labius humbertianus*** **Saussure Male**

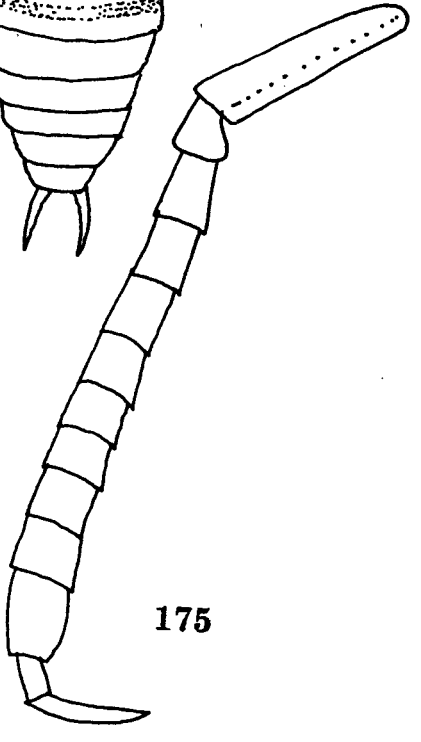
Fig. 172. Body profile
Fig. 173. Body dorsal view
Fig. 174. Head front view
Fig. 175. Antenna
Fig. 176. Head profile



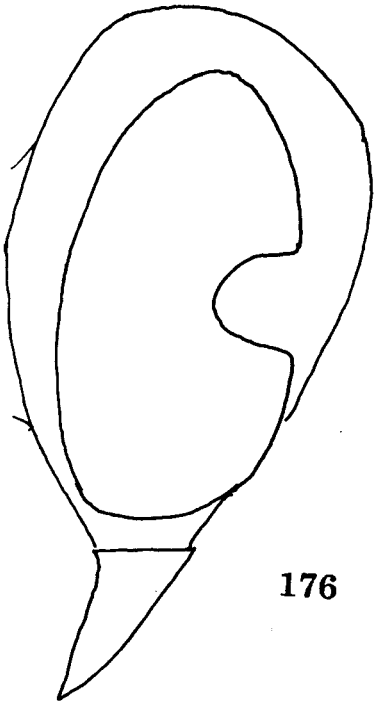
173



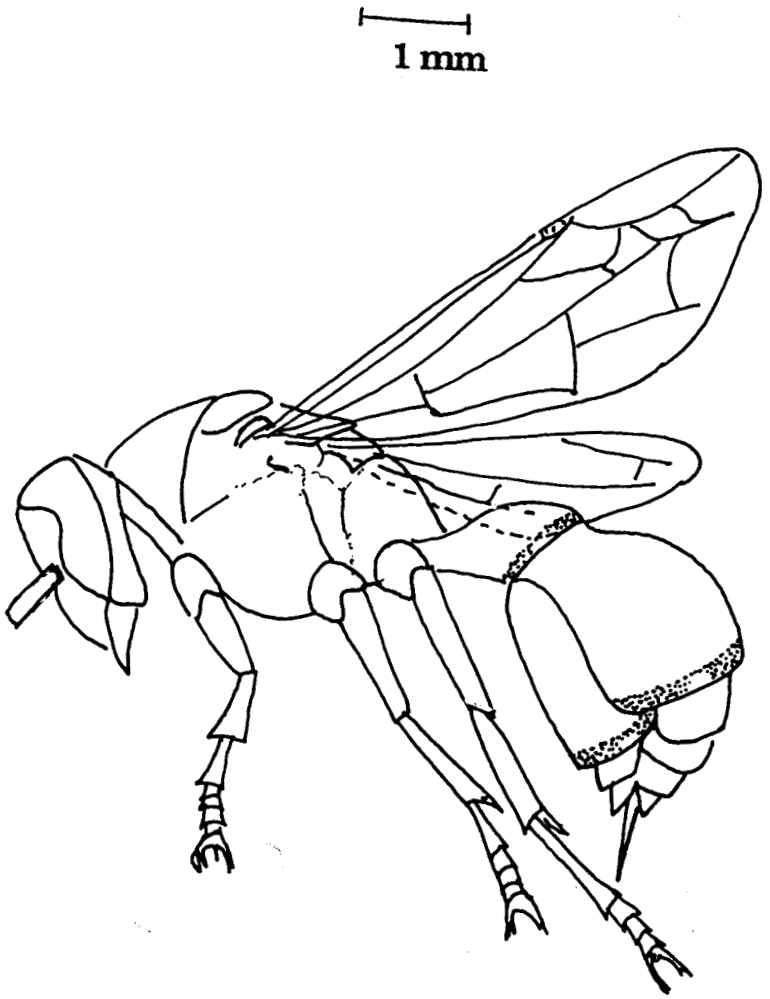
174



175



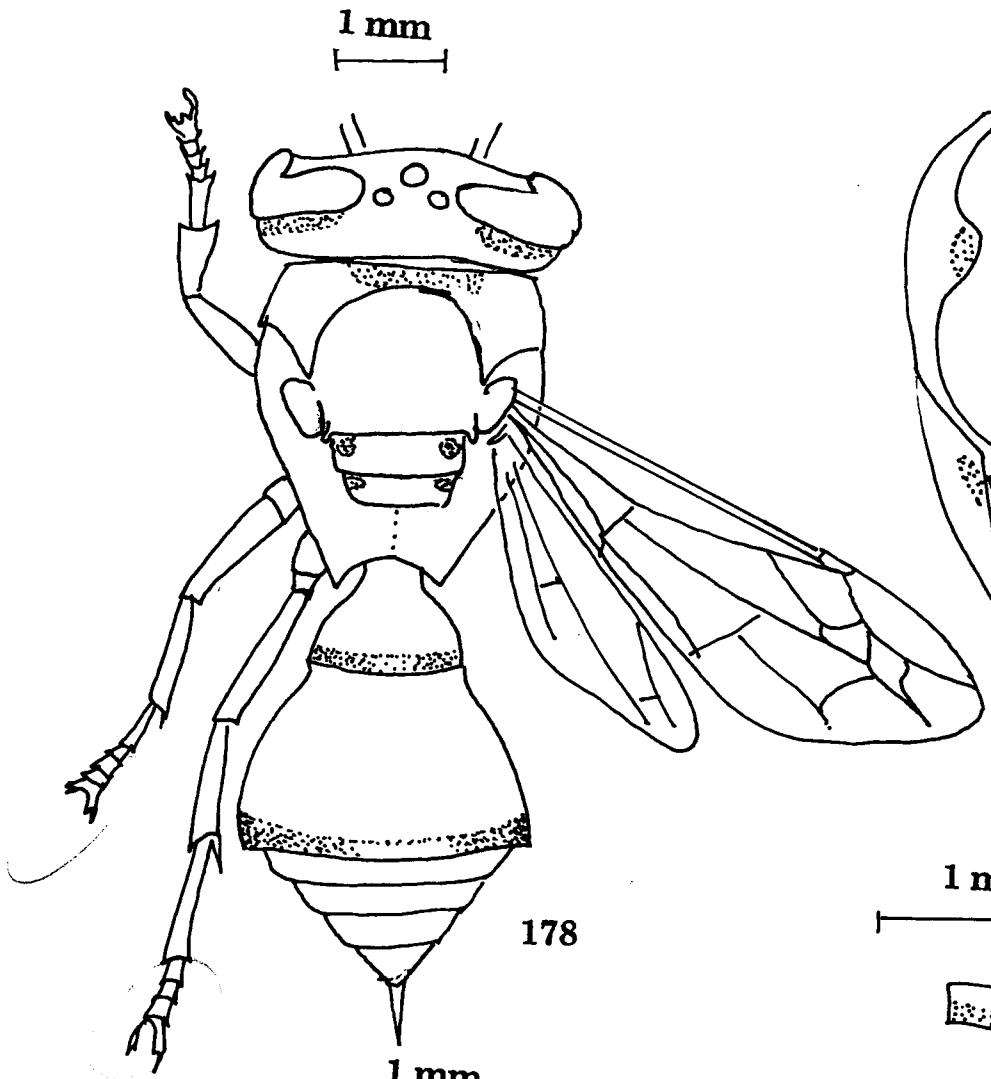
176



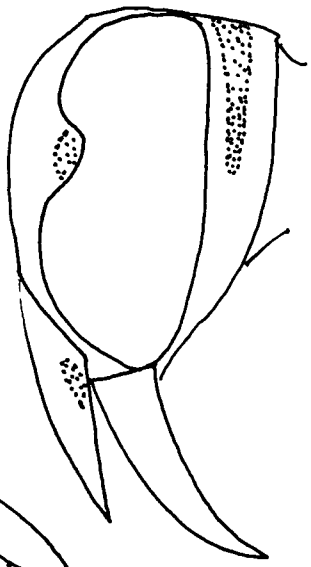
177

Fig. 177-181. ***Odynerus miniatus*** **Saussure Female**

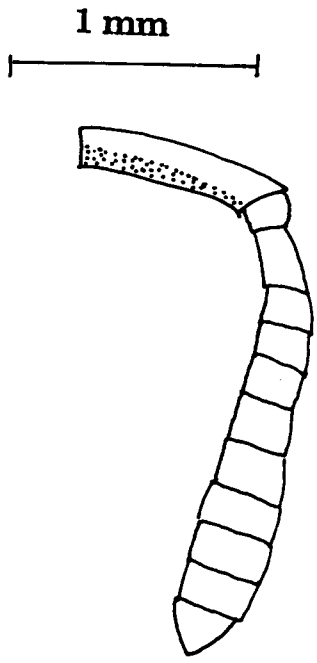
Fig. 177. Body profile
Fig. 178. Body dorsal view
Fig. 179. Head front view
Fig. 180. Antenna
Fig. 181. Head profile



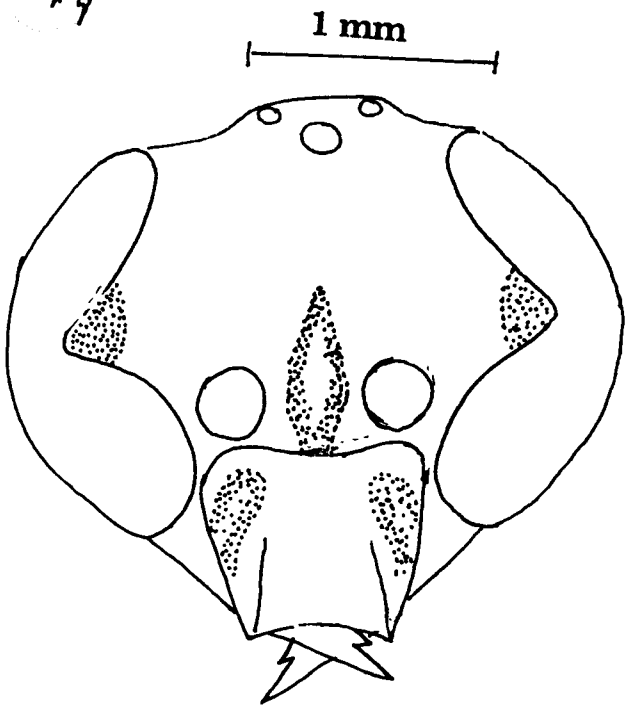
178



181



180



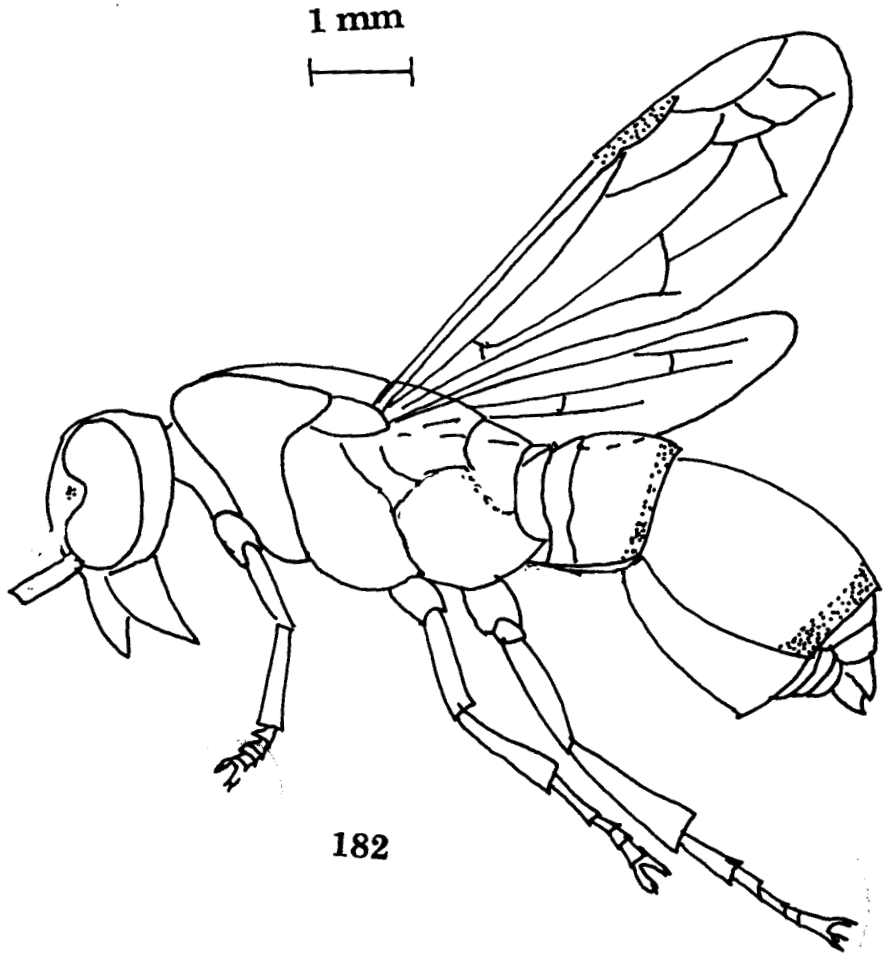
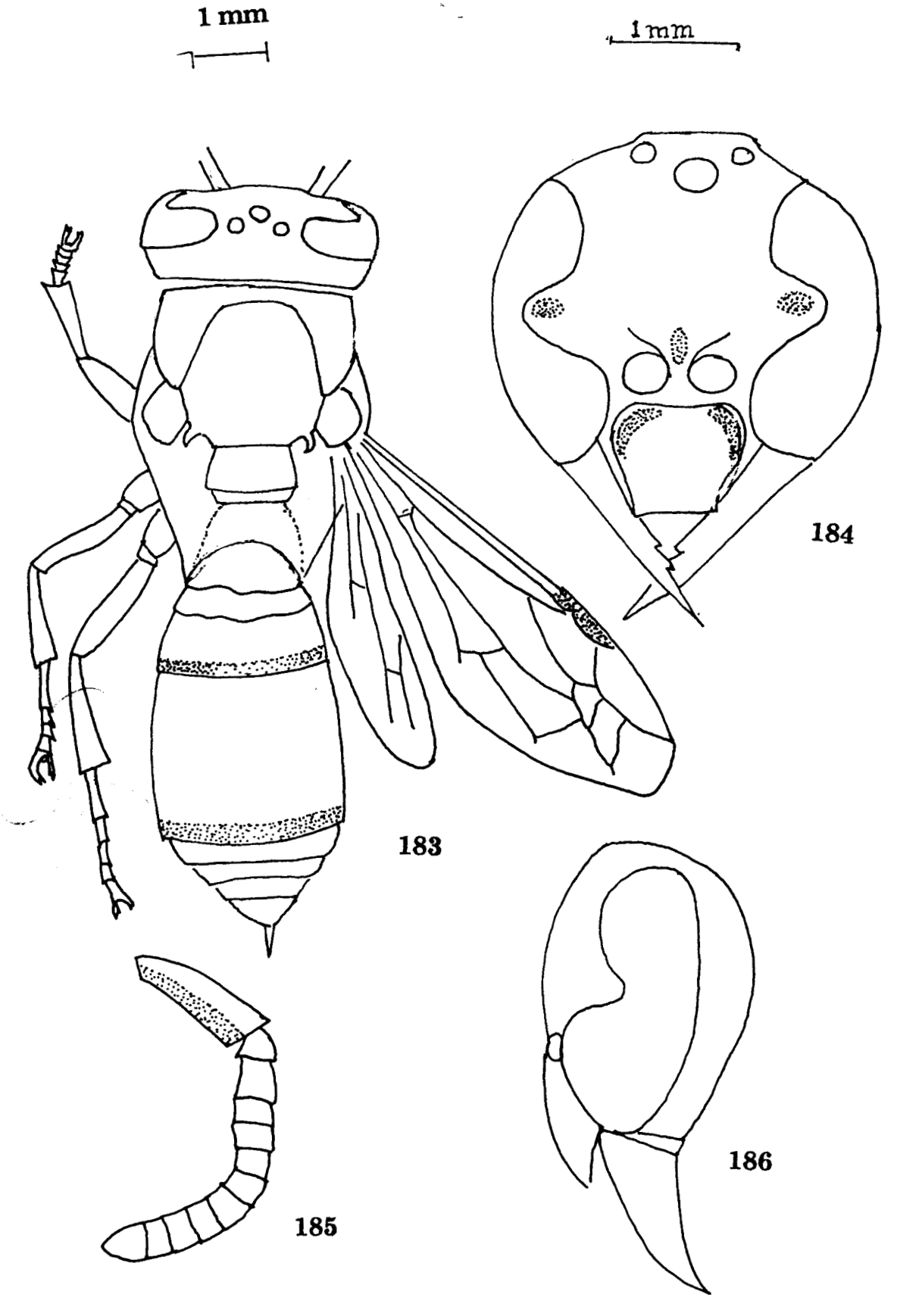


Fig. 182-186. ***Orancistrocerus sichelii*** **Saussure comb. nov. Female**

Fig. 182. Body profile
Fig. 183. Body dorsal view
Fig. 184. Head front view
Fig. 185. Antenna
Fig. 186. Head profile


1 mm
1 mm
183
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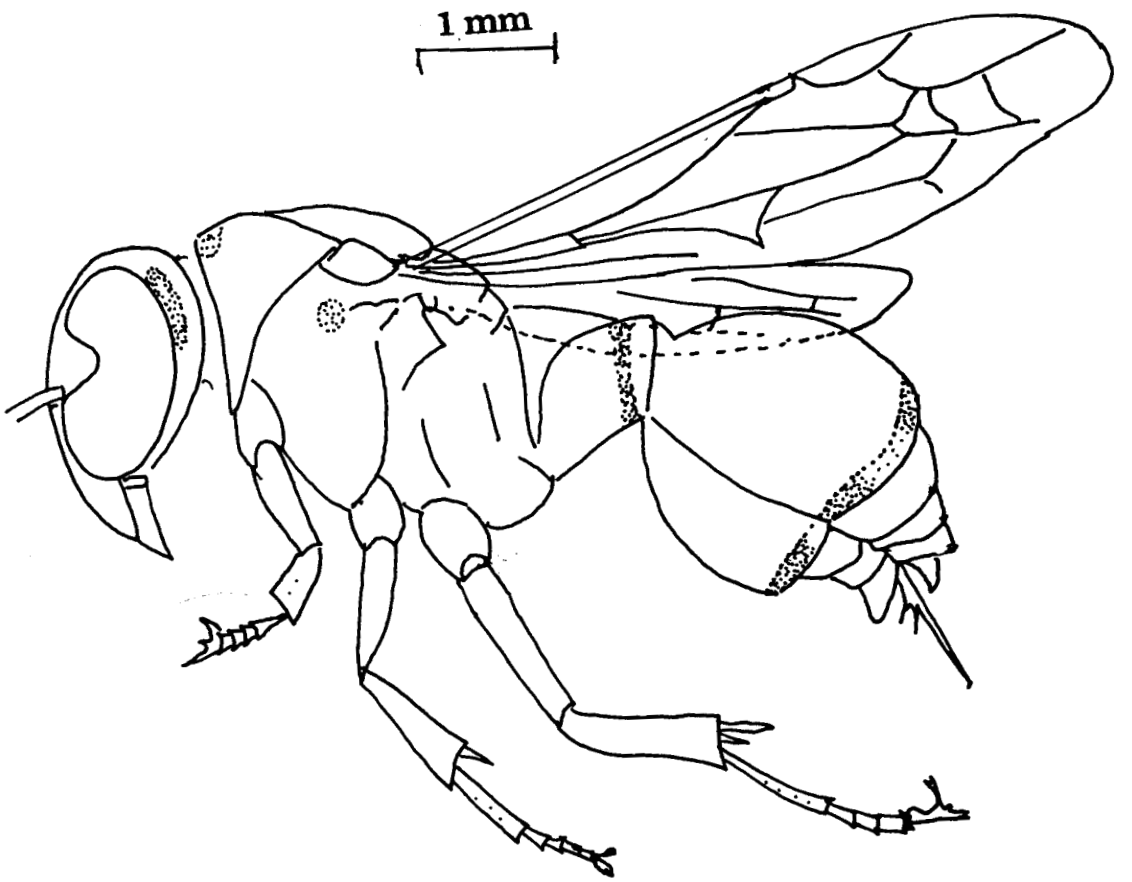
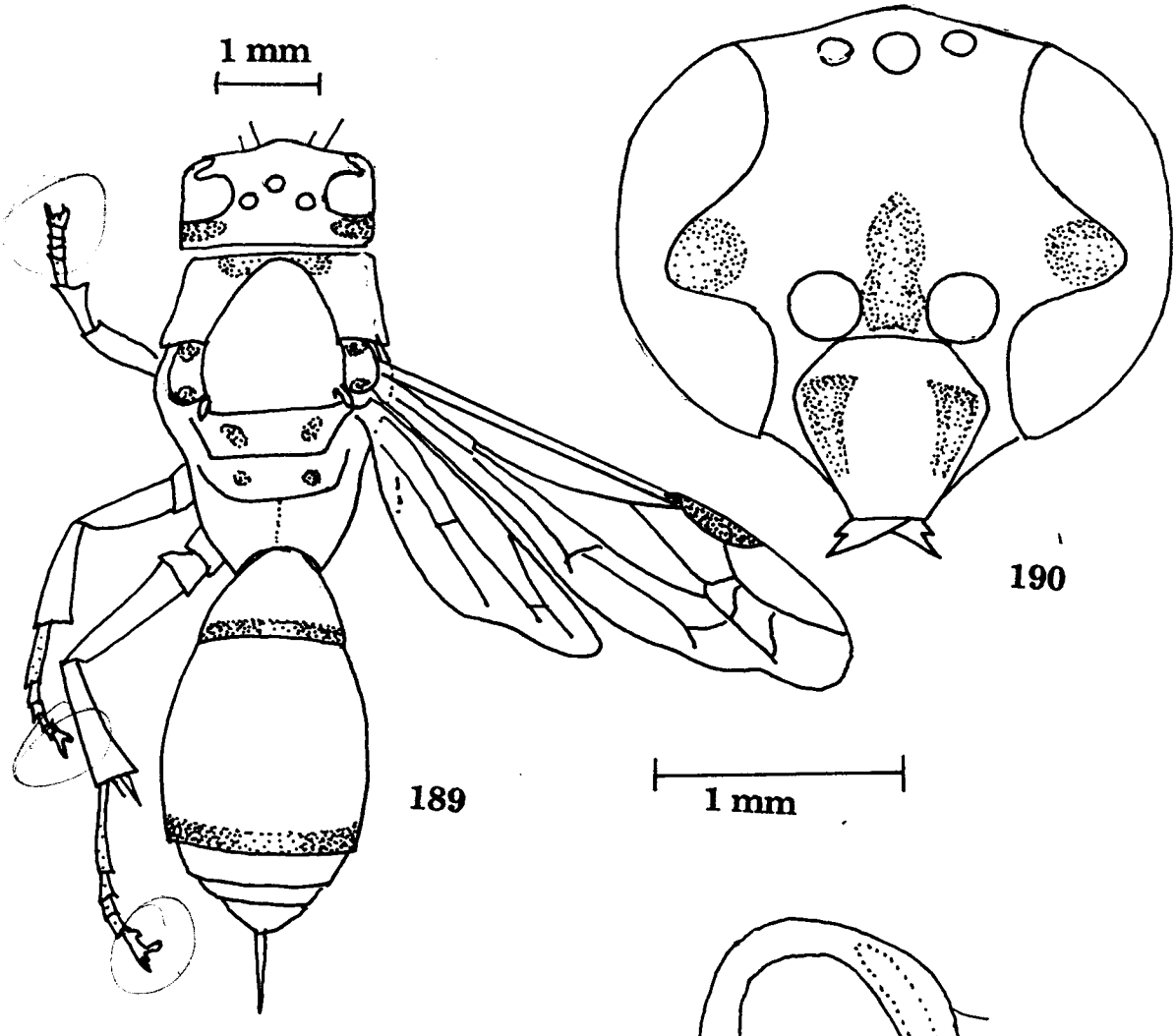
185
186



188

Fig. 188-192. ***Paraleptomenes*** **sp. indet. Female**

Fig. 188. Body profile
Fig. 189. Body dorsal view
Fig. 190. Head front view
Fig. 191. Antenna
Fig. 192. Head profile



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192

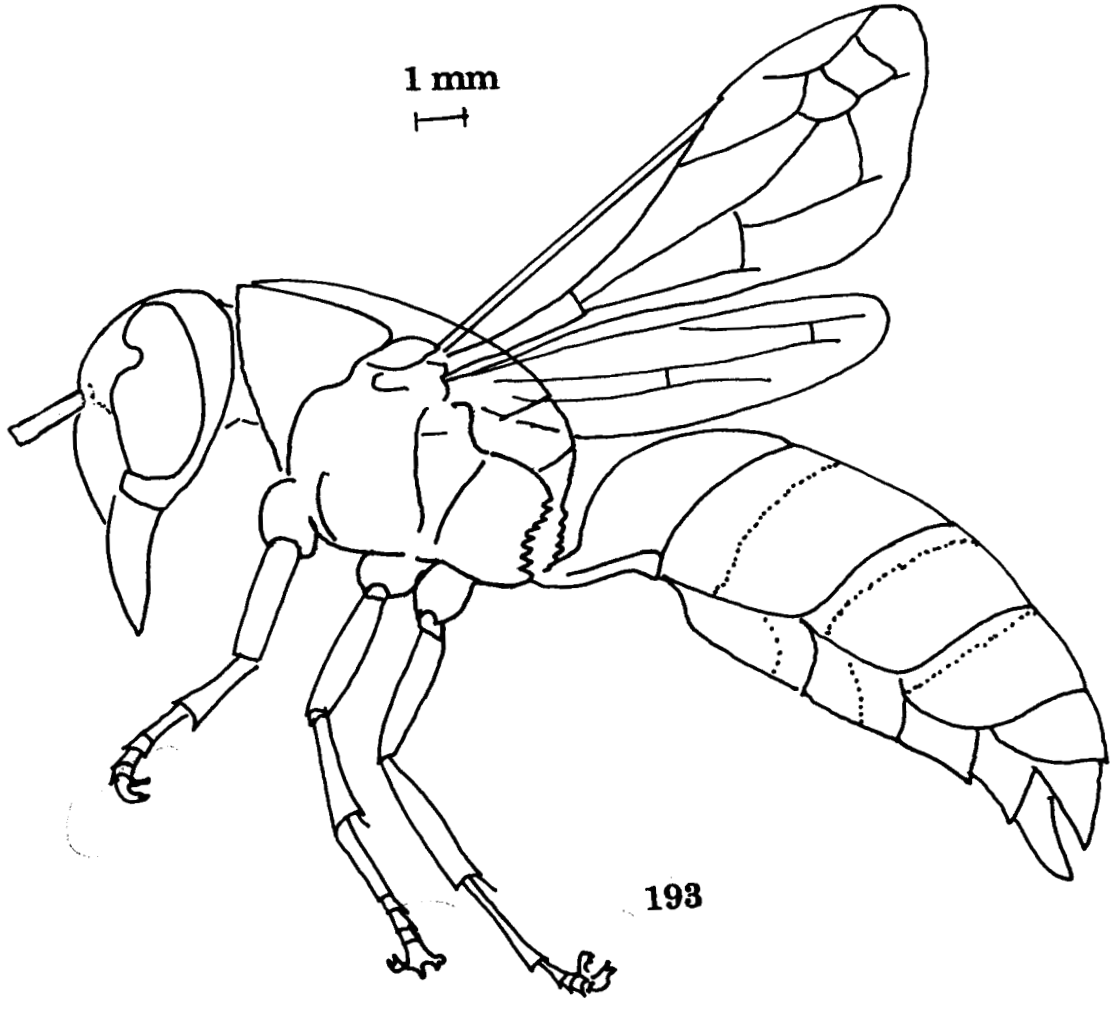
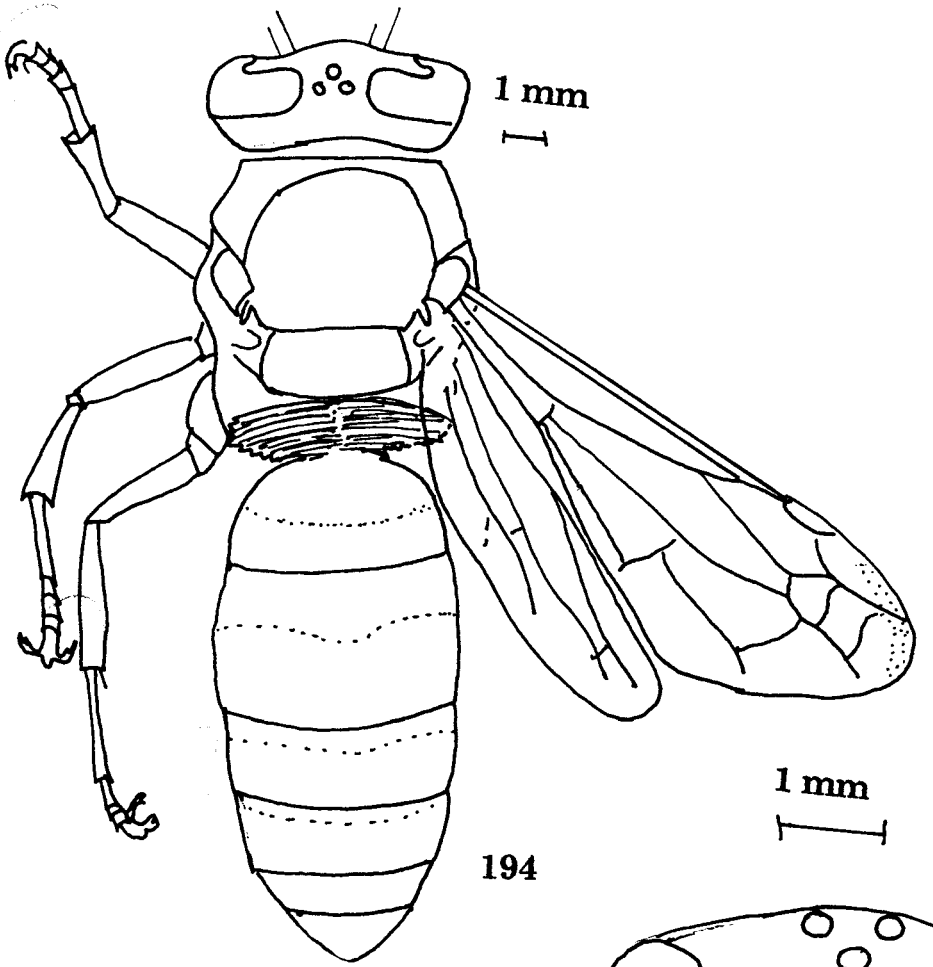


Fig. 193-197. ***Rhynchium brunneum brunneum*** **(Fabricius) Female**

Fig. 193. Body profile
Fig. 194. Body dorsal view
Fig. 195. Antenna
Fig. 196. Head profile
Fig. 197. Head front view.



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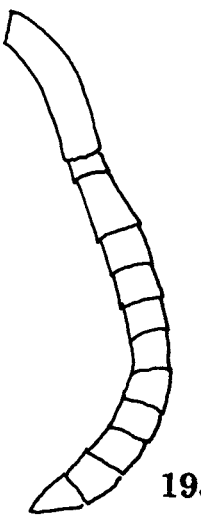

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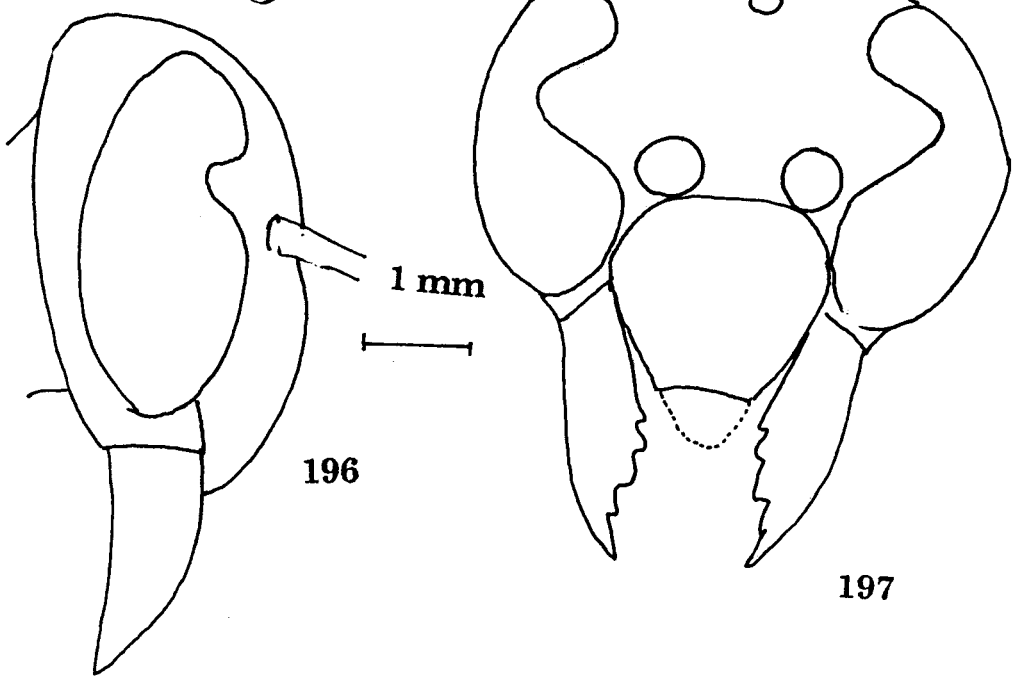
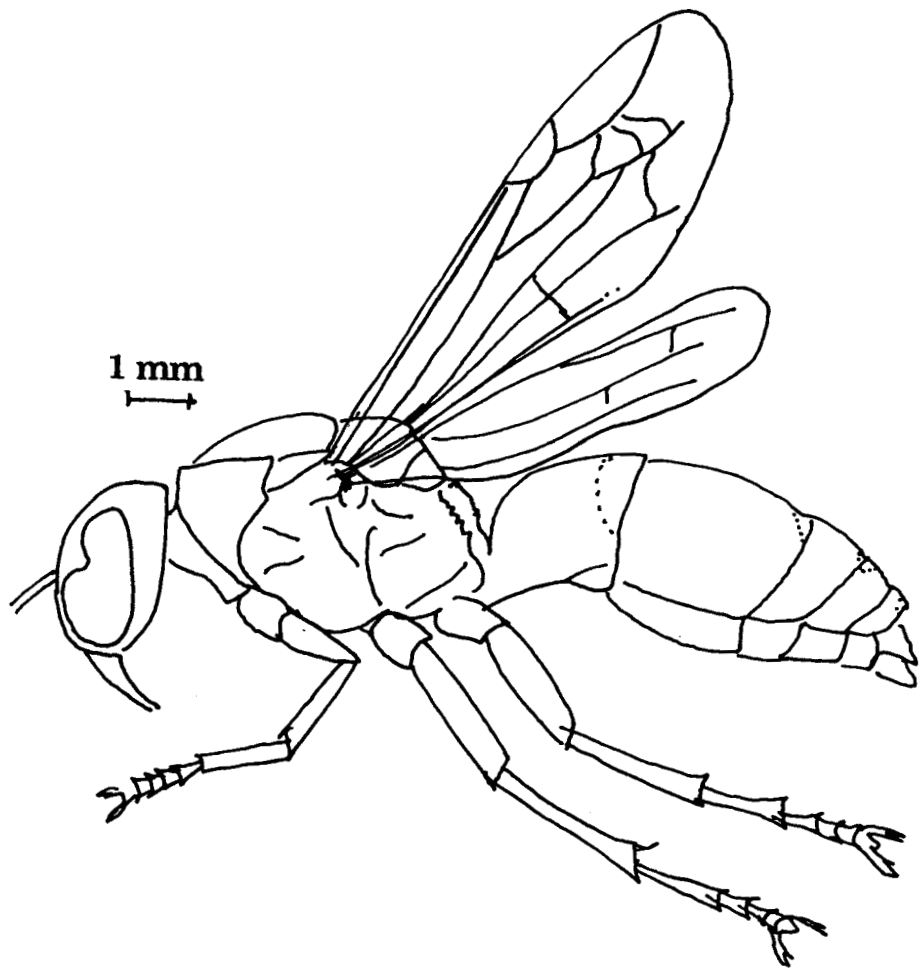


196

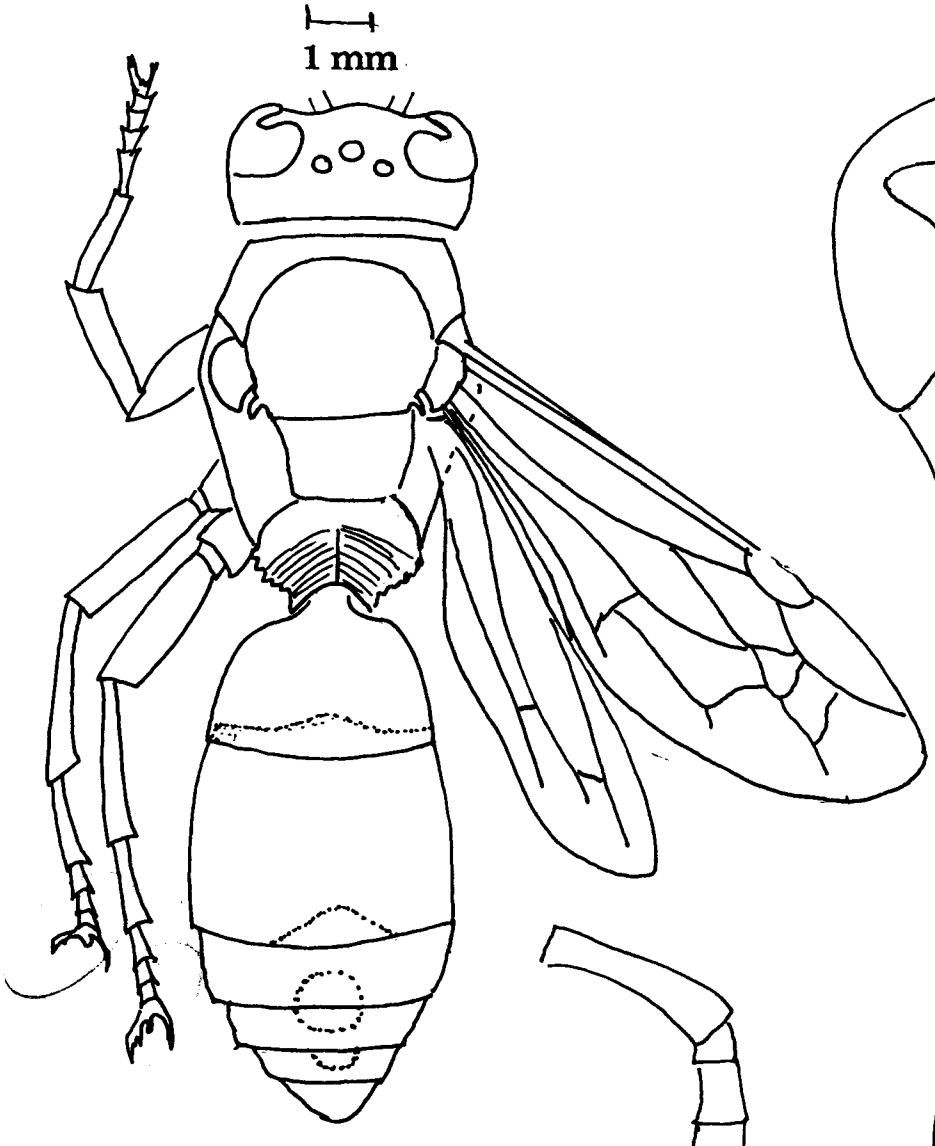
197



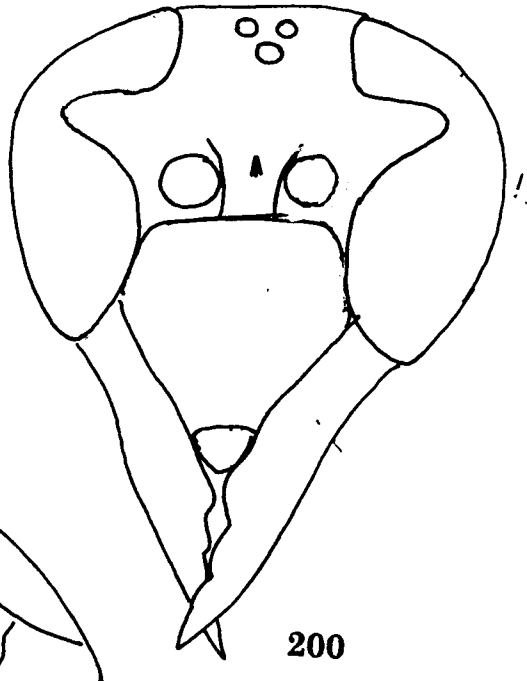
198

Fig. 198-202. ***Xenorhynchium abdominale*** **Illiger comb. nov. Female**

Fig. 198. Body profile
Fig. 199. Body dorsal view
Fig. 200. Head front view
Fig. 201. Antenna
Fig. 202. Head profile



199



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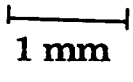

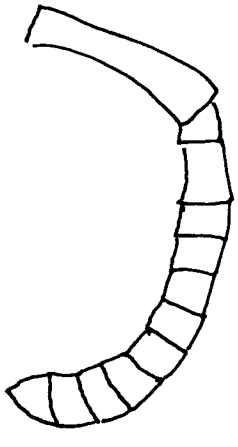

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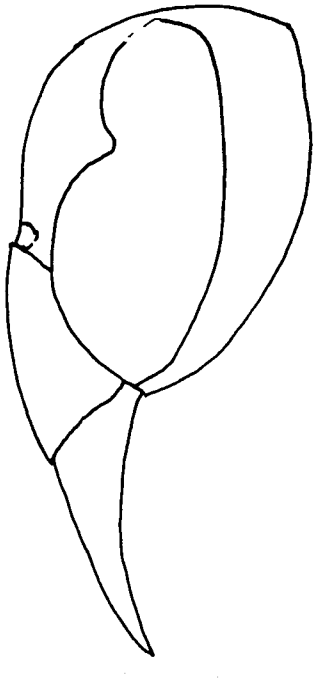


202

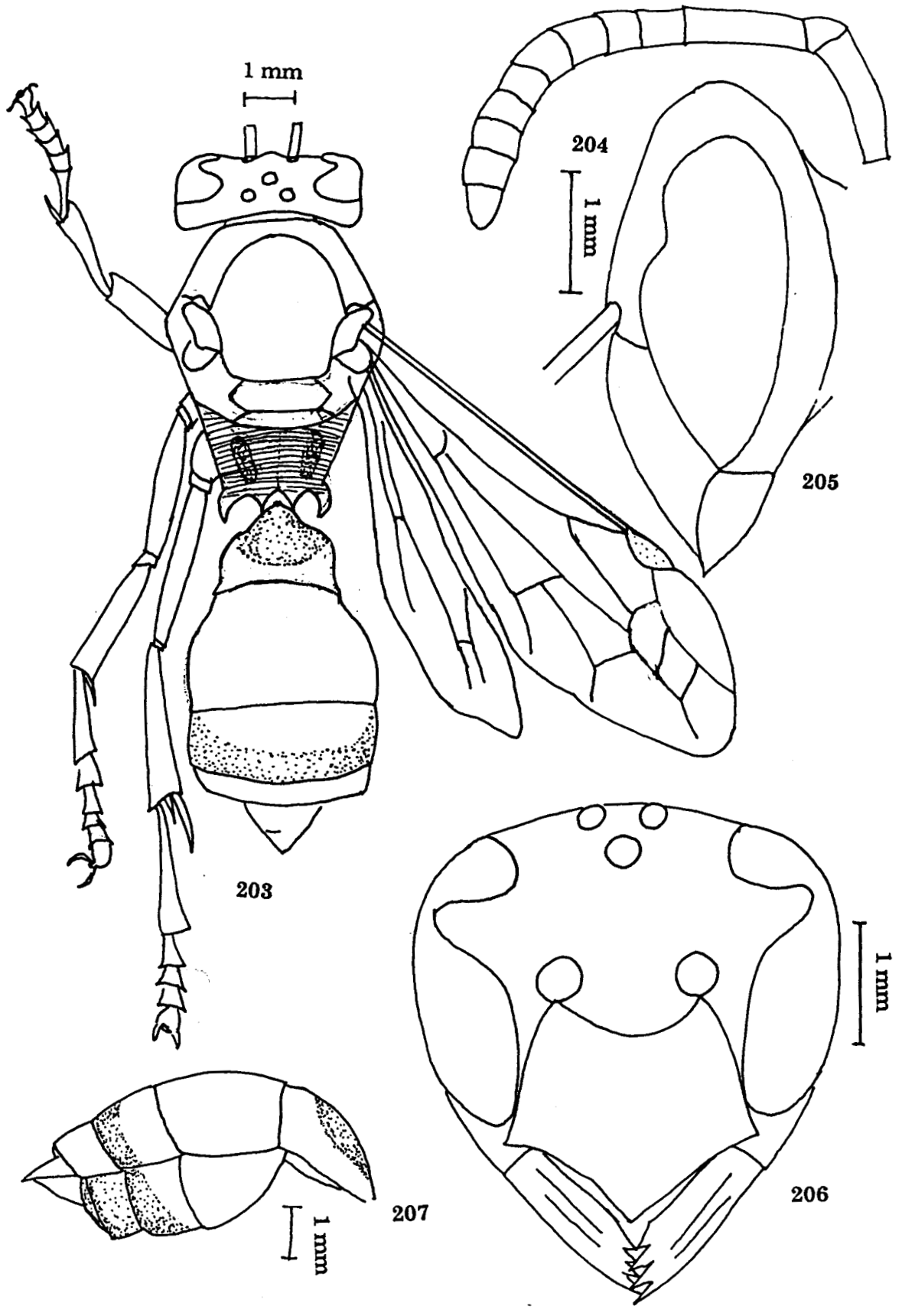
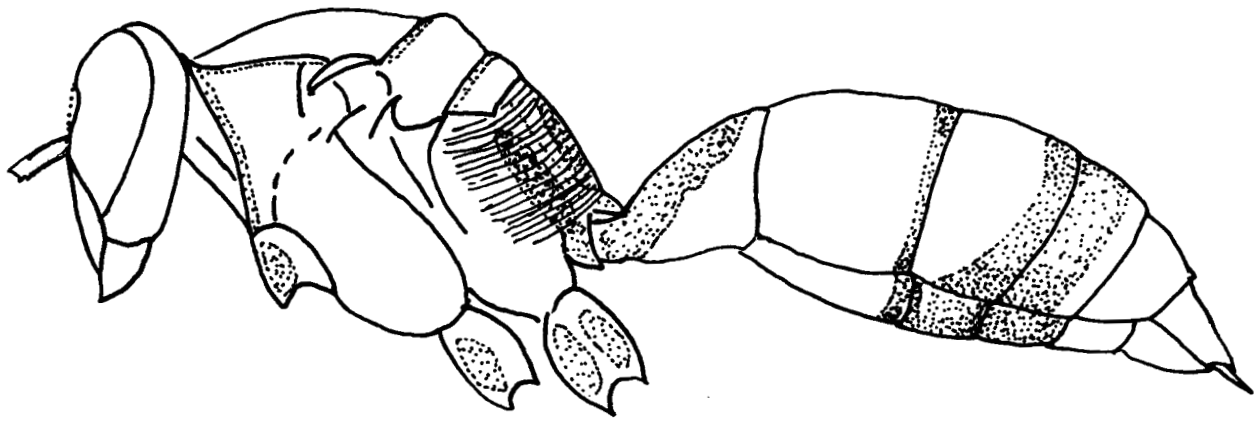


Fig. 203-207. ***Polistes (Polistella) stigma nigra*** **subsp. nov. Female**

Fig. 203. Body dorsal view
Fig. 204. Antenna
Fig. 205. Head profile
Fig. 206. Head front view
Fig. 207. Metasoma

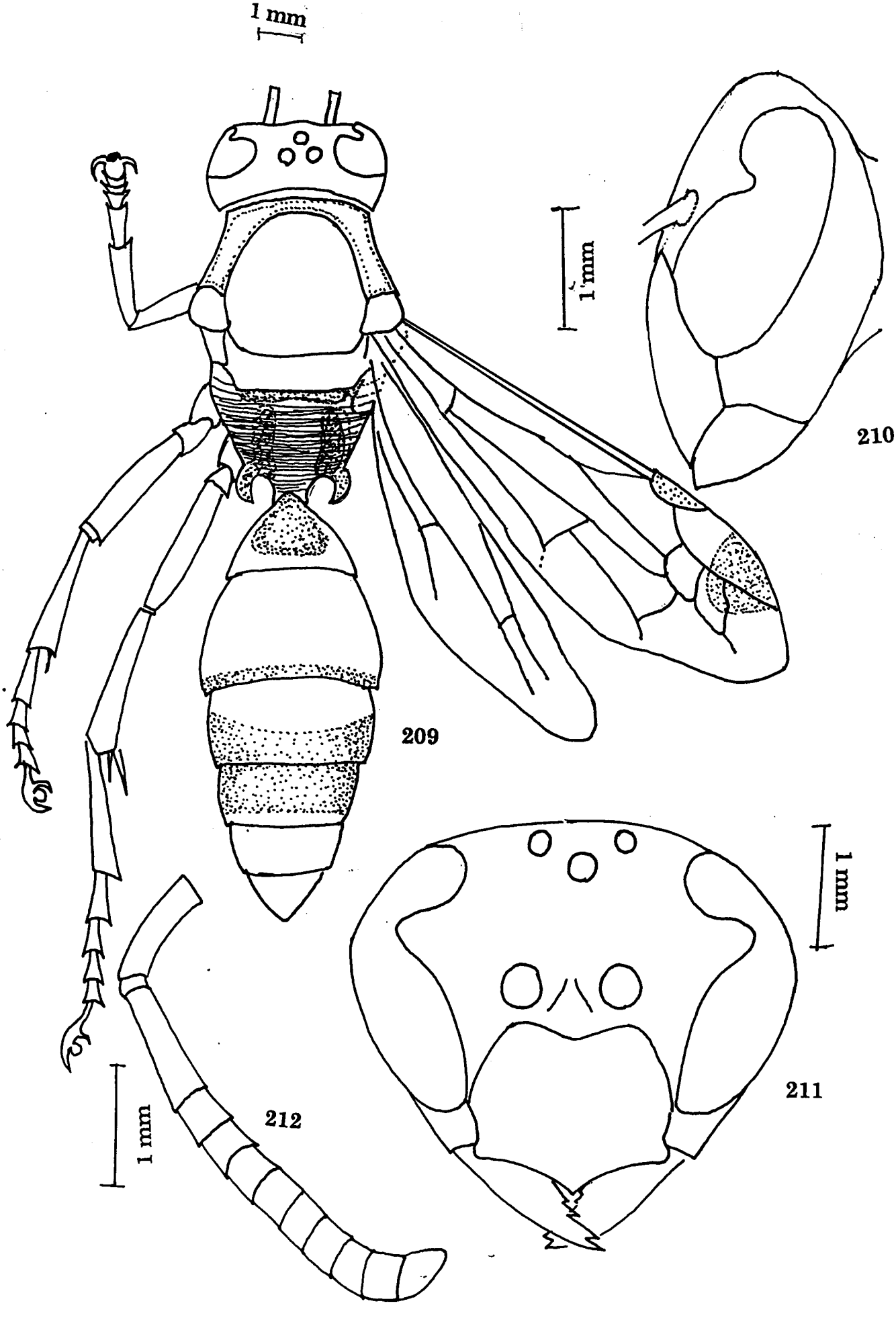


208

1 mm

Fig. 208-212. ***Polistes (Polistella) sauiensis*** **Peterson Female**

Fig. 208. Body profile
Fig. 209. Body dorsal view
Fig. 210. Head profile
Fig. 211. Head front view
Fig. 212. Antenna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209
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210
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212

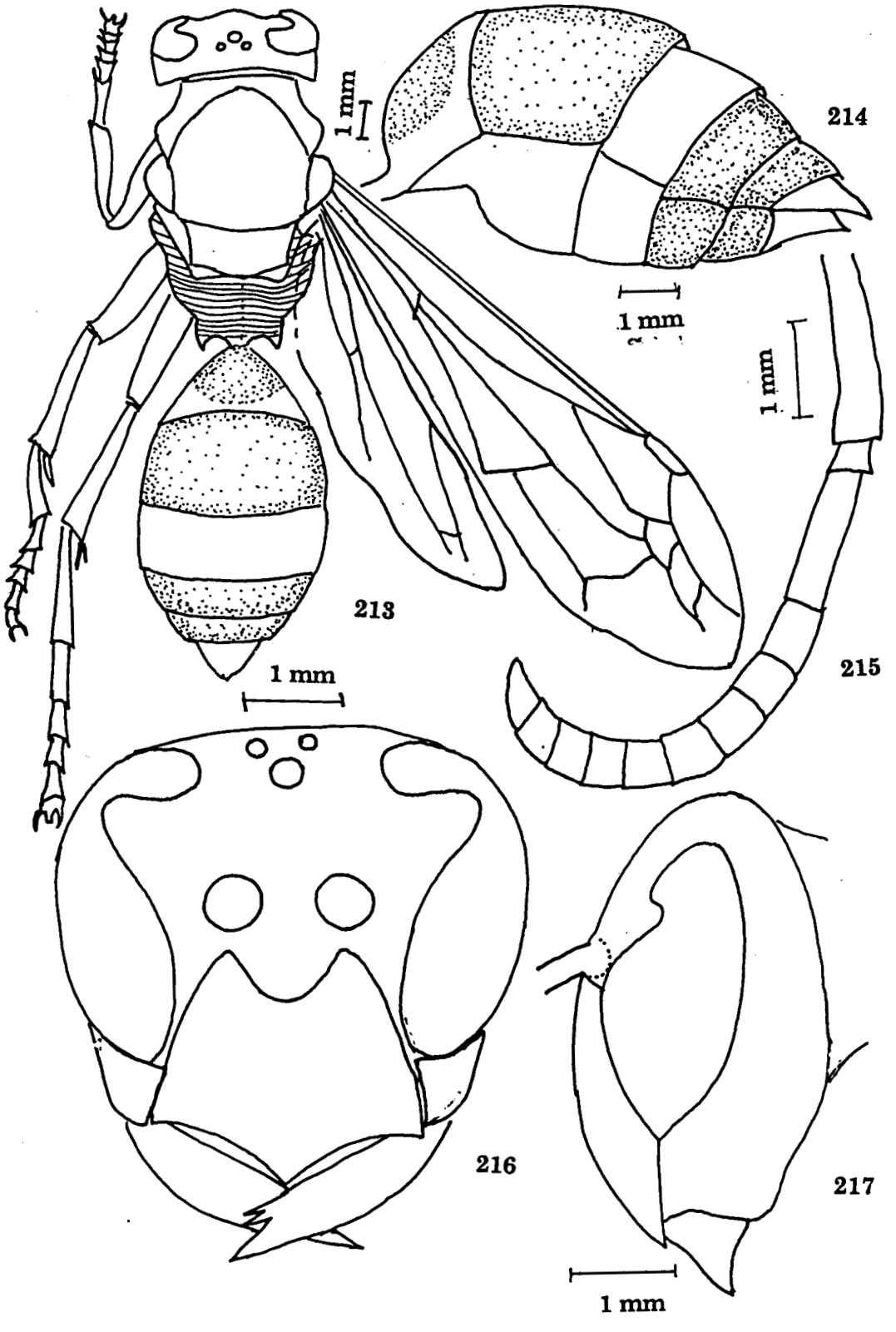


Fig. 213-217. ***Polistes (Polistella) strigosus atratus*** **Das & Gupta Female**

Fig. 213. Body dorsal view
Fig. 214. Metasoma
Fig. 215. Antenna
Fig. 216. Head front view
Fig. 217. Head profile

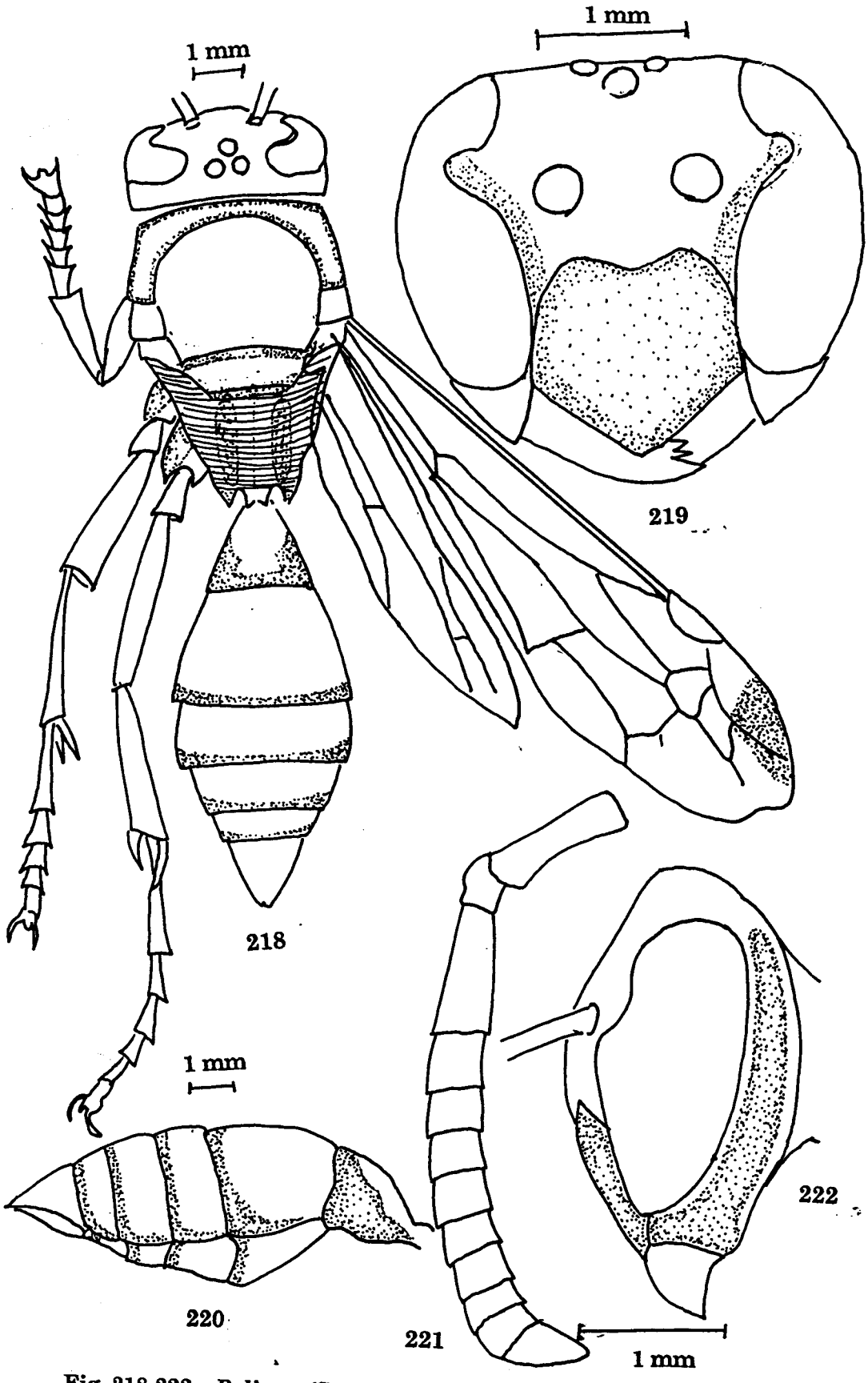
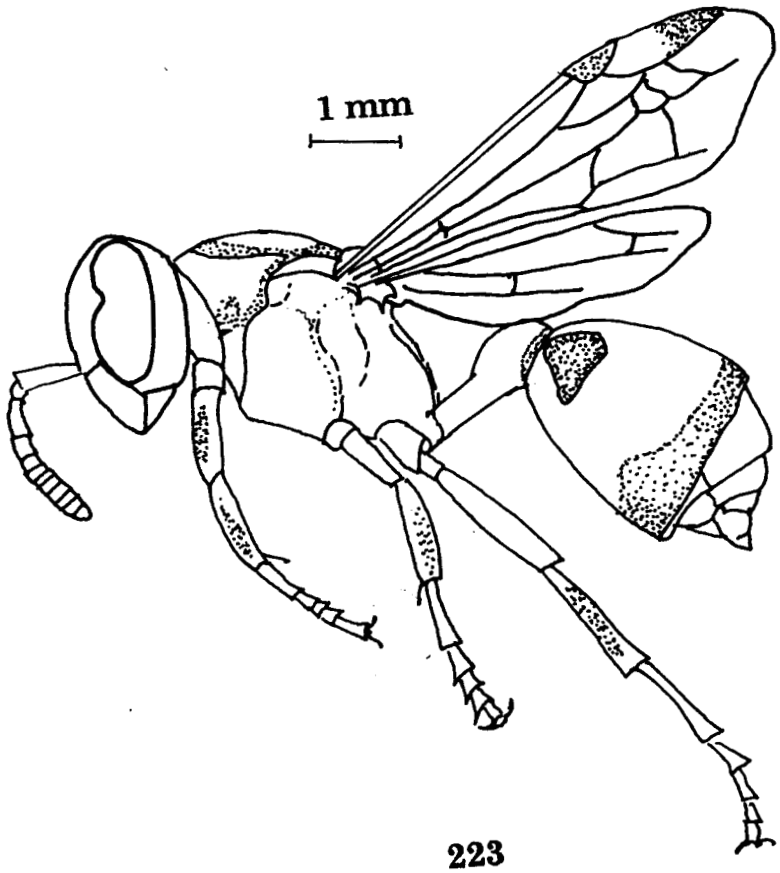


Fig. 218-222. ***Polistes (Stenopolistes) nigritarsis*** **Cameron Female**

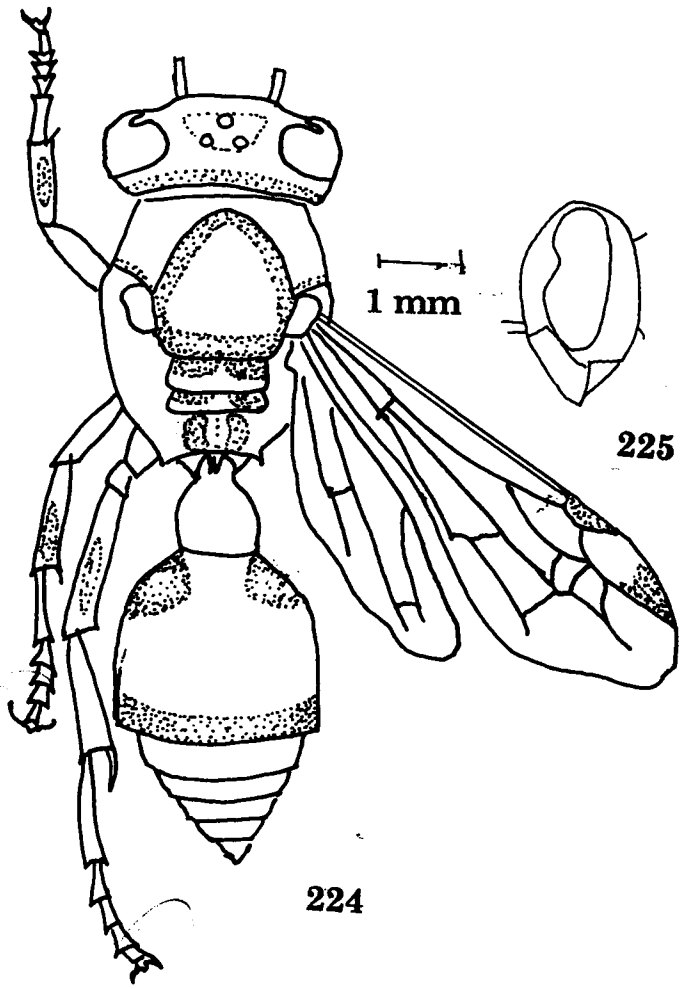
Fig. 218. Body dorsal view
Fig. 219. Head front view
Fig. 220. Metasoma
Fig. 221. Antenna
Fig. 222. Head profile



223

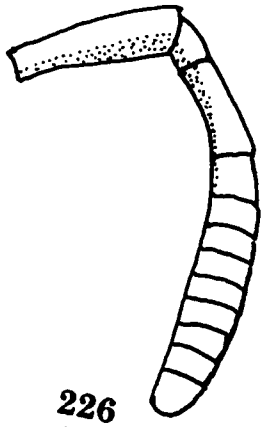
Fig. 223-228. ***Ropalidia (Anthrencida) banglorica*** **sp. nov. Female**

Fig. 223. Body profile
Fig. 224. Body dorsal view
Fig. 225. Head profile
Fig. 226. Antenna
Fig. 227. Metasoma
Fig. 228. Head front view



224

225



226

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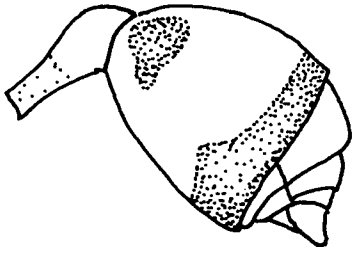
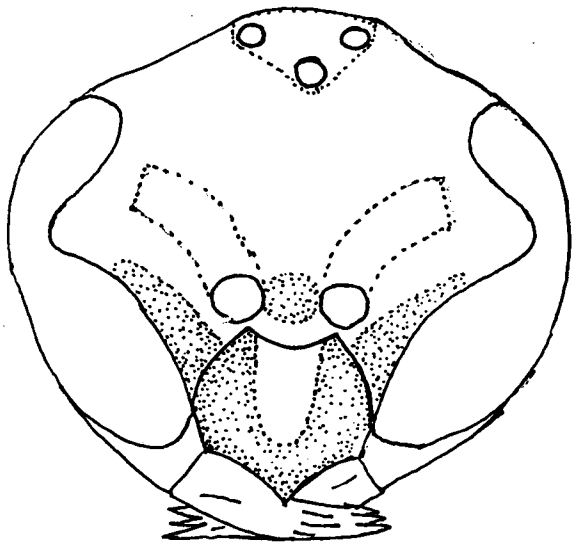


227



228

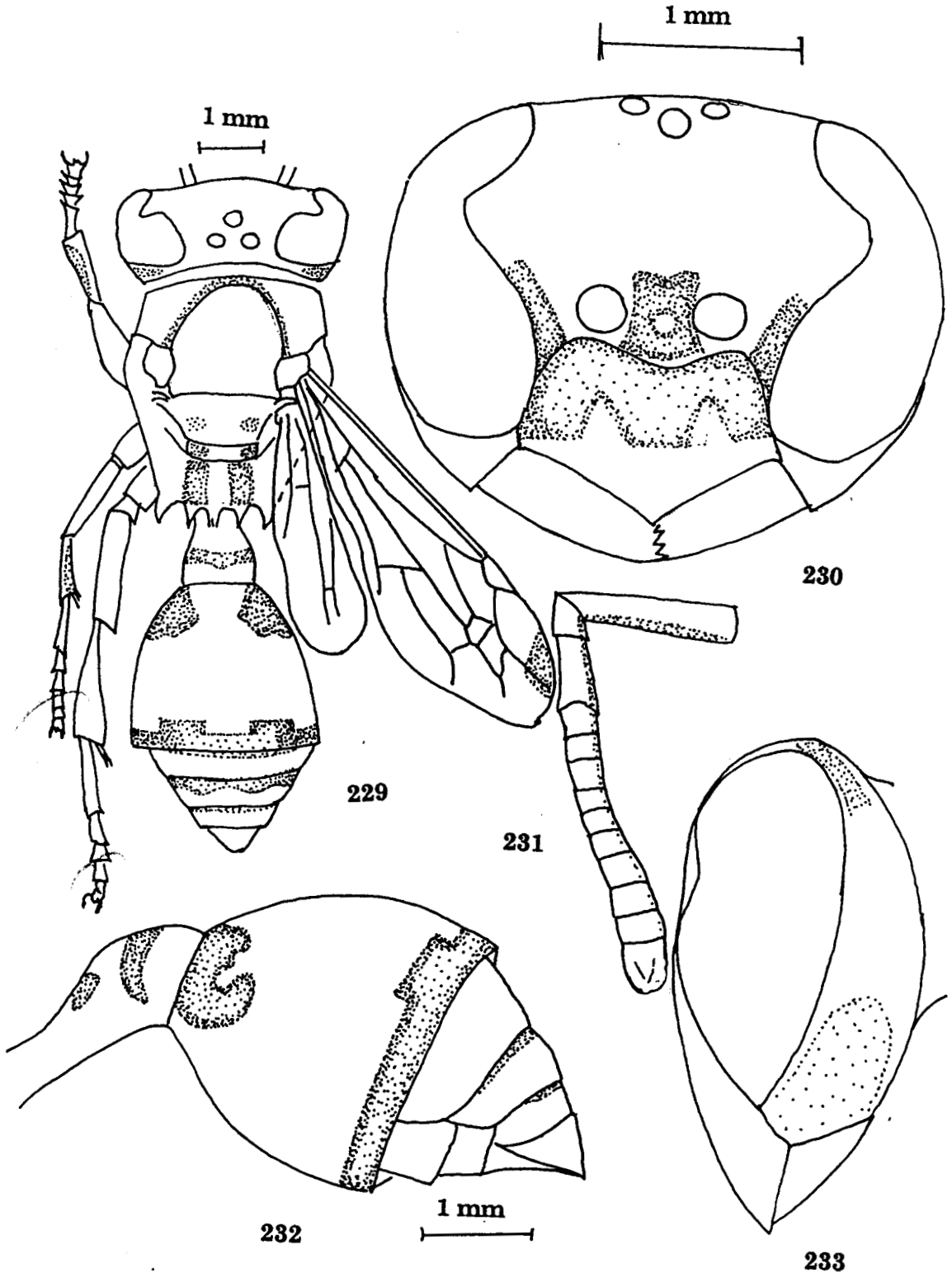


Fig. 229-233. ***Ropalidia (Anthrenidae) cyathiformis*** **(Fabricius) Female**

Fig. 229. Body dorsal view
Fig. 230. Head front view
Fig. 231. Antenna
Fig. 232. Metasoma
Fig. 233. Headk profile

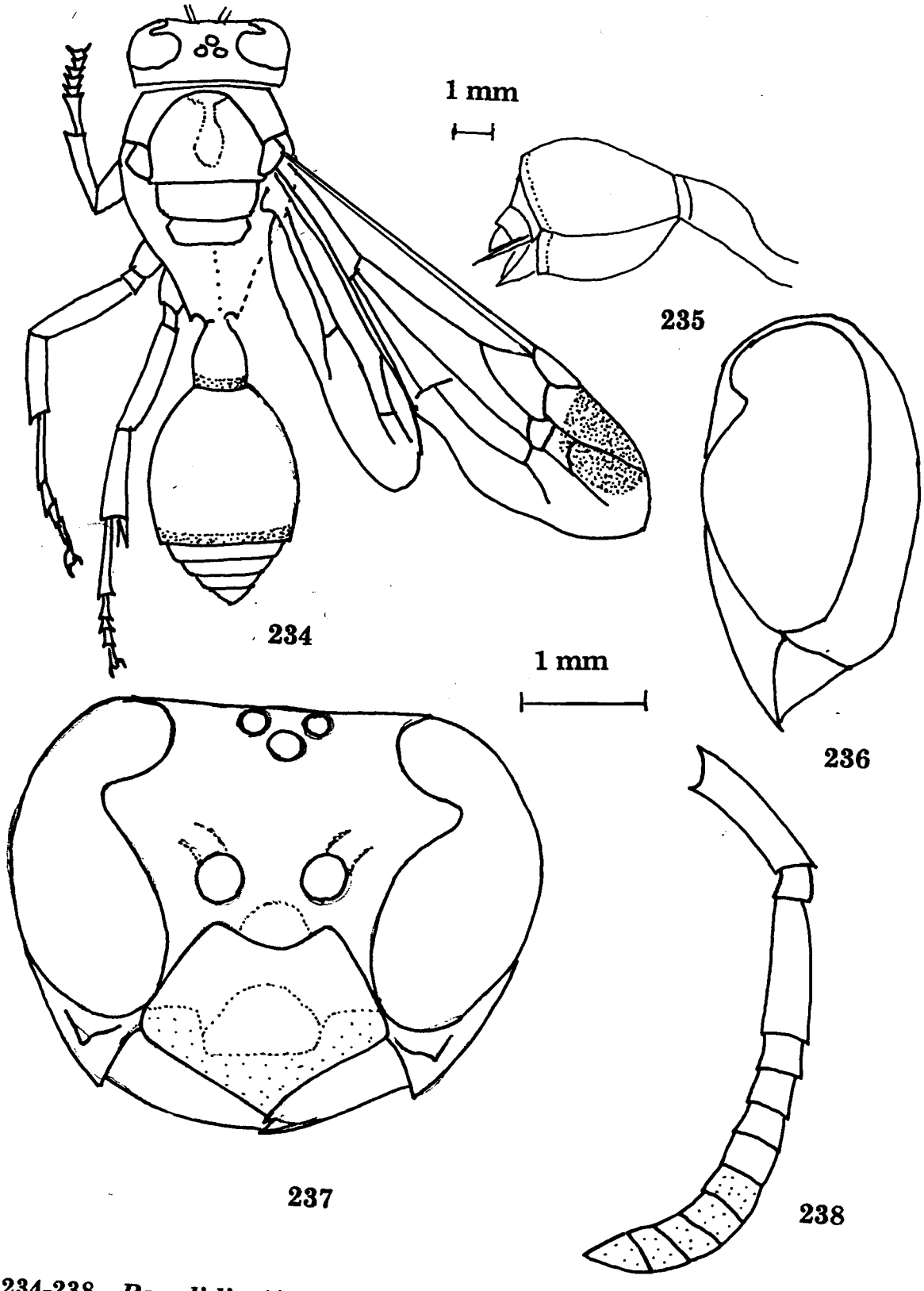


Fig. 234-238. ***Ropalidia (Anthreneida) indica*** **sp. nov. Female**

Fig. 234. Body dorsal view
Fig. 235. Metasoma
Fig. 236. Head profile
Fig. 237. Head front view
Fig. 238. Antenna

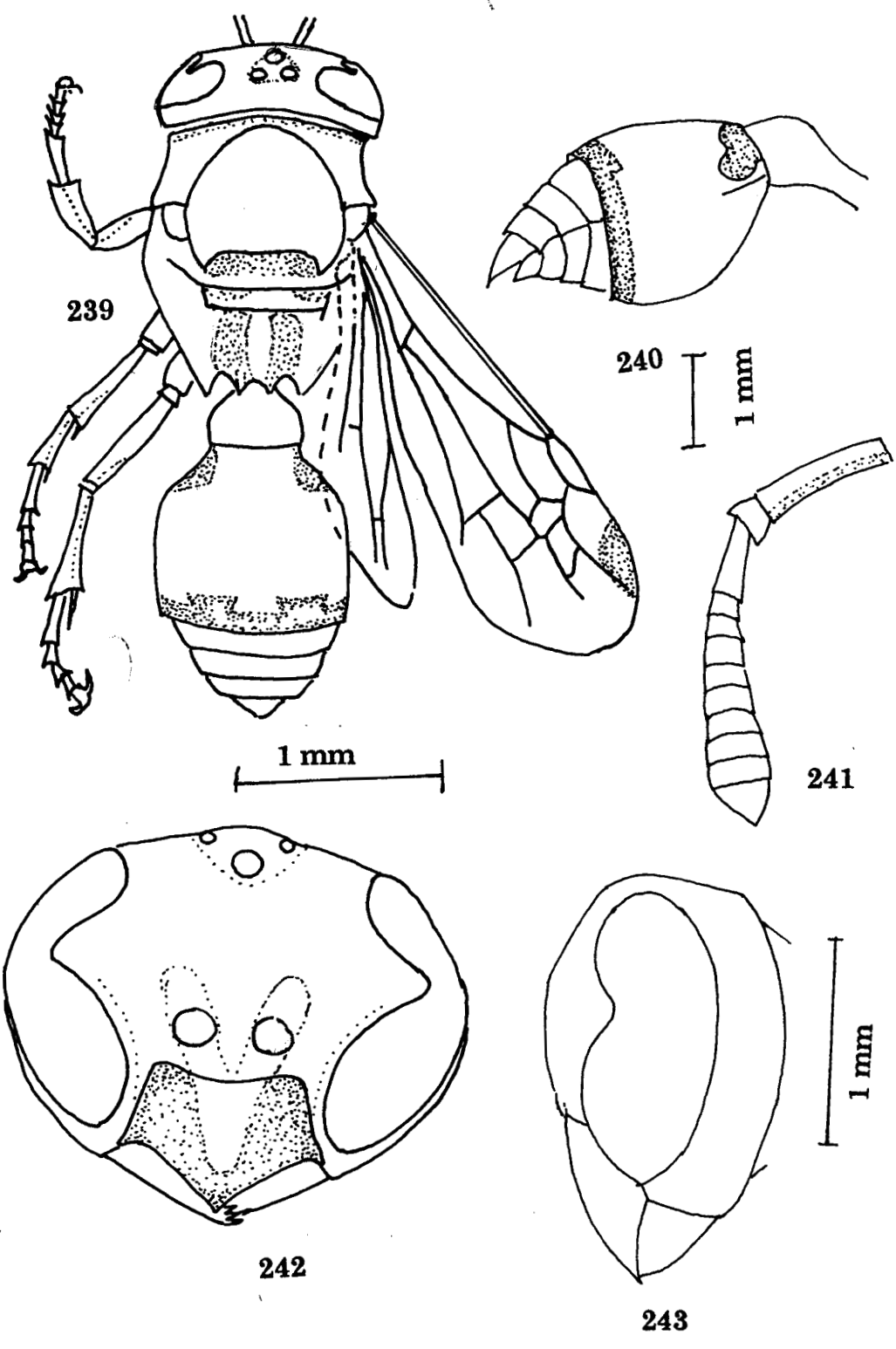


Fig. 239-243. *Ropalidia (Anthreneida) jacobsoni jacobsoni* (Buysson) Female

Fig. 239. Body dorsal view
Fig. 240. Metasoma
Fig. 241. Antenna
Fig. 242. Head front view
Fig. 243. Head profile

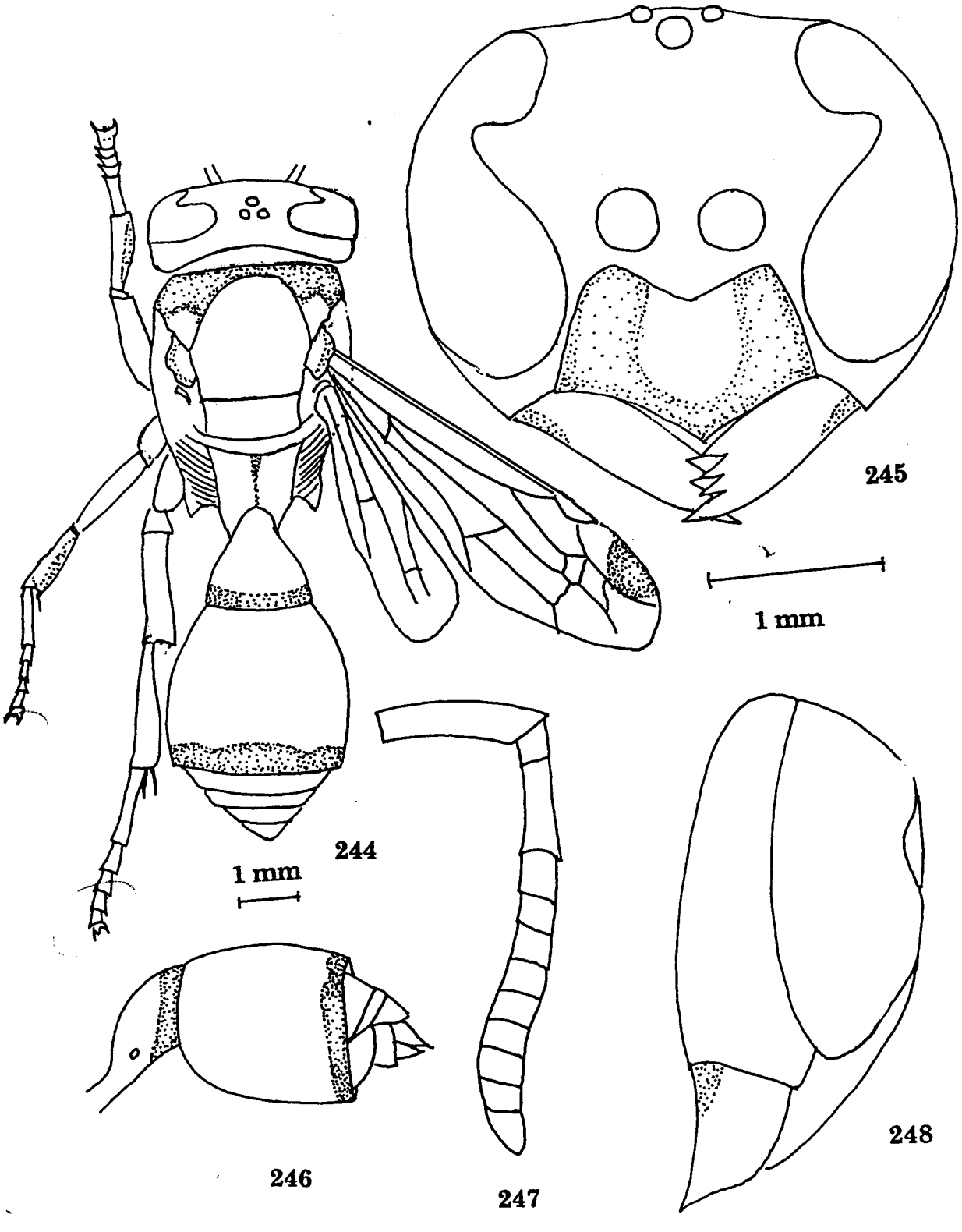


Fig. 244-248. ***Ropalidia (Anthreneida) magnanima magnanima*** **Van der Vecht Female**

Fig. 244. Body dorsal view
Fig. 245. Head front view
Fig. 246. Metasoma
Fig. 247. Antenna
Fig. 248. Head profile

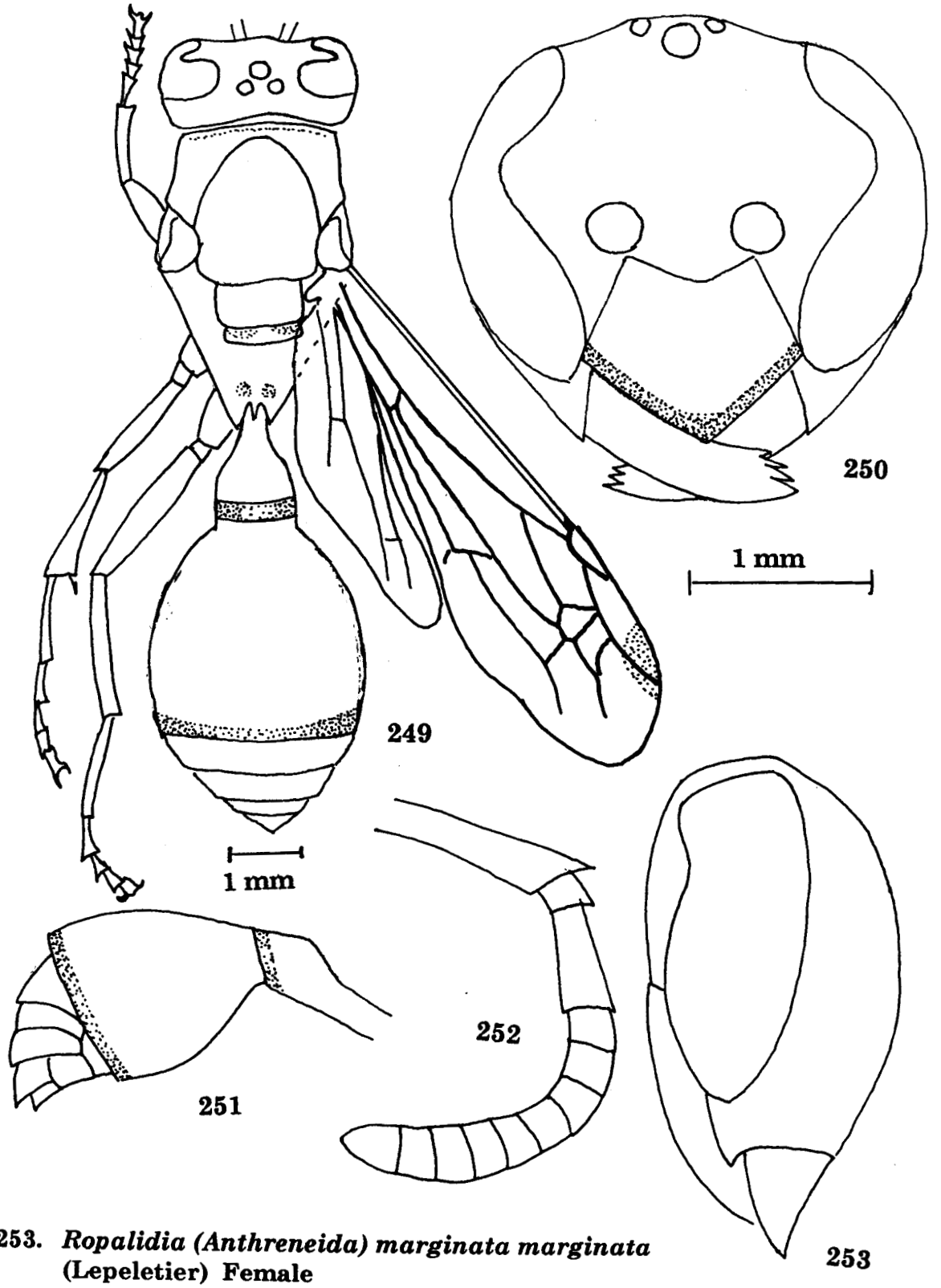


Fig. 249-253. ***Ropalidia (Anthreneida) marginata marginata*** **(Lepeletier) Female**

Fig. 249. Body dorsal view
Fig. 250. Head front view
Fig. 251. Metasoma
Fig. 252. Antenna
Fig. 253. Head profile

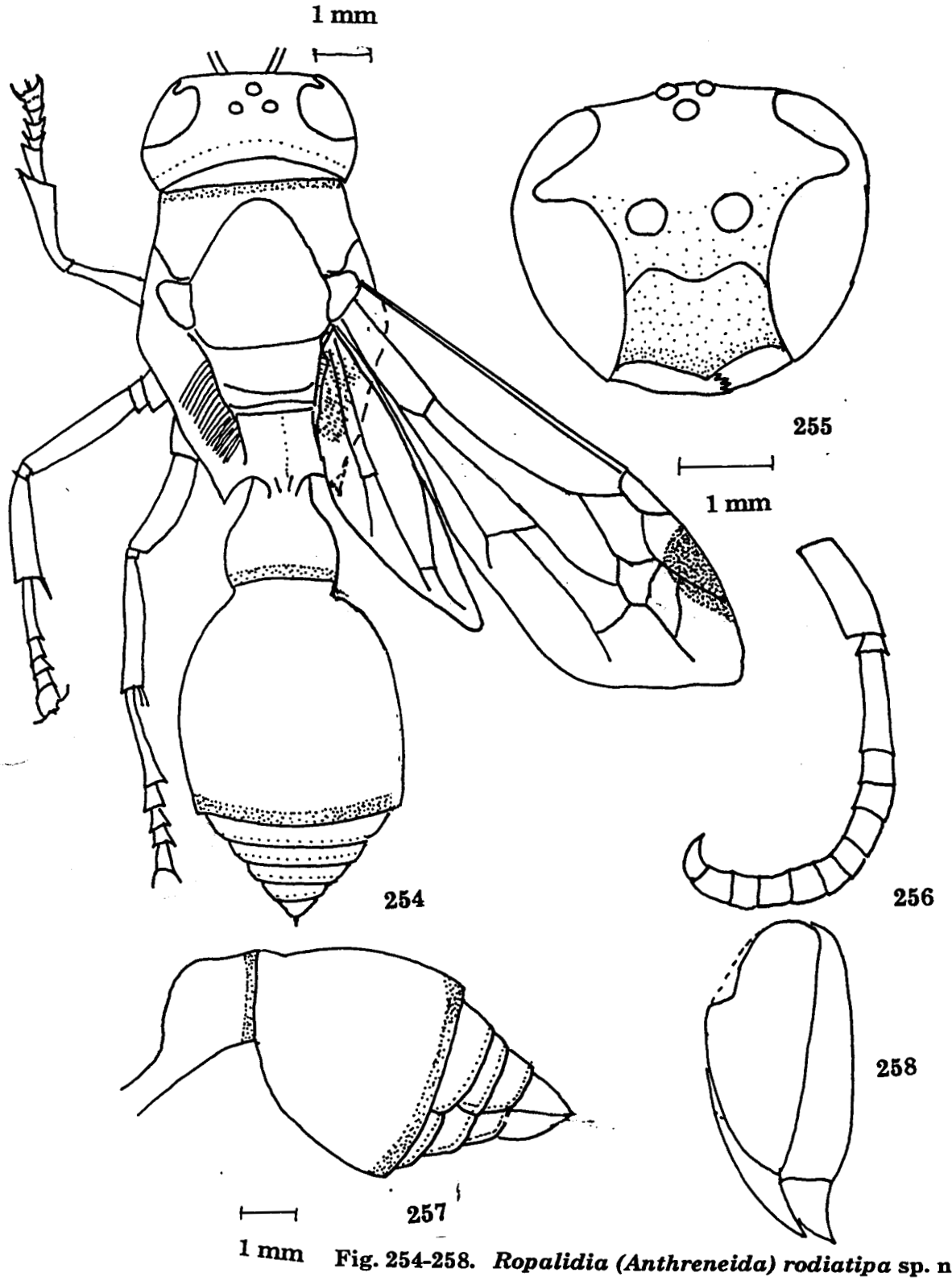


Fig. 254-258. ***Ropalidia (Anthreneida) rodiatipa*** **sp. nov. Male**

Fig. 254. Body dorsal view
Fig. 255. Head front view
Fig. 256. Antenna
Fig. 257. Metasoma
Fig. 258. Head profile

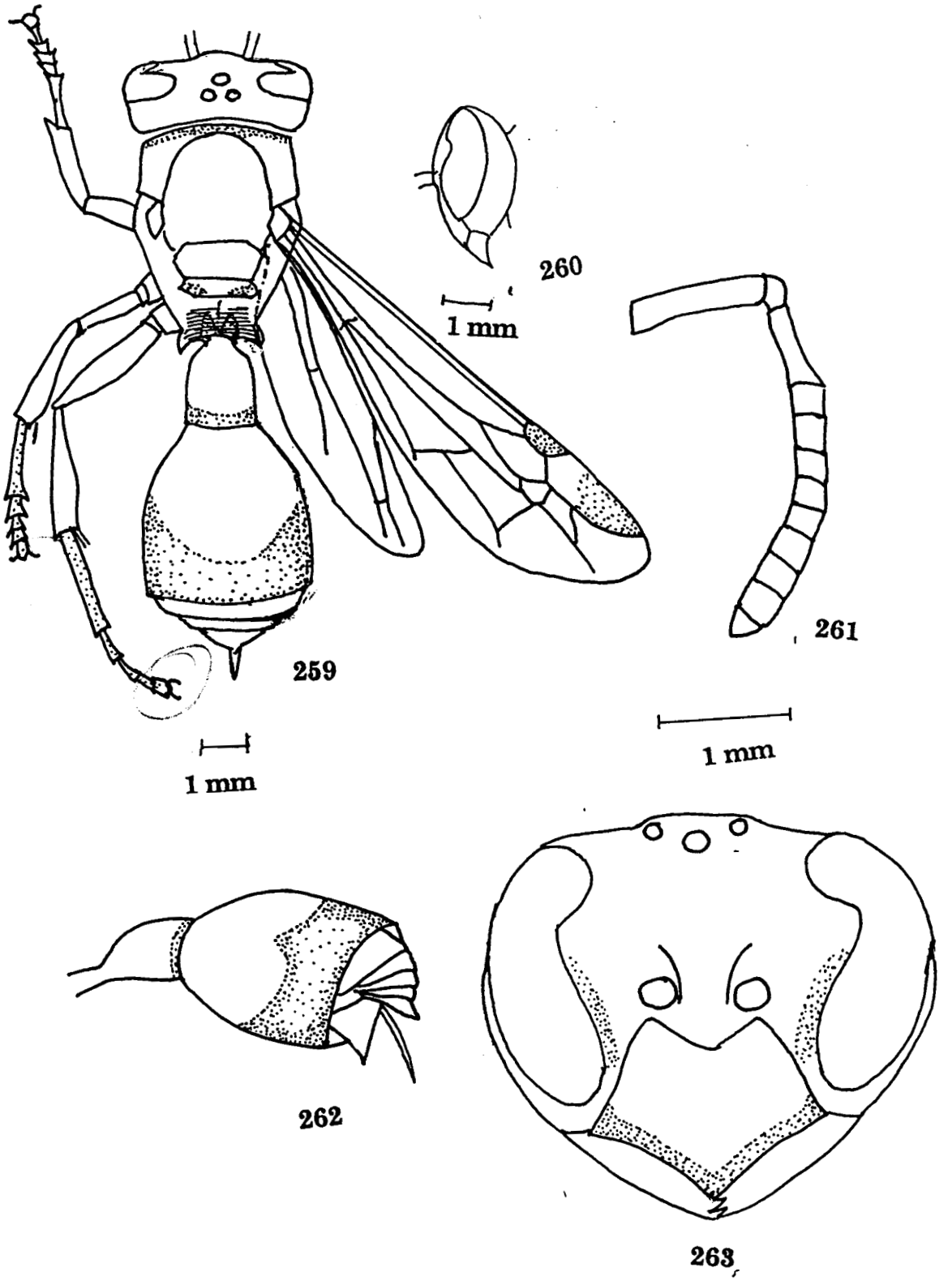


Fig. 259-263. ***Ropalidia (Anthreneida) spatulata*** **Van der Vecht**
Female

Fig. 259. Body dorsal view
Fig. 260. Head profile
Fig. 261. Antenna
Fig. 262. Metasoma
Fig. 263. Head front view

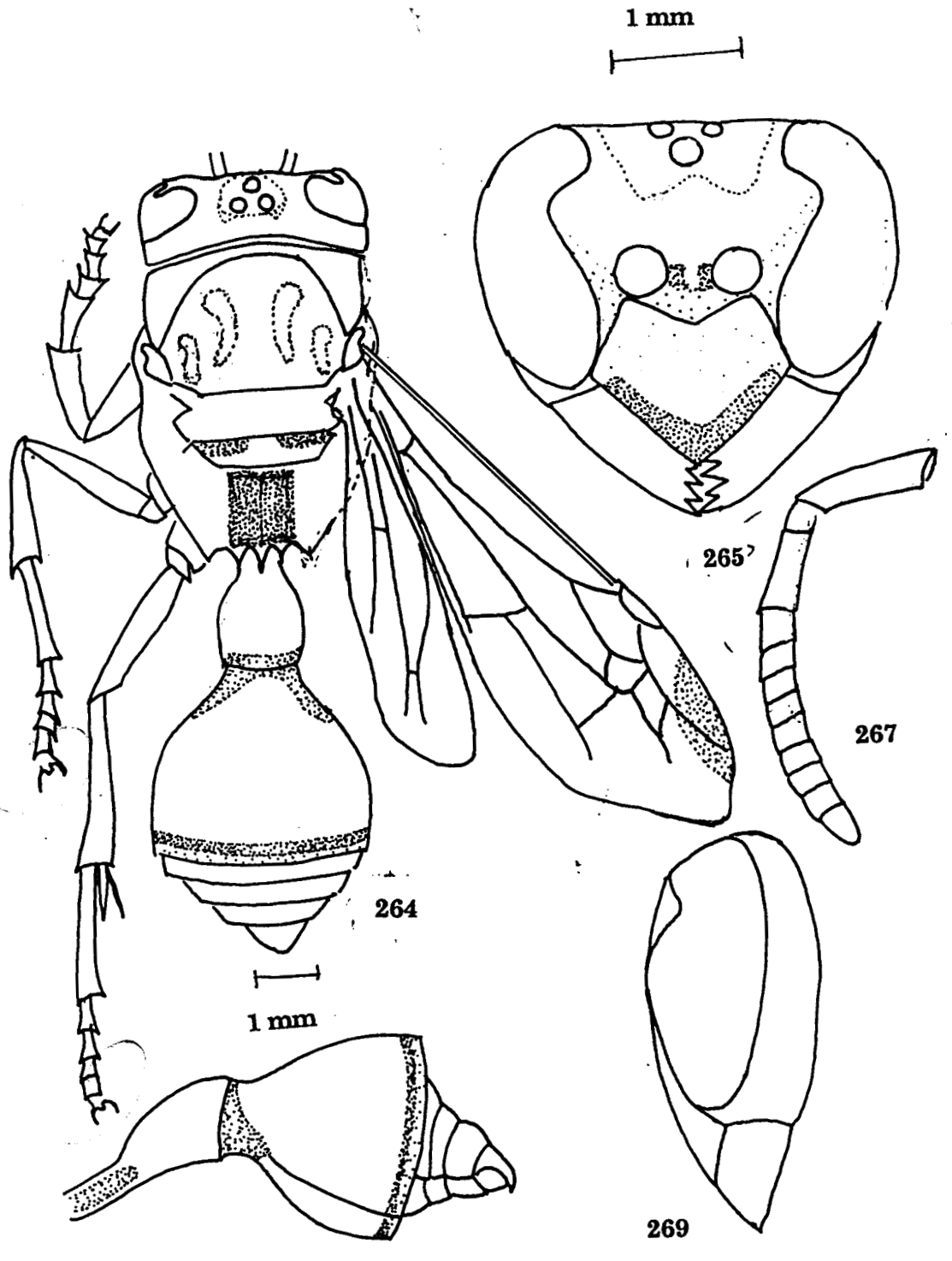


Fig. 264-269. ***Ropalidia (Anthreneida) sridharani*** **sp. nov. Female**

Fig. 264. Body dorsal view
Fig. 265. Head front view
Fig. 267. Antenna
Fig. 268. Metasoma
Fig. 269. Head profile

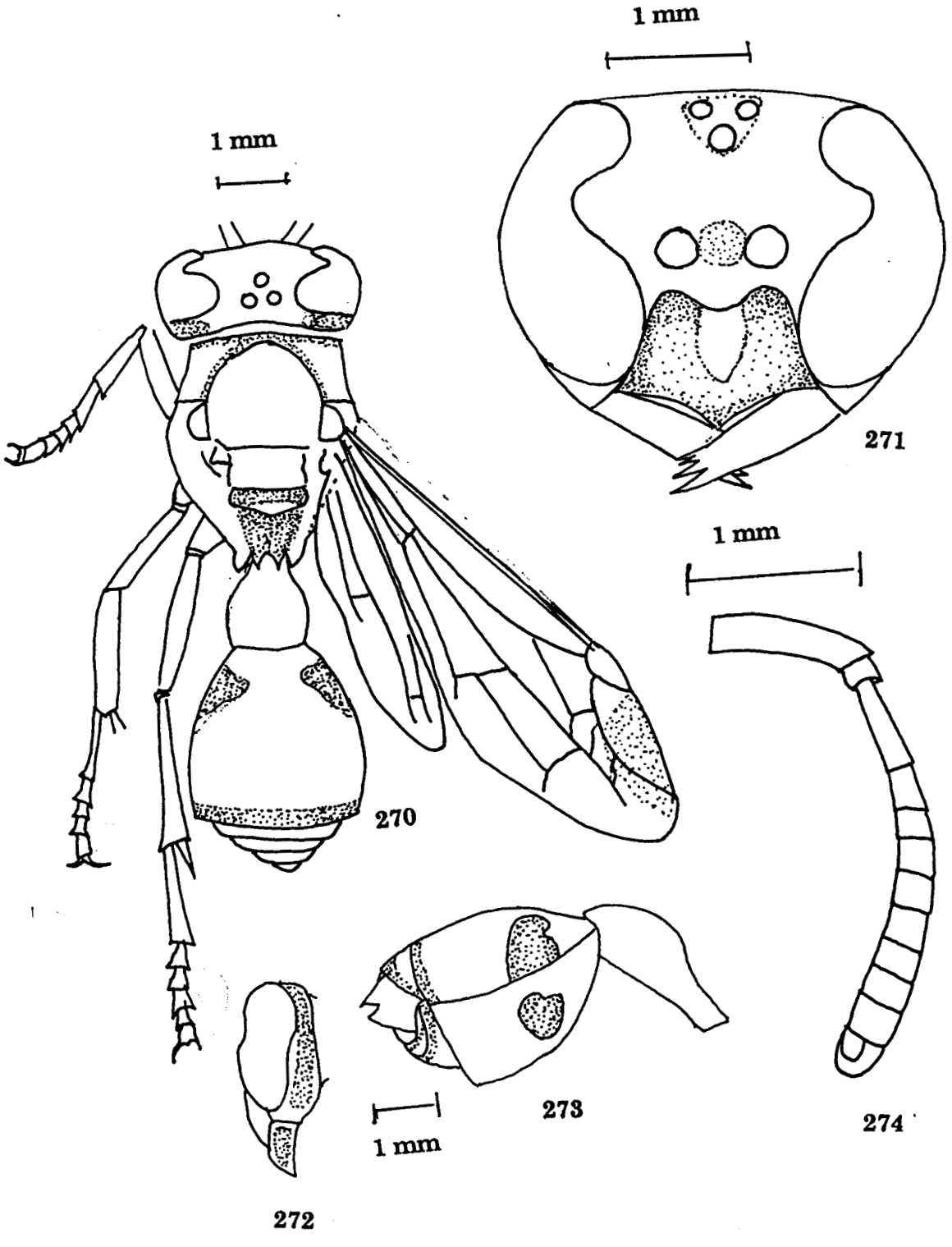


Fig. 270-275. ***Ropalidia (Anthreneida) stigma stigma*** **(Smith) Female**

Fig. 270. Body dorsal view
Fig. 271. Head front view
Fig. 272. Head profile
Fig. 273. Metasoma
Fig. 274. Antenna

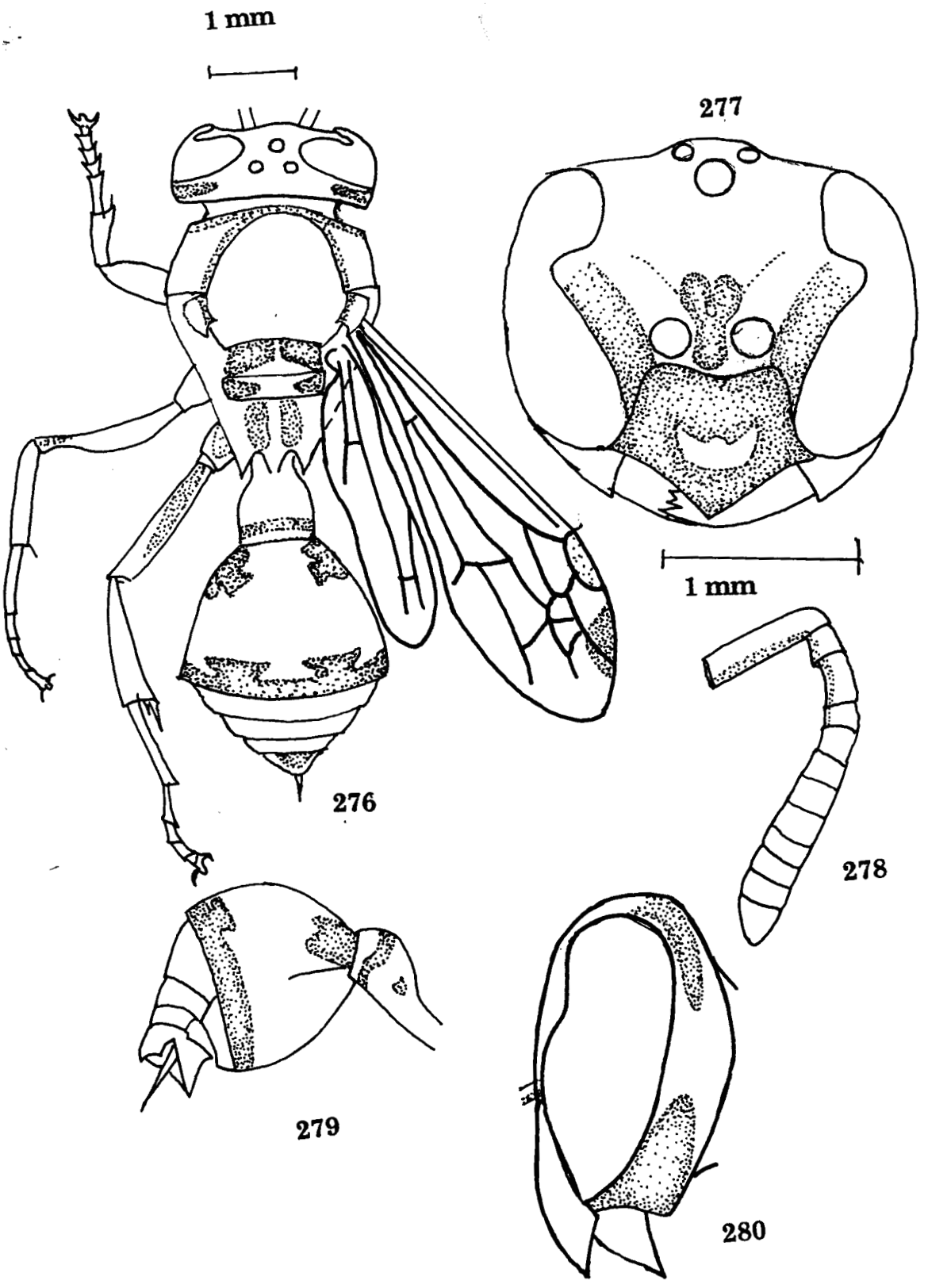


Fig. 276-280. ***Ropalidia (Icarielia) anupama*** **sp. nov. Female**

Fig. 276. Body dorsal view
Fig. 277. Head front view
Fig. 278. Antenna
Fig. 279. Metasoma
Fig. 280. Head profile

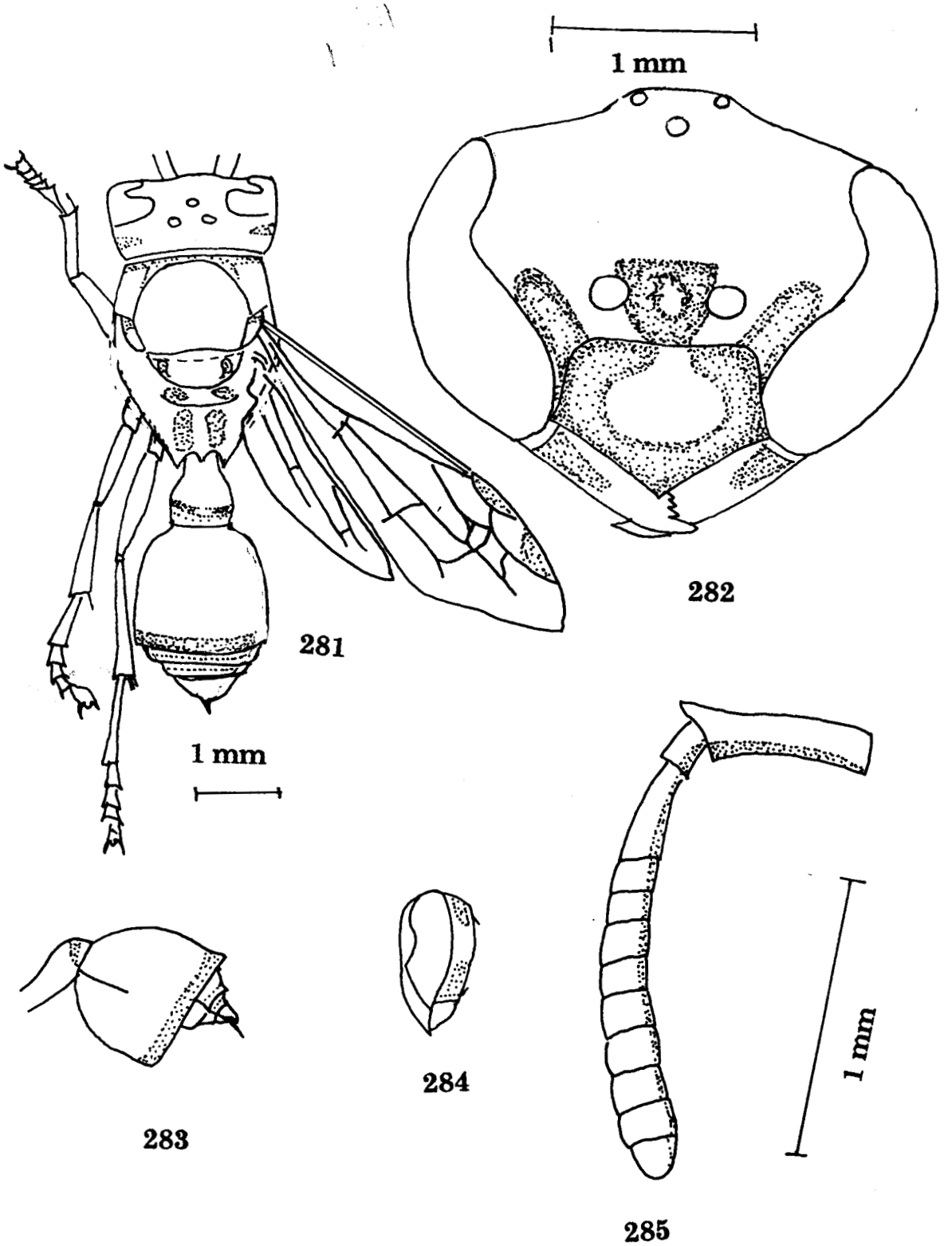


Fig. 281-285. ***Ropalidia (Icarielia) montana*** **Carl Female**

Fig. 281. Body dorsal view
Fig. 282. Head front view
Fig. 283. Metasoma
Fig. 284. Head profile
Fig. 285. Antenna

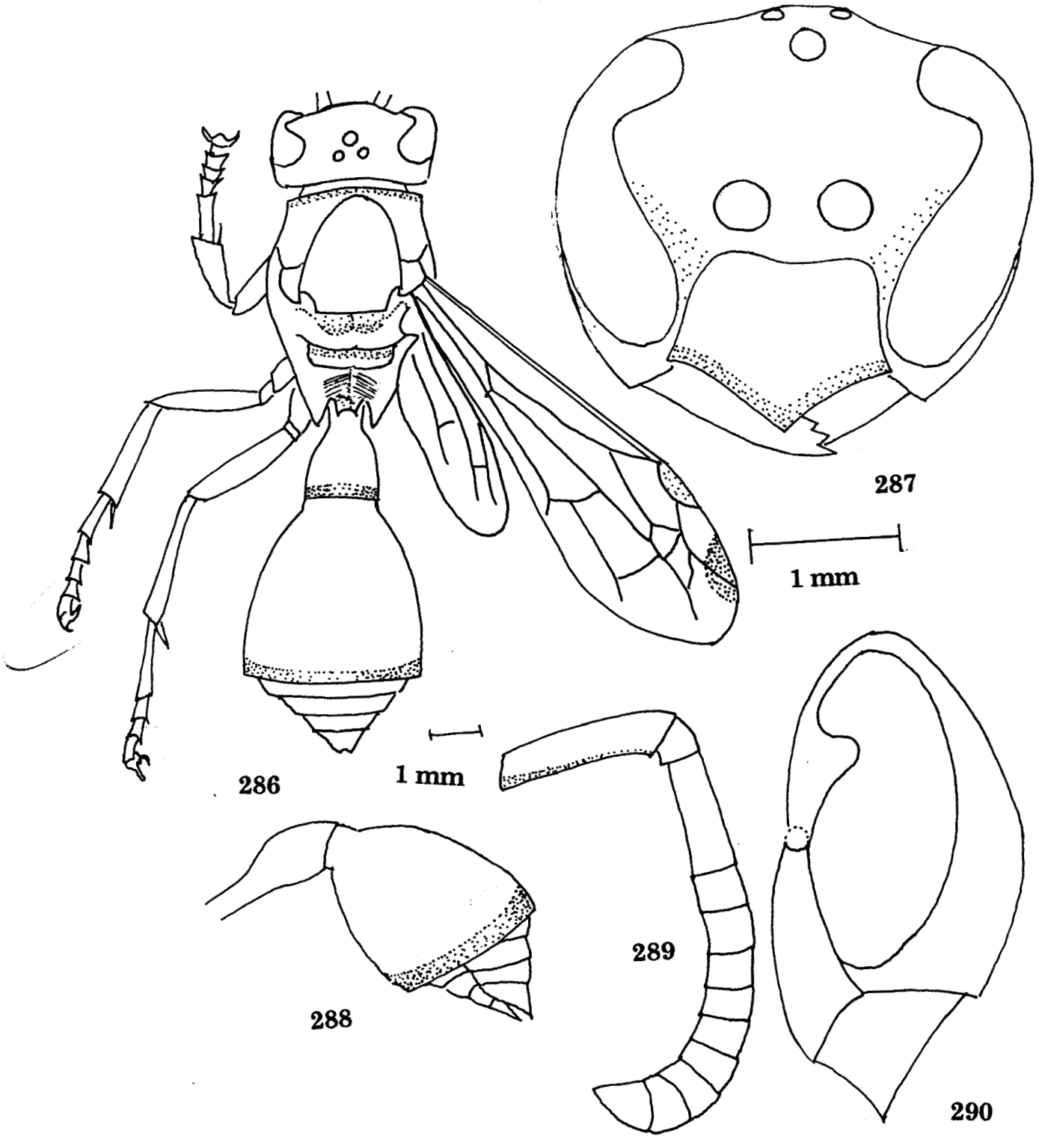


Fig. 286-290. ***Ropalidia (Icarielia) travancorica*** **sp. nov. Female**

Fig. 286. Body dorsal view
Fig. 287. Head front view
Fig. 288. Metasoma
Fig. 289. Antenna
Fig. 290. Head profile

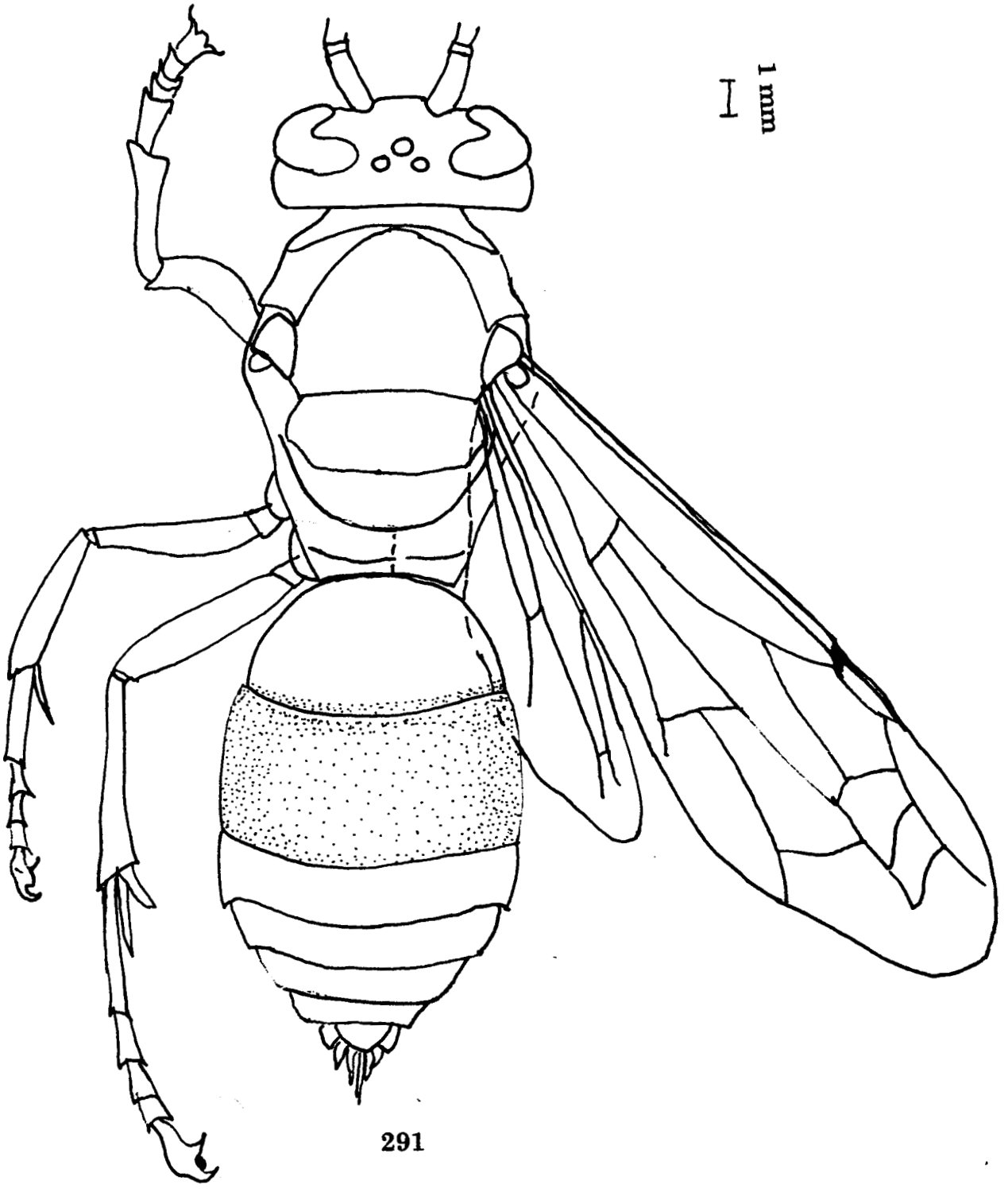
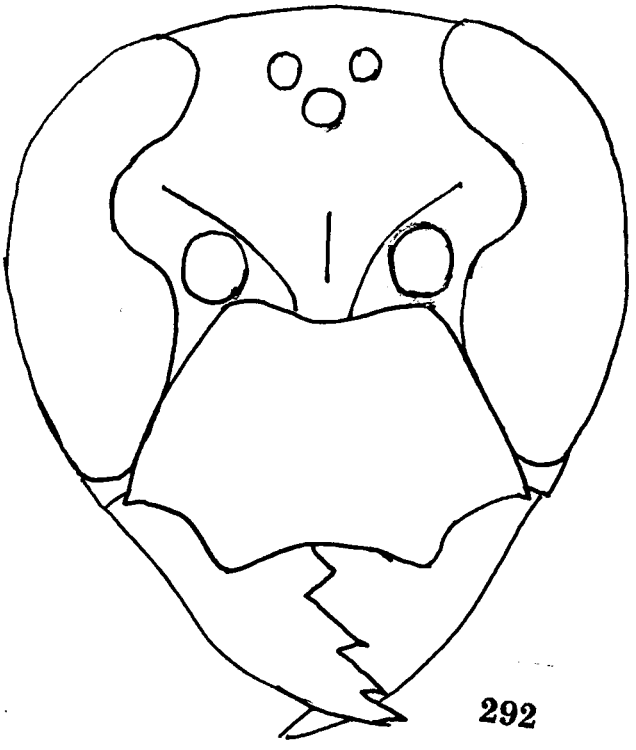


Fig. 291-294. ***Vespa affinis continentalis*** **Bequaert Male**

Fig. 291. Body dorsal view
Fig. 292. Head front view
Fig. 293. Antenna
Fig. 294. Head profile



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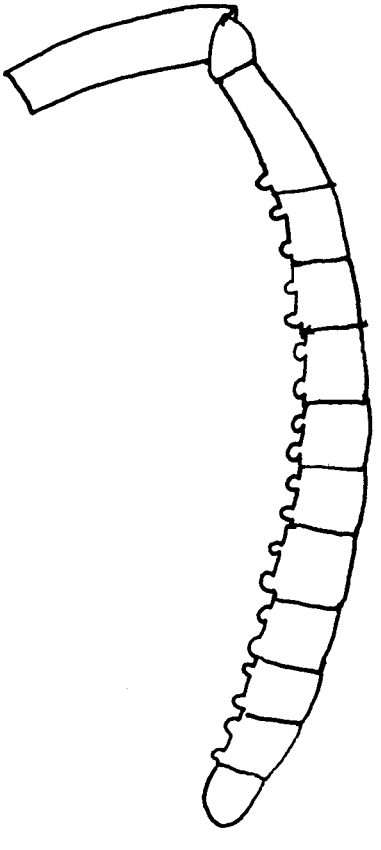

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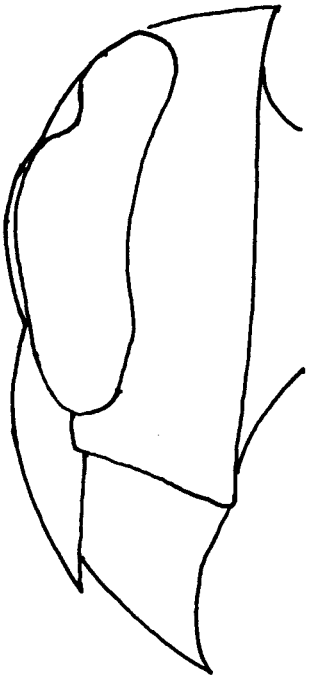

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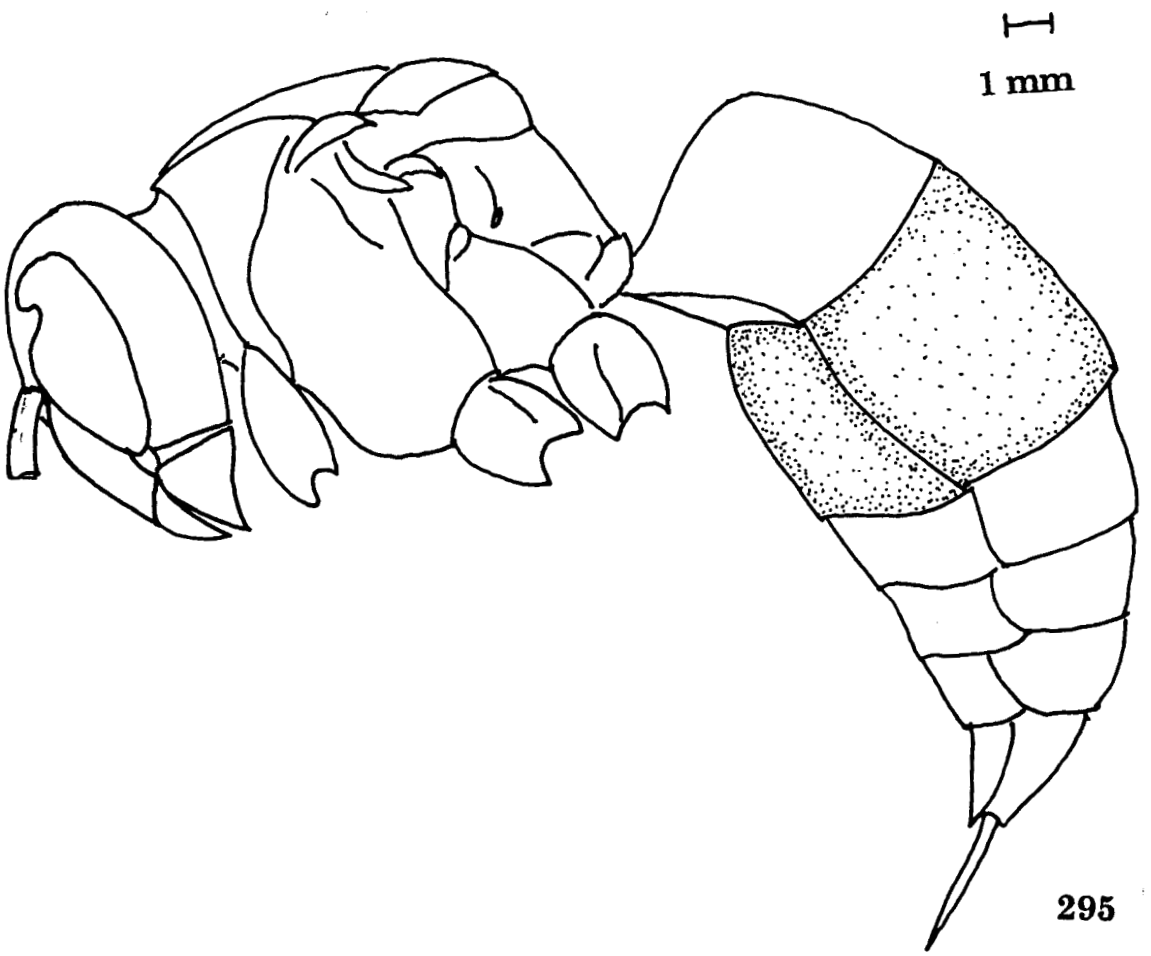
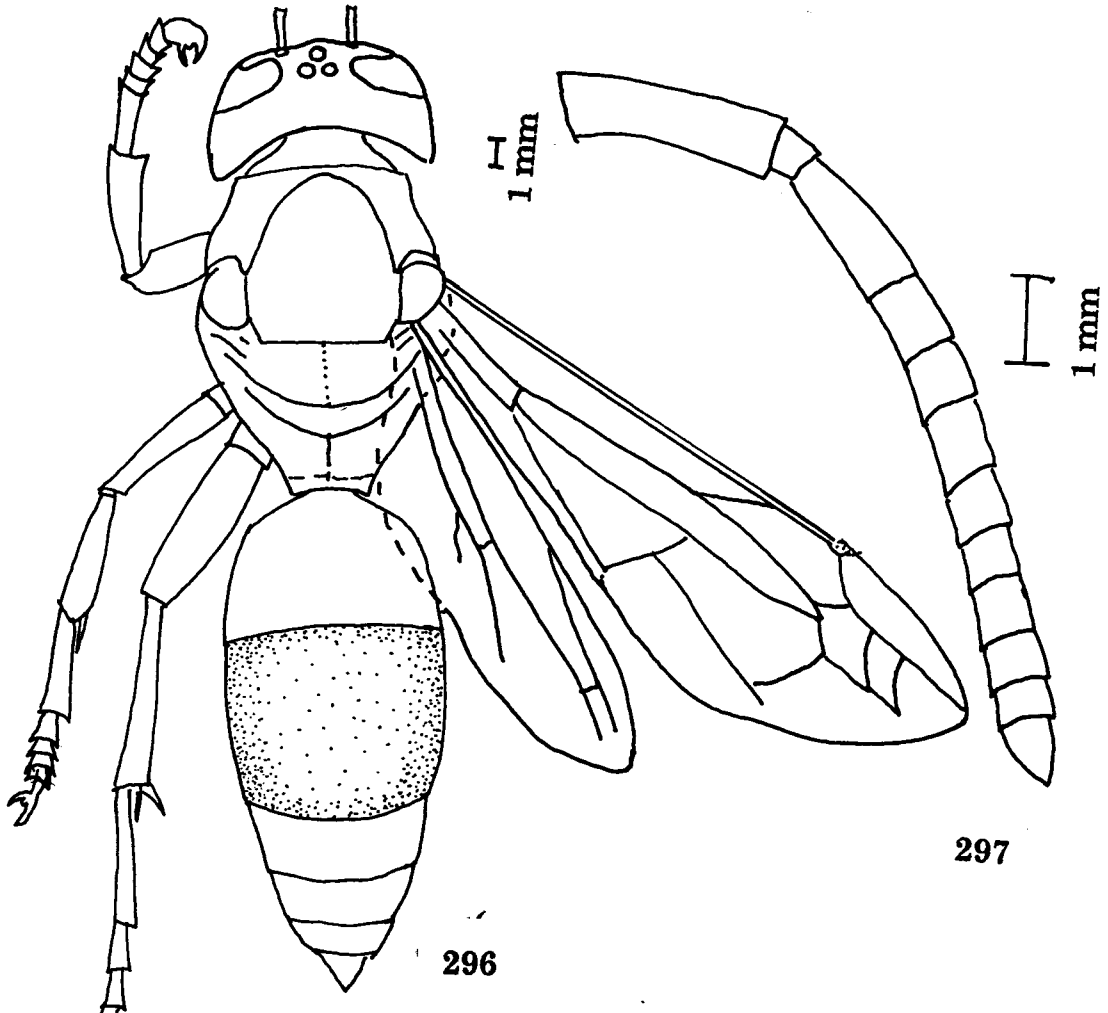


Fig. 295–299. ***Vespa tropica haematodes*** **Bequaert Female**

Fig. 295. Body profile
Fig. 296. Body dorsal view
Fig. 297. Antenna
Fig. 298. Head front view
Fig. 299. Head profile



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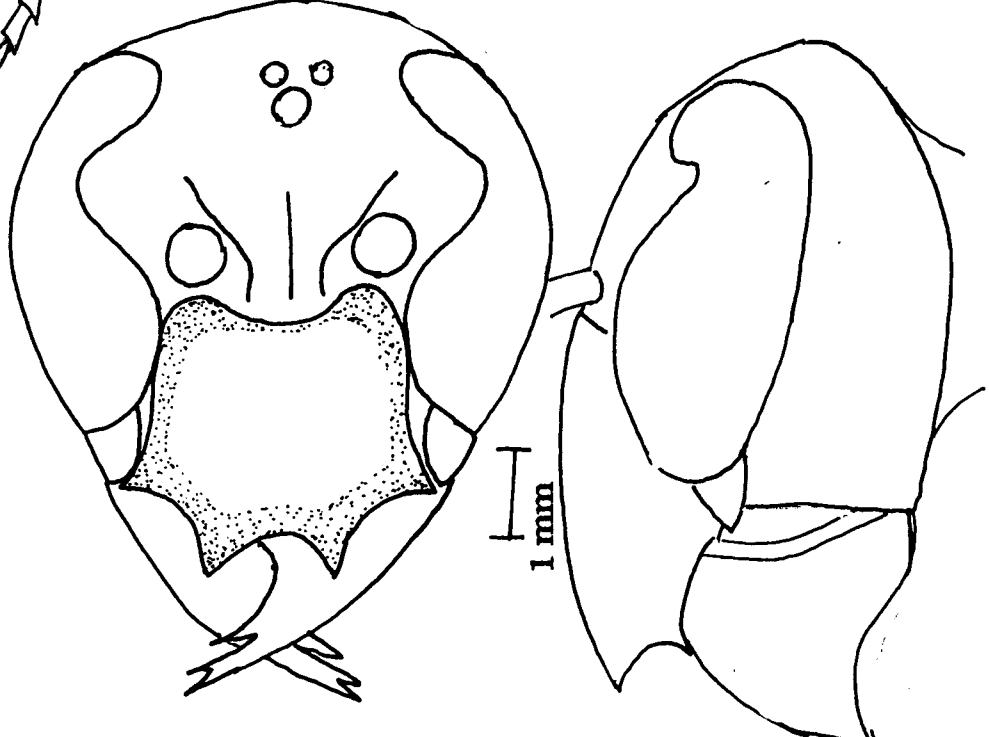

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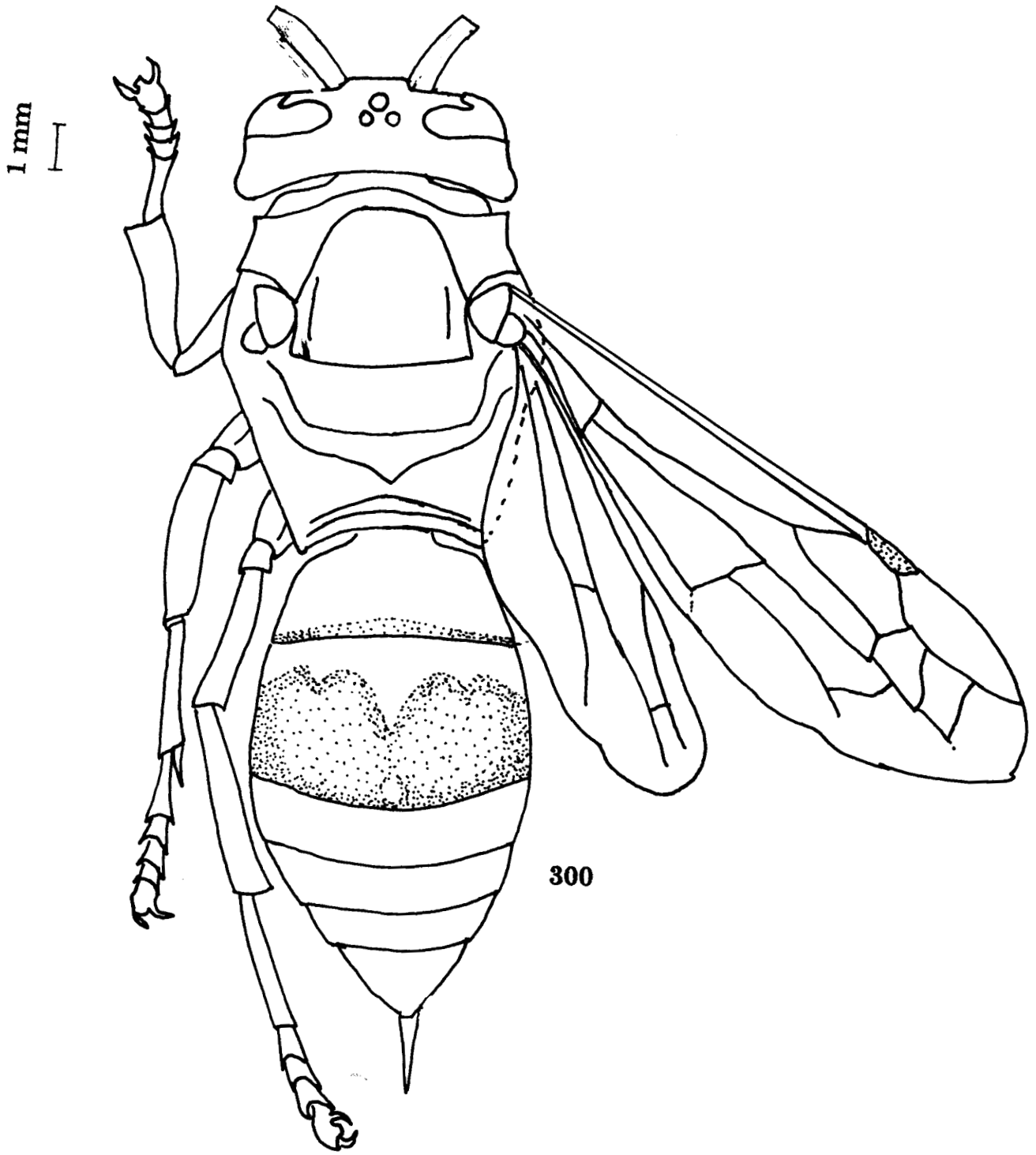

Fig. 300-363. ***Vespa tropica tropica*** **(Linnaeus) Female**

Fig. 300. Body dorsal view
Fig. 301. Head front view
Fig. 302. Antenna
Fig. 303. Head profile

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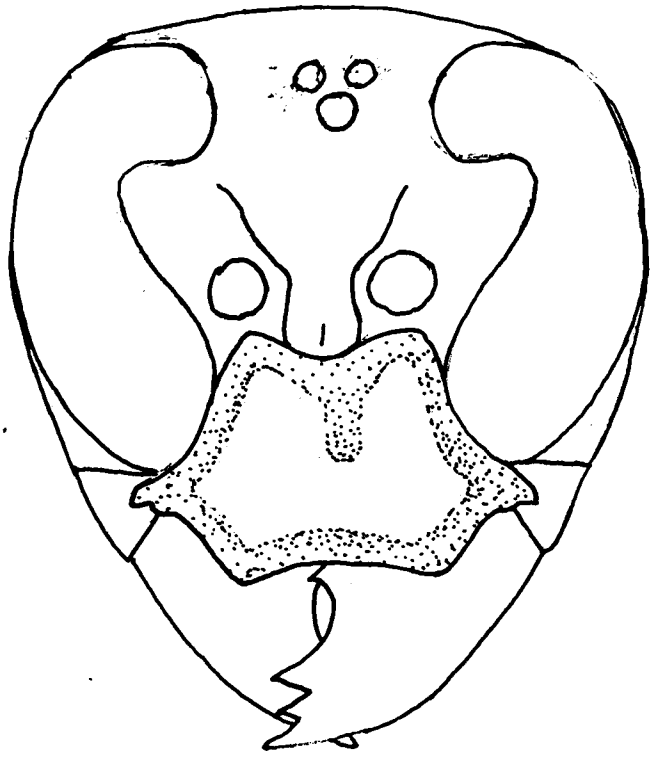

1 mm

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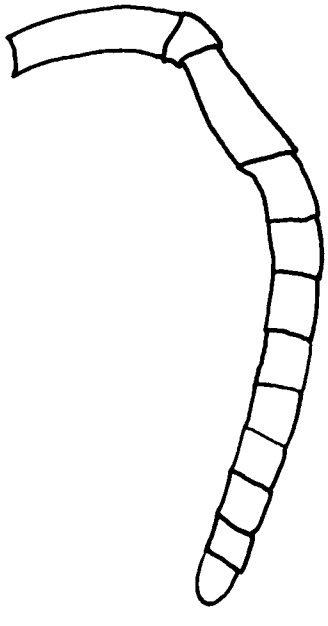

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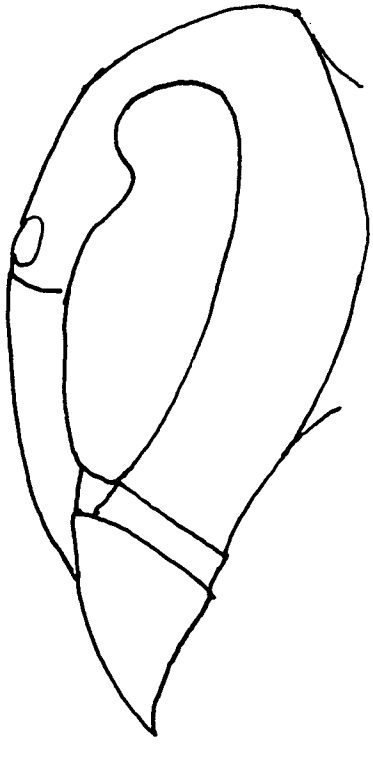

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PUBLICATION

Proc. zool. Soc. Calcutta, 55 (1) : 69 – 72 (2002)

A New Species of *Diastephanus* Enderlein (Hymenoptera : Stephanidae) from Christmas Islands

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Six Figures

ABSTRACT

A new species of *Diastephanus* Enderlein, viz., *Diastephanus christineae* Narendran sp. nov. is described from Christmas island (near Java) and its iffinities with its ~~Gosels~~ relative are discussied.

KEYWORDS : New species, *Diastephanus*.

INTRODUCTION

The Christmas island is situated in the Indian ocean, a little away from Java. It is for the first time the genus *Diastephanus* is reported from this island, based on a specimen collected in 1993 (the collector's name is unknown). This new species does not fit to the key of Elliott (1922) or to the description of any species by Elliott (1926, 1928). The new species is described below.

MATERIALS AND METHODS

The specimen of this new species was studied from the collection of Stephanids sent by Dr. Miss Christine Taylor of The Natural History Museum, London for our studies on loan. The specimen was studied using M3Z Wild Stereozoom (Switzerland) and Leitz-Watzlar (Germany) microscopes. The figures were drawn using the drawing tube of the Wild M3Z Stereozoom microscope and enlarged using KB enlarger of model B2M.

OBSERVATIONS

Descriotion : *Diasstephanus christineae* Narendran sp. nov.

(Plate I, Figs. 1-6)

FEMALE Length 14.91 mm (excluding terebra); length of terebra 15 mm. Dark liver brown colour with following parts otherwise: lower frons (=face) pale reddish-brown which extends to front tooth through a median stripe; eye pale blackish-yellow; ocelli pale reflecting yellow. Basal segments of antenna, postgena and occiput pale brown; vertex, mesoscutum, scutellum and propodeum black. Fore and middle legs reddish brown with base of femur and metatarsus pale. Pubescence on mesopleuron silvery, pubescence on hind metatarsus whitish-yellow. Wings hyaline with stigma pale white in the inner part, margins pale brown; veins pale brown.

Head (Figs. 2 & 3) width in anterior view a little more than 1.6x the distance between front ocellus and lower labral margin; width in dorsal view a little more than 1.5x the distance between front ocellus and occipital margin; frons rugoso-punctate. Vertex with 5 cross carinae between hind ocelli, followed by several close carinae with a median groove (Fig.2); postvertex smooth on sides; occipital carina forming a weak subacute angle medially. POL 3 × OOL; head with 5 teeth. Antennal scape a little longer than 2x the length of pedicel, 1.2x as long as first flagellar segment, second flagellar segment 1.4x as long as first; third longer than second and subsequal to fourth segment.

Mesosoma : Carina apicale distinct, without pubescence; colo with transverse carinae; pronotal fold indistinct; preanular region with weak cross striae and reticulate, posterior region cross reticulate. Mososcutum with a weak median carina on posterior half, anterior half reticulo-punctate (Fig.4). Notauli somewhat distinct; axillae separated from each other by a large pit in front of

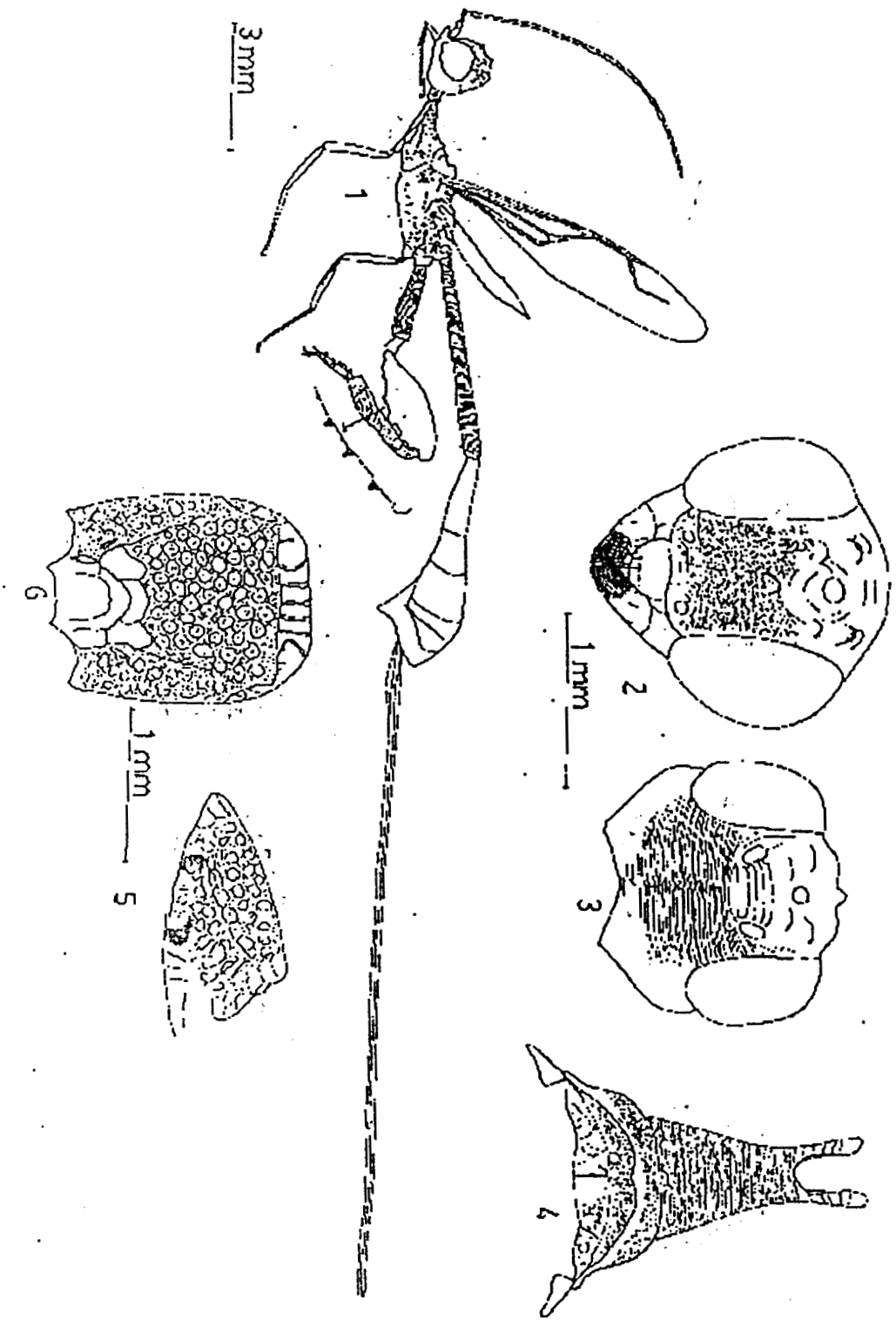

Fig 1-6. *Diastephanus christineae* Narendran sp. nov. Female. 1. Body profile ; 2. Head front view ; 3. Head dorsal view ; 4. Pronotum ; 5. Metapleuron ; 6. Propodeum.

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scutellum, each axilla rugoso-reticulate. Scutellum finely reticulate; mesopleuron reticulate with silvery pubescence on anterior dorsal end. Metapleuron rugoso-reticulate on interfovcolar area, postfovcolar area with 3 or 4 carinae (Fig.5). Propodeum (Fig.6) closely pitted, interstices and inside of pits reticulate; parapiciolar depression large, deep, smooth and shiny; spiracular frontal impression indinstinct, fully pitted as on dorsal surface. Relative median length of mesosomal parts in dorsal view: Pronotum=21; mesoscutum =5; scutellum = 9; propodeum=20; hind coxa=44. Hind coxa 0.37× length of petiole, annulate. Hind femur 2.58x as long as its maximum width, outer surface reticulate, ventral margin with 3 large teeth, with two tubercles on basal part, interspace between middle and distal large tooth with 3 denticles, interspace between distal tooth and apex with 5 or 6 extremely minute denticles; hind tibia obliquely and closely striate.

Metasoma : Petiole annulate; dorso-basal area of petiole rugoso-striate; petiole slightly shorter than combined length of post-petiolar segments (54:58). First postpetiolar segment 2x as long as second postpetiolar segment; metasomal tergites finely and minutely cross reticulate; reticulations more pronounced on last two tergites. Terebra 2.98x as long as metasoma (54+58). Posterior margin of last tergite broadly but weakly emarginate.

Male : Unknown

Host : Unknown

Etymology : The species is named after Miss Christine Taylor of The Natural History Museum, London, for her cooperation in our studies.

Holotype : Female. CHRISTMAS ISLAND (Indian Ocean) 1.iv. 1933. Coll: Unknown (Deposited in The Natural History Museum, London). Registration Number: 3a 373

DISCUSSION

This new species comes close to *Diastephanus gracilis* Kieffer in the key to species of *Diastephanus* of Elliot (1922) but differs from it in having : 1) frons rugoso-punctate (in *D. gracilis* frons trans-striate); 2) occiput cross carinate with central groove (in *D. gracilis* occiput rugose, without central groove); and 3) terebra not shorter than the body (in *D. gracilis* terebra shorter than the body).

ACKNOWDGMENTS

We are grateful to Miss Christine Taylor of the Natural History Musem, London for sending a large collection of Stephanidae on loan for our studies.

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