STUDIES ON SARCOPHAGIDAE (DIPTERA) OF WEST BENGAL, INDIA

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THESIS SUBMITTED FOR THE DEGREE OF DOCTOR OF PHILOSOPHY (SCIENCE) OF THE UNIVERSITY OF NORTH BENGAL, RAJA RAMMOHUNPUR, DARJEELING. 1977.

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595.77
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73949
27 MAR 1981

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S Y N O P S I S

The problem which has been worked out in course of the present investigation is entitled "Studies on Sarcophagidae (Diptera) of West Bengal, India"

The work has been dealt with in two Sections.

The First Section includes the Taxonomy, Distribution and Bionomics of the imaginal forms of 37 species of Sarcophagid flies. Out of these, 12 species are new to science and another 12 are being recorded for the first time from West Bengal. A new species is described from the North West Himalayas.

Twentytwo species are redescribed in detail and the figures of different parts of the genitalia (including 9 females) are given.

All the species have been assigned their correct generic positions, on the basis of our present day knowledge and the keys have been prepared mainly on the basis of male genitalia. A check list of Indian species along with their distributions in India is also given.

The Second Section includes the Taxonomy of the immature forms of 5 species of Sarcophagid flies along with the descriptions of different instars. Keys to and figures of different instars and the species have been provided.

PREFACE

A comprehensive account of the Taxonomy of Sarcophagidae from West Bengal is presented in this work. The Chapter 1 dealing with Taxonomy is mostly based on collections made by the author from different parts of West Bengal, - from the foot-hills of the Himalayas to the shores of Bay of Bengal. The author could also examine a fairly large number of specimens in the collections of the Zoological Survey of India and the Indian Agricultural Research Institute, New Delhi. More than 22 identified species of the family, from different parts of the world were received from Dr.H. S. Lopes of Academia Brasiléria de Ciéncies, Rio de Janeiro, Brazil, for reference and aid to study.

A total of 37 species, under 15 genera of the tribe Sarcophagini, are included in the present work. Of these, 12 are new to science and 12 are being recorded for the first time from West Bengal. Females are described only if they were collected either in copula or were reared in the laboratory. Reprints of 2 papers, dealing with 3 new and two known species of the group are being attached under addenda.

An attempt has been made, for the first time, to study the Taxonomy of the immature forms of some of these flies from India.

The author is thankful to the Director, Zoological Survey of India, Calcutta, for permission to work on the material and also for laboratory facilities.

The author is indebted to Dr. A. N. T. Joseph of the Zoological Survey of India, Calcutta, for valuable suggestions and encouragement.

The author wishes to record his gratitude to Dr. P. T. Cherian of the Zoological Survey of India, for his constant support and untiring help throughout the course of the work. He was kind enough to go through the manuscript and suggest improvements.

Valuable help rendered by all the Research Assistants in the Diptera Section of the Zoological Survey of India is acknowledged.

The author expresses his thanks to Dr. H. S. Lopes of Academia Brasiléria de Ciéncies, Rio de Janeiro, Brazil, for his constant help from the very begining of this work. Dr. Lopes was kind enough to supply relevant literature and sent suggestions and comments about the identity of the species which were referred to him. Dr. Lopes also very kindly sent to the author about 22 identified species from various parts of the world for reference and comparision.

The author also wishes to express his thanks to Prof. B. B. Rohdendorf of the Palcontological Institute, Leningrad, U.S.S.R.; to Prof. P. Kano of Tokyo Medical and Dental University, Tokyo, Japan; to Dr. H. Kurahashi of the Department of Medical Entomology, National Institute of Health, Tokyo, Japan; to M.T. James of the Washington State University, Department of Entomology, Washington; and to Dr. F. Zumpt of the South African Institute for Medical Research, Johannesburg, South Africa, for providing valuable literature on the subject.

Thanks are due to Prof. S. K. Dasgupta, Head of the Department of Zoology, Hooghly Mohosin College, for suggestions and useful comments.

The Research Fellowship granted to the author by the Govt. of India, Department of Science and Technology, is also duly acknowledged

Finally, the author wants to express his deep sense of gratitude to Prof. B. Dasgupta, Principal, Darjeeling Govt. College, for constant encouragement and invaluable guidance received at every stage of the work.

1. INTRODUCTION

The Sarcophagid flies, popularly known as flesh flies, belonging to the family Sarcophagidae of the superfamily Sarcophagoidea in the order Diptera are of cosmopolitan distribution.

These flies often carry the germs of diseases of man and animals in their gut and may also act as mechanical carriers of such germs.

According to Greenburg (1971) the Sarcophagid flies have found associated with the following [illegible]organisms : Polio virus, Escherichia coli, Salmonella typhi, Pasteurella pestis, Bacillus radiciformis, B. thuringiensis, Giardia intestinalis, Trichomonas hominis, Endolimax nana, Entamoeba coli, E. histolytica, Iodamoeba bütschlii, Trichuris trichura, Enterobius vermicularis, Ascaris lumbricoides, Leishmania donovani and Mycobacterium tuberculosis. Greenburg (1971) also reported that the larvae of these flies have been found associated with the larvae of other Dipterous flies, viz. Dermatobia hominis (Cuterebridae) and Chrysomyia rufifacies (Calliphoridae) in cases of myiasis in man and animals.

The larvae of some Sarcophagid flies are also of economic importance because they are parasitic on other animals. For example, some species are parasitic on various insects which are harmful to man directly or indirectly. The parasitic habits of Sarcophagid larvae on various Arthropods, such as cockroaches, grasshoppers, locusts, mantids, camel crickets, spiders, bumblebees, honeybees and wasps,

certain coleopteran genera (*Aside*, *Eleodes*, *Plectodera*), Neuroptera and Lepidopterous larvae and pupae, have been discussed by various authors (Karsch, 1885, Townsend 1893, Aldrich 1916, Osborn 1919, Branch 19[illegible] Frison 1926, Marchionatto and Blanchard 1933, Wood 1933, Bonna 1936, Iyer 1940, Bibby 1942, Breland 1942, Smith 1944, Callan 1946, Dambach and Good 1943, Arthus and Coppel 1953, Smith and Finlayson 1950 and Downes 1955b.

Thompson (1943) mentioned *Sarcophaga* parasitising *Glossina* palpalis in the Upper Congo. Downes (1955b) recorded that the larvae of the subgenus *Fletcherimyia* live in the water in pitcher-plant and feed on other insects found therein. He also mentioned that the larva of *Sarcophaga* devour eggs in the egg-sacs of certain spiders.

Pandian and Delvi (1973) reported from India that the larvae of *Blaesoxipha kaestneri* are parasitic on the grasshopper *Poecilocerus pictus*. They also pointed out the possibility of using these larvae for the effective biological control of this grasshopper which feeds on buds and flowers of cultivated plants like brinjal and castor.

Cases of parasitisation of Oligochaeta and Mollusca by the larvae of Sarcophagid flies were reported by Schmitz (1917), Keilin (1919, 1921), Lopes (1940, 1942b) and Nair (1968). Some of these larvae are scavangers eating dead insects, molluscs and decomposing animal matter.

Lopes and Vogelsang (1953) reported a case of parasitisation of *Bufo granulosus* by *Sarcophagid* larvae. Knipling (1983) reported Sarcophagid larvae parasitic on turtle and tortoise.

Some Sarcophagid species cause myiasis in different parts of body of animals and man. For example, larvae of the Sarcophagid flies affect ear, mouth, eye, skin, nasal cavity, chest of infants and vagin of human beings (James 1947, Zumpt 1951b, 1965). Kano et al. (1967) reported several cases of intestinal myiasis caused by the larvae of Parasarcophaga similis (Meade) from Japan. Dasgupta et al. (1972) recorded from Darjeeling, India, a case of intestinal myiasis in leopard and its Keeper caused by the larvae of Sarcophaga macrosuriculata Ho. Ali-Khan and Ali-Khan (1974) reported two cases of myiasis from Quebec; one (Sarcophaga haemorrhoidalis Fallen) from the stool of a 5-year old child; the other (Sarcophaga crassipalpis Macquart) from the toe of a middle-aged man.

A few larvae of Cynomyia Roback and Sarcosyia Lopes, are venemous and can destroy all the larvae of other species in the same environment (Lopes, 1969a).

Various workers in different parts of the world worked on the Taxonomy of these flies. The Indian Sarcophagid fauna, particularly from West Bengal, has not however been thoroughly investigated. A review of the literature shows that only 0.14% of the Sarcophagid fauna of the world have so far been recorded from West Bengal.

In view of lack of adequate information on Sarcophagid fauna in West Bengal the present work has been undertaken covering all Districts of this State.

West Bengal is bounded on the north by Nepal, Bhutan and Sikkim, on the east by Bangladesh and Assam, on the south by Bay of Bengal and on the west by Orissa and Bihar. It lies between 21°-38' and 27°-10' north latitude and 85°-50' and 89°-50' east longitude.

The present study has shown that West Bengal with its varied geographical factors and diverse climatic conditions provide the habitat for many species of this cosmopolitan group of flies. Some of these species recorded in the present work are new to science.

II REVIEW OF LITERATURE ON THE FAMILY SARCOPHAGIDAE

Sarcophagid genera and species were formerly included under the genus *Musca* of the family Muscidae. The first species *Musca ruficornis* of the present family Sarcophagidae was described from the Oriental Region by Fabricius in 1974 and the type locality was East India. In the same year, he also described *Musca cinerea*, *Musca striata* and *Musca occidua* which are now placed under the genera *Leucomyia* Brauer and Bergenstamm, *Ruvinia* Robineau-Desvoidy and *Sarcophagula* Wulp respectively of the family Sarcophagidae. The first genus *Metopia* of the family was erected by Meigen in 1803 with the type species *Musca leucocephala* Rossi = *argyrocephala* Meigen from Italy. In 1805, he described a few more species under the genus *Musca*, which also belong to *Sarcophaga*. The genus *Sarcophaga* was erected by the same author in 1826 with *Musca carnaria* Linnaeus from Sweden as type species.

Robineau-Desvoidy carried out pioneering work on Sarcophagid Taxonomy. In 1830, he erected 2 genera *Amobia* with the type species *Amobia conica* Robineau-Desvoidy (mon) = *signata* (Meigen) and *Pekia* with type species *Pekia imperials* Robineau-Desvoidy = *paraceps* (Wiedemann). He also described a number of new species in the same year. Robineau-Desvoidy (1830, 1863) further erected

Phrosinella, Anicia, Ravinia and Servaisia from North and South America as new genera and described several new species under these genera. Walker (1852, 1859) added more species under the genus Sarcophaga. Rondani (1856-1864) described the genera Hillarella, Brachicoma and Macronychia from America. Brauer and Bergenstamm (1889-1894) described the following new genera Lepidodexia, Pachygraphia, Erythrandra, Pachoneura and Wohlfahrtia.

Townsend, an outstanding student of Sarcophagid Taxonomy, in his series of papers from 1892-1938 erected 78 new genera comprising a large number of species from both Nearctic and Palaearctic regions.

Girschner (1893) the well known Systematist of Calyptrate Muscoids, classified the group into Anthomyiden and Tachiniden. The Anthomyiden roughly corresponds to the Muscoidea and Tachiniden to Oestroidea together with the Sarcophagidea of Roback of 1951.

Pandellé (1894-1896) described a few Sarcophagid flies from France and America. Van Der Wulp erected a new genus Sarcophagula with the description of a few species in 1887.

Williston (1908) in his 'North American Diptera' divided the Calyptrates into six families, viz, Oestridae, Tachinidae, Sarcophagidae, Dexiidae, Muscidae and Anthomyiidae. Oestridae, Tachinidae (including Miltogramminae), Sarcophagidae and Dexiidae correspond to Girschner's Tachinidae and he included most of the

Calliphoridae in his family Muscidae. Thus the Muscidae and Anthomyiidae equal Girschner's Anthomyiidae.

Parker (1914-1923) worked on Sarcophagid flies from New England and North America and erected a lot of new species under the family Sarcophagidae and described the following new genera viz. Sarcofahrtia, Sabinata and Boettcheria. In 1917 he reported 4 new species Sarcophaga subtuberosa, S. crinita, S. orientalis and S. knabi from Guam and Philippines. Aldrich (1914-1932) reported 6 genera from North and South America.

Senior-White (1924) revised the Oriental species of Sarcophagid flies and reported a total number of 45 species including many new species.

Rohdendorf, the well-known Palaearctic Sarcophagidiologist, in a series of publications from 1928-1973 reported many new species under the family Sarcophagidae. In 1937 in his faunal work on Sarcophagidae from USSR, he made use of the hypopygial characters for the first time in Sarcophagid Taxonomy and divided the family into six subfamilies, viz. Sarcophaginae, Chrysogrammatinae, Agriinae, Mimodexiinae, Macronychiinae, Metopiinae. He divided the subfamily Sarcophaginae into 2 tribes, i.e.Sarcophagini and Raviniini and reported 27 genera and several subgenera containing more than 200 species out of which 13 genera and several subgenera were new.

Hardy in a series of his publications from 1927 to 1953 made valuable contributions to Australian Sarcophagid flies. He (1934b) divided the family Calliphoridae into 5 subfamilies Metopiinae, Phiniinae, Sarcophaginae, Chrysomyiinae and Calliphorinae. Enderlein (1928a) described 38 new genera from Berlin and its adjacent areas.

Patton *et al.* (1929) placed the Sarcophaginae under the family Muscidae with Tachinidinae and Calliphorinae as subfamilies of the same family.

Lopes, H. S. the world renowned Sarcophagidiologist in a series of his valuable papers, from 1935 to 1975 described several new species and 17 new genera. In his catalogue of Sarcophagidae from America South of United States, he reported 144 genera and 622 species (1969a) and provisionally considered four subfamilies, *viz*, Miltograminae, Micronychiinae, Paramacronychiinae, and Sarcophaginae. He divided the subfamily Sarcophaginae into six tribes, *viz*, Microcerellini, Notochaetini, Tephromyiini, Raviniini, Sarcophagulini and Sarcophagini. He also reviewed the genera *Strongylogaster* Macquart, *Neivamyia* Pinto et Fons, *Goniophyto* Townsend, *Helicobia* Coquillet, *Udamopyga* Hall, *Notochaeta* Aldrich, *Oxysarcodexia* Townsend, *Acanthodotheca* Townsend, *Tricholioproctia* Baranov, *Paraphrissopoda* Townsend, *Blaesoxipha* Loew, *Sarcophagula* Wulp, *Boettcherisca* Rohdendorf, *Lepidodexia*, Brauer and Bergenstamm, *Seniorwhitea* Rohdendorf, *Endonimyia* Lopes, *Tricharaea* Thomson and the subgenus *Pseudothyrsocnema* Rohdendorf from different parts of the world.

Lopes (1939) also carried out exhaustive studies on Sarcophagidae from the Australian region revising the Australian Sarcophagidae and reporting altogether 43 species under 12 genera. Out of these, 3 genera, viz, Johnsteinmyia, Taylorimyia and Hardyella and 7 species are new.

He (1932-1938) described several new species from Chekiang, Kiangsu, Kansu, Hainan, Java and its neighbouring areas.

Hall (1928-1938) who has done considerable work on this family has erected 9 new genera and several new species and also made valuable contributions to the study of Sarcophagid flies from Panama (1933), Patagonia and South Chile (1937).

Imms (1934) placed the Sarcophaginae under the family Tachinidae. Later on (1963) he transferred Sarcophaginae to family Calliphoridae.

Curran (1934b), the well-known Dipterist, included Anthomyiidae and those of Williston's species which lack hypopleural bristles in Muscidae. Sarcophagidae (including Miltogramminae), a part of Tachinidae and a part of Muscidae of Williston's Manual were included by him under his family name Metopiidae. In his conclusion, he stated that the family name should be changed to Metopiidae as the genus Sarcophaga was proposed long after Metopia and included 57 genera under Metopiidae.

Reinhard (1937-1967) described five new genera and many new species from the Nearctic and Neotropical regions.

Senior-White et al. (1940) in their faunal work reported 60 species of Sarcophagid flies from British India which then included India, Pakistan, Bangladesh, Burma and Sri Lanka.

Extensive and elaborate surveys on Sarcophagidae were conducted by Kano and Kano et al. in Japan from 1950 to 1971. Such surveys revealed the Sarcophagid flies of medical importance from different islands of Japan. Kano, Field Gordon and Shinonaga in 1967 in their faunal work reported altogether 77 species of the subfamily Sarcophaginae and a few species of Agrinae under 19 genera. They also included additional notes on the following genera Tokunea Rohdendorf, Herrisca Rhodendorf, Sinonipponia Rohdendorf and Kanoa Rohdenforf.

In 1951 Roback proposed a new classification for Calyptrate Muscoidea. He included these flies in three superfamilies, viz, Oestroidea, Muscoidea and Sarcophagoidea and under Sarcophagoidea he placed the families Sarcophagidae and Calliphoridae. In 1954 he divided the family Sarcophagidae into 2 subfamilies, viz, Sarcophaginae and Miltogramminae and after careful examination of aedegal parts, the Sarcophaginae was divided into 2 tribes Agrini and Sarcophagini and the former into three subtribes Wohlfahrtiina,

Sarcofahrtina and Agriina. In Sarcophagini there are 3 series, Series 1 with 1 subtribe Imparina, Series 2 with 5 subtribes Sarcophagulina, Hypopeltina, Hystricosomina, Sarcophagina, Raviniina.

Dodge, another well-known Sarcophagid Taxonomist, who in a series of publications from 1953 to 1967, dealt with the Sarcophagid fauna of Nearctic region and described 14 new genera and many new species from North America. He (1968a) made a detailed study of Sarcophagid flies from Barro Colorado Island and keyed and recorded 4 Miltogrammine and 68 Sarcophaginae out of which 7 genera and 33 species were new. In 1968b he also dealt, in detail, with the genus Nephochaetopteryx Townsend.

Rohdendorf, the outstanding student of flesh flies, published (1963a) a good account of the systematics of the Sarcophagidae from Ethiopian region wherein he dealt with 25 genera and 14 subgenera. Out of these 13 genera and 8 subgenera were new. In 1965 he divided the tribe Sarcophagini into 11 subtribes and 44 genera and subgenera. Of those 4 genera and 11 subgenera were new. He also synonymised many genera described by earlier authors. Another notable contribution by him and Gregor in 1973 is on Cuban Synanthropic flies wherein he keyed the species of 19 genera for the first time. In 1975 he also recorded 39 species including two new species of Sarcophagidae from Southern Spain.

Grunin (1964) studied the distribution of synanthropic flies from USSR and erected one new genus Rohdendorfiana and a few new species.

The next addition to our knowledge of this group came from the study by Fan (1964)[a] who described a number of new species from China. In 1965, in his key to the common synanthropid flies from China, he divided the family Sarcophagidae into 6 subfamilies viz, Sarcophaginae, Chrysogrammatinae, Agrinae, Mimodexiinae, Miltogramminae and Metopiinae. Sarcophaginae were further[sub-]divided into 3 tribes, Pavininii, Blaesoxiphini and Sarcophagini, and under Sarcophagini he placed 21 genera.

Downes (1965)[b] in his catalogue on North American Sarcophagids reported 47 genera and 22 subgenera, including a number of species, from Nearctic region.

Draber-Mońko (1966, 1968) revised the genus Pachyophthalmna Brauer and Bergenstamm and Miltogramma Meigen from Poland. In 1973 he also gave an account of the distribution of Sarcophagid fauna in Poland.

Kurahashi (1970, 1972, 1975) revised the three subfamilies, Miltogramminae, Macromychiinae and Agrinae from Japan and reported 13 genera and described a number of species.

Zumpt (1972) revised the species of Ethiopian Sarcophagid flies mainly on the basis of male hypopygia. He dealt with 13 genera from the Ethiopian regions under this group. Out of these, 8 genera were new and he relegated the following genera Aethiopisca Rohdendorf, Afrothyrsocnema Rohdendorf, Boreaca Robineau-Desvoidy, Braunsiella Enderlein, Chaetophalla Rohdendorf, Liopygia Enderlein, Harpagophalloides Rohdendorf, Scotathryxia Enderlein, Spinerubitea Rhodendorf, Stygiophalla Rohdendorf, Thyrsocnema Enderlein and Xanthopterisca Rohdendorf of certain authors to subgeneric status and treated them under the genus Sarcophaga. At the same time he followed the subgeneric status of Curranea Rohdendorf, Parasarcophaga Johnston and Tiegs and Prionophalla Rohdendorf like his predecessors. He (1967, 1972) in his earlier papers considered members of the family Sarcophagidae under the name Sarcophaginae and treated it as a subfamily of Calliphoridae along with other subfamilies Calliphorinae and Milliograminae. However in line with other workers Zumpt (1973) considered Sarcophagidae as a family separate from Calliphoridae with Miltigramminae as subfamily of the former. Shinonaga and Lopes (1965, 1975), Rhodendorf (1975) and Kurahashi (1975), differ from Zumpt in the generic concept of many Sarcophagids. (In the present work the generic concepts of Lopes, Rhodendorff and Kurahashi are followed).

Read in 1974 revised the Sarcophagid flies from Madagascar and reported 20 species under 3 genera.

Mihalyi (1975) and Soper et al. (1976) added some new species from Hungary and Canada respectively.

We owe greatly to Senior-White (1924) for our knowledge of Oriental Sarcophagidae. He revised the subfamily Sarcophaginae and reported 48 species including many new ones, under two genera viz, Sarcophaga Meigen and Sarcophila Rondani. Out of these 48 species, 31 were reported from India. But from West Bengal only 14 species were recorded belonging to one genus Sarcophaga Meigen. Later on Senior-White et al. (1940) included 60 species in Fauna of British India where two species were further added from India. Since Senior-White (1940) considered Sarcophaga flavipalpis only as a variety of S. knabi the total number of species known from India became 32 and the number of species reported from West Bengal 15, after the addition of one new species from Darjeeling by Senior-White in 1930. Thomas (1949) reported 5 new species under the genus Sarcophaga Meigen from the Oriental region. Lopes (1961[b]) and Lopes and Kano (1969[a]) described new species Boettcherisca nathani and Sarcophaga (Parkerimyia) nathani from South India. Shinonaga and Lopes (1975) while revising the sub genus Pseudothyrsocnema Pohdendorf from the Oriental and Palearctic regions, reported 2 new species Thyrsocnema(Pseudothyrsocnema) indica and T. (P.) longistylata from India which are conspecific with Sarcophaga caudagali Böetteher and S. crinita Parker. Alwar and Seshiah (1968) reported S. brevicornis Ho from South India and Dasgupta et al. (1972), S. macrosuriculata Ho from Darjeeling, India.

Rohdendorf (1966) reported 13 species under 9 genera from Nepal out of which 2 genera, 1 subgenus and 6 species were described as new. Lopes, (1967) reported a few species from the Philippines. Kano and Shinonaga (1969) added 2 new species Iranihindia nepalensis and Sarcosolomonia shresthani from Nepal. Nandi (1976) reported five species including three new species from India. Out of these, four species are available in West Bengal also.

From the above review it is evident that only 40 species under 6 genera viz, Sarcophaga Meigen, Sarcophila Rondani, Boettcherisca Rohdendorf, Sarcosolomonia Baranov, Thyrsocnema Rohdendorf and Kosloves Rohdendorf are known to occur in India. So far the family is known to be represented in West Bengal by only 20 species under the genera Sarcophaga, Kosloves and Sarcosolomonia though 2262 species (Rhodendorf, 1974) of the family are known from the world today.

Little work has been done on the taxonomic identity of the larvae of Sarcophagid flies especially with regard to their different immature stages. Portschinsky (1910) was the first to study the morphology of the larvae of Sarcophagid flies. Later on MacGregor (1914) made use of the structure of posterior spiracles in identifying the larvae. Keilin (1917) discussed the importance of larval characters such as the cephalopharyngeal sclerite,

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anterior and posterior spiracles, and also other external and internal features, from the taxonomic point of view. Root (1923) described the morphology of the larvae of these flies with special reference to spiracular characters.

Greene (1926) dealt with the larvae and pupae of Sarcophagid flies. Pao (1927) gave a comparative account of the larvae of Muscidae, Calliphoridae, Sarcophagidae and Anthomyiidae and prepared keys for the identification of the first and second instars of some genera of these flies including Sarcophaga. Knipling (1936) studied the larvae of a few species on a comparative basis. Lopes (1943, 1945[b], 1946[a]) described many Sarcophagid larvae from the Neotropical region. James and Gassner (1947) covered the larvae of three species of Wohlfahrtia and provided the keys for the identification of all three instars. Hall and Bohart (1948) and Bohart and Gressit (1951) presented the keys and short descriptions and figures of 6 species from Guam. Kano et al. (1951) described the different stages of nine species of Sarcophagid flies from Japan and prepared the keys for their third instar. Roback (1951) used the characters such as the pharyngeal sclerite and posterior spiracles of the larvae in the classification of the Calyptrate Diptera. Another notable Japanese worker, Ishijima (1957) revised and prepared the keys for the third instar larvae of all the Sarcophagid flies available in his country.

The only work done in India on the immature stages of the group is that of Sinton (1921) who described the third instar of Sarcophaga ruficornis Fabricius. But nothing has been done so far on this aspect from West Bengal.

III. MATERIAL AND METHODS

A) ADULT

Collection and preservation of the adult flies

The entire material of Sarcophagid flies included in the present study was collected by the author from different parts of West Bengal (Plate I, Fig.1) from various habitats such as bushes, grasses, flowering plants, decaying organic matters, dead body of different animals and from and near human excrement with the help of butterfly net. In some cases the flies were also collected with bait traps (Plate 1, Figs.2-3). Different kinds of baits such as dead fish, meat and banana were used. Prior to their use meat and fish were allowed to rot for 24 hours.

The flies were killed in a killing jar containing Paradichlorobenzene, xylene or chloroform vapour. In cases where the flies were collected in bait trap, the trap was covered with an oil paper bag and the poisonous vapour absorbed in cotton was introduced inside the bag. Later the specimens were taken out from killing jar or bait traps and preserved dry in insect envelope. Locality, habitat, date, altitude, etc. were noted on a small piece of paper used as a label and the labels were kept along with the specimens inside the envelope.

After returning to the laboratory, the specimens were sorted out and relaxed in a relaxing chamber for about 24 hours. Then they were pinned (Pin No.3), the pin passing through the specimen on the right side just a little anterior to the prosuture. The legs and wings were spread fully at right angle to the body so as to facilitate easy study. The specimens were kept in a dry chamber for at least 4-5 days before being preserved in insect cabinet.

Morphological study and preparation of genitalia

The chaetotaxy is best studied in dry condition. For studying male genitalia, the flies were kept in a relaxing jar for about 24 hours and later the genetalia were pulled out with the help of a fine forceps. The best procedure for taking out the genetalia of the flies is by placing the pinned specimens with its abdomen slightly turned upward on a pinning board, at an angle of 45° - 60°. After that the 5th tergite was pressed dorsoventrally with the help of a fine forceps held in the left hand and the genetalia were pulled backwards, very cautiously, with another fine forceps in the right hand. Attention was paid so that first and second genetalia segments also came out smoothly along with the rest of the genetalia.

The genitalia were boiled in a test tube immersed in 10% KOH solution for 3-5 minutes. Caution was taken in not over-boiling the genitalia. After boiling, the parts were put in a cavity block and washed with distilled water to remove the KOH. Then they were

transferred to 30% alcohol and dissected out with the help of needles under Stereoscopic binocular microscope (10 x 3x 2 [illegible]). A blunt needle was used with the left hand for keeping the genitalia in a fixed position and also to remove the chitinous parts during dissection. A pointed needle was used with the right hand for dissecting the different parts of genitalia. During dissection, care was taken in not damaging bristles as these are also having taxonomic value.

After study the genitalia were passed for dehydration through 50%, 70%, 90% and finally absolute alcohol. Then the parts were cleared in clove oil for about 3 minutes, mounted on the tip of a triangular paper board with Arabic Gum and attached to the pin bearing the specimen. In cases where they were to be figured the genitalia were transferred to phenol from clove oil and the figures were drawn with the help of a camera lucida. In some cases the genitalia were mounted in between two cover slips in Canada balsam ~~gum~~ medium and glued to a small paper piece. The paper piece carrying the cover slip with genitalia was attached to the same pin of the specimen for further study. But in most of the cases the genitalia were preserved dry on triangular paper board as described earlier.

To make sure of their identity the females described in this dissertation were either collected from the field during copulation or were taken after rearing from the same generation. It is difficult to identify the females not so collected because the genitalia do not exhibit sufficient variations enabling one to ascertain their true identity.

For the study of female genitalia the specimens were relaxed and placed on the pinning board in the same way as males. In females the whole abdomen was dissected out from the rest of the specimen. Later the first five abdominal sternite, then the spermatheca and lastly the genitalia parts were dissected out, dehydrated in various grades of alcohol and mounted in Balsam medium as mentioned earlier.

B) LARVAE

Collection of the adult flies

The adult female flies used in the study of the larvae were collected with net sampling and brought back to the laboratory. In a few cases the flies were collected in copula and kept isolated in individual vials. The adult flies were identified. After that the gravid females were sorted out and transferred to plastic tubes of (4 cm high and 2.5 cm diameter). and 0.50 grams of lean meat were supplied for larviposition. Within a short time first stage larvae were deposited. During this procedure, the mouth of the plastic tube was covered with silken cloth, fixed with adhesive tape, so that other Phorid fly could not deposit any larvae and thus contaminate the culture medium.

Rearing of the larvae

A few of the first stage larvae were taken out from the plastic tubes and the rest were supplied with 0.50 gms. of rotten meat (free from fat substance) every day. After 2-3 days the second

stage larvae and in 4-6 days the third stage larvae were separated and preserved in 70% alcohol. Before preservation the larvae of first, second and third stages were killed in hot water.

Making slides for microscopic studies

The spines and tubercles of the specimens were studied under Stereoscopic binocular microscope (10 x 3x 2). For this the larvae were boiled in 10% KOH solution for 3-8 minutes depending on the size of the larvae and washed in water. After removing the internal debris the larvae were passed for dehydration through, 30%, 50%, 70% and 90% alcohol to absolute alcohol. After proper dehydration the larvae were cleaned with Clove oil. The larvae were further processed in creosote and mounted in Canada Balsam.

For studying the anterior and posterior spiracles and the cephalopharyngeal skeleton, the anterior parts (including 1st to 3rd segments) and the last segment were cut off by microscissors. The dissected portion (except the anterior spiracle) was boiled with 10% KOH solution for 4-8 minutes. The material was then transferred to water in a small dish to remove the liquified muscle, fat and excess KOH particles. The clean material was put in 30% alcohol and dissected finely under dissecting microscope. These were dehydrated in alcoholic grades as described earlier, cleaned in clove oil and creosote and finally mounted in Canada Balsam.

The anterior spiracle was not required to be boiled because in this process the spiracular branches could be damaged. In this case after dissection in 30% alcohol and proper dehydration, the parts were mounted in slides with Canada balsam.

Before mounting the posterior spiracle, the ligaments and tendons joining the posterior spiracles were removed. It was also required to trim the surrounding cuticle so as to obtain a flat mount and the posterior part was kept in front view for drawing accurately before mounting in Canada balsam.

In dissecting the cephalopharyngeal skeleton, it was necessary to remove the muscle and ligament surrounding the mouth hook carefully so as not to damage the small structure like dental and accessory sclerites.

Before mounting the anterior and posterior spiracles and cephalopharyngeal skeleton with cover slip, a few pieces of cover glass were placed around the specimen in Canada balsam to make sure of good orientation. Then a cover glass was placed upon the specimen gently and carefully and pressed down so as to lay the parts laterally.

All the figures in the present dissertation were drawn with the help of a camera lucida by the author and the measurements used were in millimetres. The materials are deposited in the National Collections of Zoological Survey of India, Calcutta.

Most of the terminologies and abbreviations used in the present work are those followed by Kano et al. (1967), Lopes (1952) and Ishijima (1967) and the classification followed after Rohdendorf 1937, 1962).

// IV. TAXONOMIC ACCOUNTS //

// S E C T I O N - 1 //

TAXONOMY OF THE IMAGINAL FORMS

SALIENT FEATURES OF THE FAMILY SARCOPHAGIDAE

The family Sarcophagidae comprises a group of fairly large flies (6 mm. to 18 mm.). These flies are widely distributed all over the world. The members of this family are generally greyish in colour and with the following characters: Bare and dicheptic eyes, narrower frons in males than in females, long third antennal segment, bare, pubescent or basally plumose arista, three dark longitudinal stripes on scutum, checkered or tessellated pattern on abdominal tergites, sharply curved M 1 + 2 that is close to R_{4+5}, a vertical row of bristles on hypopleuron, not convex postscutellum and very large phallosome. These flies are mostly larviparous but some deposit eggs. Larvae are elongated and conical and of the cyclorrhaphous type with a series of tubercles in the posterior margin and the posterior spiracles situated in a deep cavity. (Typical adult fly, Plate I A. Fig.A, and Figs.1-9., Male I B, Figs. 1-7).

KEY TO THE SUBTRIBES OF SARCOPHAGINI FROM WEST BENGAL

1. Usually three stout postsutural dc bristles of uniform length which are equidistant ... 2

Usually four stout postsutural dc (rarely six, five or three) of unequal length, with the longest at the rear ... 3

2. Apical part of paraphallus always undefined, usually not separate from basal part; lateral plate of paraphallus usually well developed; postabdomen always black; sometimes only two postsutural dc, rarely four ... Subtribe Bellieriina

Apical part of paraphallus usually distinctly separate and even clearly defined; postabdomen often with red anal tergite; postsutural dc very rarely four; lateral plate of paraphallus usually not developed, occasionally present as slender processes ... Subtribe Heteronychiina

3. Arista almost bare, except for short, fine hairs; parafacials and gena without black bristles; a pair of large, overlapping membranous processes present; apical part of paraphallus not separate; frons of male very broad; body covered with very dense light bloom ... Subtribe Leucomyiina

Arista basally plumose; gena and parafacials often with black bristles; frons of male narrow or of average width ... 4

4. Apical part of paraphallus not separate; postabdomen always deeply black; propleura bare ... 5

Apical part of paraphallus always clearly separate; postabdomen sometimes blackish-brown, especially in females; propleura sometimes setigerous ... 6

5. Entire paraphallus strongly sclerotised, dark; lateral plate of paraphallus forming a massive process, sometimes bipartite; ventral and membranous processes long ... Sarcoselemonina

Phallosome very large, slightly sclerotised, vesiculate; ventral and membranous processes short, only slightly projecting ... Subtribe Seniorwhiteina

6. Apical part of paraphallus always large, clearly demarcated and sclerotised, often bearing many processes or protuberances; propleura sometimes setiferous; postabdomen sometimes light coloured; lateral plate of paraphallus usually well developed, often intricately constructed and erect ... Subtribe Parasarcophagina

Apical part of paraphallus forming long, slender, more or less cylindrical processes, more delicate than basal part; propleura bare; postabdomen always black; lateral plate of paraphallus in the form of short humate processes ... Subtribe Harpagophallina

1. Subtribe : Bellieriina

This subtribe is widely distributed and Rhodendorf (1966) has reported seven genera from Eurasia, viz, Notoecus Stein, Sarcotachinella Townsend, Kramerella Enderlein, Bellieria Robineau-Desvoidy, Thyrsocnema Enderlein, Bellieriomima Rohdendorf, Pierretia Robineau-Desvoidy. Out of these only two genera viz, Thyrsocnema Enderlein and Pierretia Robineau-Desvoidy are known from India both of which occur in West Bengal also.

Key to the genera of Bellieriina from West Bengal

Third and fourth abdominal sternites of male with short bristles; second sternite with long, dense hairs

... Thyrsocnema Enderlein

Second, third and fourth abdominal sternites of male with long, dense bristles; hairs on fourth sternite sometimes short

... Pierretia Robineau-Desvoidy

Genus : Thyrsocnema Enderlein, 1928

Type-species : Sarcophaga ineisilobata Pandellé 1896

Thyrsocnema Enderlein, 1928. Arch. Klass. phyl. Ent., 1:42

Generic characters : Cell R_5 always open; three or more postsutural dorsocentral bristles; middle femora without orange spots; second sternite with long dense hairs; third and fourth abdominal sternites of

male with short bristles; phallosome not laterally compressed, sometimes dorsoventrally flattened, always more or less elongate or with distinctly separate appendages and with well developed median transparent zone; apical plate of paraphallus well developed; ventralia long.

This genus is distributed in the Oriental, Ethiopian and Palaearctic regions. Only two species have so far been recorded from Oriental region.

Subgenus Pseudothyrsocnema Rohdendorf, 1937

Faune de l' URSS., 19(1) : 167, 431.

Type species : Sarcophaga spinosa Villeneuve, 1911.

Subgeneric characters : Paraphallus well developed, long and slender; ventralia short with 1 to 3 pairs of lobes; apical plate of paraphallus elongated, lateral plate short; styli of glans long, extending in some cases beyond the apex of apical plate of paraphallus; cerci almost wholly covered with hairs, its apical part not slender.

This subgenus is distributed in the Oriental and Palaearctic regions and a total of eight species have so far been recorded from these regions. Out of these, only two species have been described from India and only one species is available from West Bengal.

Thyreocnema (Pseudothyreocnema) longistylata

Shinonaga and Lopes, 1975 // Plate III, Figs.1-6 //

Sarcophaga grinata Senior-White, 1924, Rec. Ind. Mus., 26(3) : 245, nec Parker, 1917; Shinonaga and Lopes, 1975, Pacif. Insects, 16(4) : 459, Syn.

Sarcophaga saudagali Lopes, 1938, Mem. Inst. Oswaldo Cruz, 33(4) : 557; Shinonaga and Lopes, 1975, Pacif. Insects, 16(4) : 459, Syn.

Thyreocnema (Pseudothyreocnema) longistylata Shinonaga and Lopes, 1975, Pacif. Insects, 16(4) : 459.

Male : Body length 8 to 10 mm.

Head : Frons about three-fifths the width of eye; frontal vitta black, its width at narrowest point twice that of parafrontal, parafrontal and parafacial black with golden pollen, the former with scattered black hairs, the latter with a row of seven black hairs below the eye margin of which lower three are stout. Antennae brownish reaching to about 0.9 the distance to vibrissae; 1st and 2nd segments blackish-brown, with short spines, tip of 2nd segment reddish; 3rd segment brownish, with silvery pollen, its length about two and a half times that of the 2nd; arista long and plumose on basal half. Facial ridge brownish, wholly with silvery pollen and with short black spines at its lower one-third; vibrissae long, cruciate, distance between vibrissae about one and a half times the parafacial width; frontal bristles 9-10, arranged in a row on parafrontal, upper two reclinate,

lower three below base of antennae reaching to about two-thirds the 2nd antennal segment, others decussate and directed forwards; gena black with silvery pollen and black hairs; postgena black, with greyish hairs; ocellar triangle black, with four pairs of long, divergent black hairs; outer vertical short, inner one well developed, about three times the outer vertical; postvertical moderately developed, about two-fifths the inner vertical; ocellar and posteocellar short, shorter than postvertical; two rows of postocular setae present besides the postocular cilia of which the 1st rew is almost regular and the 2nd irregular, the rest of the area with greyish hairs; palpi slender, black; probescis brown.

Thorax : Grey, with three black longitudinal stripes; ac 0 + 1; dc 5 + 5 (posterior two stout); ia 1 + 2; pa 1; h 3; ph 2; np 4; pa 2; sa 3; st 1 + 1 + 1; mpl 6; hpl 6-7; upper part of propleura bare, black; prostigmatic and propleural bristles well developed and accompanied by short hairs; pro- and metathoracic spiracles brown; apicoscutellar and discoscutellar bristles 1 pair each, the former cruciate; laterescutellar bristles 2 pairs each.

Wings Hyaline with brown veins; R_1 bare; R_{4+5} with 7-8 short setae located dorsally and extending upto three-fourths the distance from basal node to r-m; several setae present on ventral surface of R_{4+5}; fifth sector of costa about one and a half times the third, the former on its anterior margin with short spines along its basal five-sixths; costal spines stout; epaulet black, with short spines; basicostal scale yellowish; squama yellowish; haltere brown.

Legs : Black; fore femur with two rows of long bristles on posterodorsal surface and a row of bristles on posterior margin of ventral surface; fore tibia with 3 bristles on the basal part of anterodorsal surface, 1 bristle on posterolateral surface and 1 bristle on posterodorsal surface the last two at about one-third the distance from the distal end; mid femur with about 4-5 bristles along the middle portion of anterodorsal surface, a row of short setae on distal half of anteroventral and posteroventral surfaces, a row of bristles each on the basal half of anteroventral and posteroventral surfaces and 3 bristles on the distal part of posterolateral surface; mid tibia with 2 long and a row of short bristles on posterodorsal surface, 1 bristle on anterodorsal and 1 on posterolateral surfaces at about one-third the distance from the distal end and a row of bristles on anterodorsal surface; hind femur with two rows of long bristles on anterodorsal surface, a row each on anteroventral and posteroventral surfaces besides 1 bristle each on posterodorsal and posterolateral surfaces distally; hind tibia with a row of bristles on anterodorsal surface and 2 bristles each on the distal half of posterodorsal and anterodorsal surfaces, the tuft of hairs on anterior and posterior margins of ventral surface absent.

Abdomen : Black and silvery grey checkered pattern; median marginal bristles on 2nd and 3rd abdominal tergites absent but both with a pair of lateral marginal bristles; 5th tergite with a row of about 14-16 marginal bristles. 1st and 2nd sternites with moderately

long hairs; 4th sternite with a tuft of short setae at its posterior end; 5th sternite V-shaped, with stout spines on each arm laterally and short hairs on distal end; 1st and 2nd genital tergites brownish black, with short hairs but without bristles; inner forceps long, straight with a small notch at its pointed end, outer forceps almost triangular with hairs on distal end; anterior paramere almost blunt at end, with a small lateral projection; posterior paramere curved and pointed at apex, with 2 hairs on its anterior margin; theca is shorter than paraphallus, not much sclerotised; apical plate of paraphallus as long as the styli; styli long and pointed, without serration at its end; lateral plate of paraphallus narrowed and curved anteriorly; ventralia bear a pair of rounded, well sclerotised, anteriorly dentate plates.

Specimens examined : 1 ♂ , West Bengal : 24 Parganas, Diamond Harbour, 6.vii.1974, coll. B.C.Nandi; 1 ♂ , Midnapore, Digha, 30.xi.1974, coll. B.C.Nandi; 1 ♂ , Midnapore, Arabari Forest, 26.xi.1974, coll. B.C.Nandi.

Distribution : India : Tamil Nadu : Madras, Kodaikanal (Karikal); Bihar : Pusa, Chapra, Chota Nagpur; West Bengal : Canning, Midnapore, Calcutta; Orissa : Dongeapesi.

Bionomics : Nothing is known.

The author has collected this species from bushes.

Genus : Pierretia Robineau-Desvoidy, 1863

Type-species : Sarcophaga nigriventris Meigen, 1826

Pierretia Robineau-Desvoidy, 1863, Hist. Dipt., 2 : 422

Athyrsia Enderlein, 1928, Arch. Klass. Phyl. Ent., 1 : 34; Rohdendorf, 1963, Stuttg. Beitr. Naturk., 124 : 7, Syn.

Generic characters : Antennae short, length of third segment about twice that of the second; arista long and plumose on basal half; frons about two-thirds the width of eye; parafacial with a row of long hairs; oral margin protruding forwards; upper part of propleura bare; lateral postscutellar plates setose; presutural bristles not differentiated; postsutural dorsocentral bristles 4; apicoscutellar and discoscutellar bristles 1 pair each; lateroscutellar bristles 2 pairs; cell R_5 open; vein R_1 setose or bare; 3rd abdominal tergite without median marginal bristles; inner forceps tapering towards their apices; theca shorter than paraphallus; apical part of paraphallus well developed but usually fused with basal part; styli of glans usually long, ventralia usually well developed; genitalia black.

This genus is distributed in the Oriental and Palaearctic regions. Seven species have been recorded from these regions out of which only one species is known from India.

Subgenus : Asceletella Enderlein, 1928

Type-species : Sarcophaga calcifera Böettcher, 1912

Asceletella Enderlein, 1928, Arch. Klass. Phyl. Ent., 1:50

Oxyphalla Rohdendorf, 1965, Revue d' entomologie de L'URSS., 44(3) : 692,

Lopes, 1976. Syn.(Dr.H.S.Lopes in a personal communication in September 1976 has informed the author that Oxyphalla Rohdendorf is a synonym of Asceletella Enderlein and that this opinion will be published by him shortly)

This subgenus is distributed in South China, Sri Lanka and India. Only one species calcifera (Boettcher) is known under this subgenus which is being reported for the first time from West Bengal also.

Subgeneric characters : Vein R_1 setose; apical plate of paraphallus slender and sharp, extending distally; lateral plate of paraphallus is attached almost apically; phallosome floriform.

Pierretia (Asceletella) calcifera (Böettcher,1912)
// Plate IV, Figs. 1-5 //

Sarcophaga calcifera Böettcher, 1912, Ent. Mitt., 1 : 169

Asceletella formosana Enderlein, 1928, Arch. Klass Phyl. Ent., 1 : 50; Kano and Lopes, 1970, Rev. Brasil. Biol., 30(2) : 315, Syn.

Pierretia calcifera (Böettcher), Fan, 1965. Key to the common synanthropic flies in China, P.233.

Pierretia (Oxyphalla) calcifera (Böettcher), Rohdendorf, 1965, Revue d' entomologie de l' URSS., 44 (3) : 602.

Pierretia (Asceletella) calcifera (Böettcher), Keno and Lopes, 1970, Rev. Brasil Biol., 30(2) : 315.

Male : Body length 5-7 mm.

Head : Frons about two-thirds the width of eye; frontal vitta black, width at narrowest point more than that of parafrontal; parafrontal and parafacial blackish, with silvery pollen, both with a row each of short hairs near the eye margin of which the lower three in the latter case are stout. Antennae brown, reaching to about 0.9 the distance to vibrissae; 1st and 2nd segments blackish-brown, with short black hairs, the latter with one long bristle apically; 3rd segment black, pollinose; its length 2.5 times that of the second; arista long and plumose on its basal two-thirds; facial ridge almost bare, brownish-black, silvery pollinosity, vibrissae long, cruciate, distance between vibrissae about two times the parafacial width; frontal bristles 8, arranged in a row on parafrontal, upper two reclinate, lower two below base of antennae reaching to about half the length of 2nd antennal segment, the rest decussate and directed forwards; gena black, with short hairs; postgena black with grayish hairs; ocellar triangle brownish, with silvery pollen and 3 pairs of short, divergent hairs; outer vertical bristle not differentiated; inner one well developed; postvertical short, about one-third the inner vertical;

ocellar well developed; the postvertical longer than the shortest parafrontal bristle; postocellar short; two rows of postocular setae besides postocular cilia, 1st row regular, 2nd irregular with black and white hairs, the rest of the area with greyish hairs; palpi slender, blackish; proboscis black.

Thorax : Greyish, with three black longitudinal stripes; ac 0 + 1; dc 4 + 4 (1st post dc weak); ia 0 + 2; pa 1; h 3; ph 4; np 4; sa 3; pa 2; st 1 + 1 + 1; mpl 5; hpl 6; upper part of propleura bare with silvery pollen; prostigmatic and propleural bristles well developed and accompanied by short black hairs; pro- and metathoracic spiracles brown; apicoscutellar and discoscutellar bristles 1 pair each, the former stout, cruciate; the latter weak; lateroscutellar bristles 2 pairs each.

Wing : Hyaline with brown veins; R_1 with a row of 9-10 stout setae located dorsally; R_{4+5} dorsally with a row of 7-9 short setae extending from basal node to r-m; third costal sector shorter than the fifth, the latter with short spines along its whole length on anterior margin; costal spines short; epaulet black, with black spines; basicostal scale yellowish; squama creamy white; haltere brownish.

Legs : Black; fore femur with two rows of bristles on posterodorsal surface and a row of bristles on posterior margin of ventral surface; fore tibia with 3 bristles on the basal one-third of anterodorsal surface and 1 bristle on the posterodorsal surface at about

one-third the distance from the distal end; mid femur with 4 bristles along middle portion of anterolateral surface, a row each of short setae on the distal halves of anterodorsal and posteroventral surfaces, a row of about 4 bristles in the basal half of anteroventral surface and a row of bristles on posterodorsal and 1 bristle on posterolateral surfaces distally; mid tibia with 2 bristles on posterodorsal surface, 1 bristle each on posterolateral and ventral surfaces at one-third the distance from the distal end and 3 bristles on anterolateral surface; hind femur with two rows of bristles on anterodorsal surface (2nd row incomplete), 3 long bristles on anteroventral surface and several bristly hairs on posterior margin of ventral surface; hind tibia with a row of short and long bristles on anterodorsal surface, 2 bristles on posterodorsal surface medially, 1 bristle on anteroventral surface at about one-fourth the distance from the distal end and several long hairs on anterior and posterior margins in the distal half.

Abdomen : Grey, silvery checkered pattern; 2nd and 3rd abdominal tergites without median marginal bristles but with one pair of lateral marginal bristles on each segment; 4th segment with a pair of median and three pairs of lateral marginal bristles; 5th segment with a row of about 14 marginal bristles; 1st four sternites with long hairs but without bristles; 5th sternite almost V-shaped, with short spines laterally on each arm and with several short and 1-2 long hairs on distal end; 1st genital tergite black, with short hairs but without

marginal bristles; 2nd tergite black, with numerous short and long hairs; inner forceps almost straight, curved and pointed at apex, with short hairs on four-fifths its length from the base; outer forceps almost triangular, with hairs; anterior paramere slender, blunt at apex; posterior paramere curved and pointed at apex, with 2 short hairs on anterior side apically; theca shorter than the paraphallus, both sclerotised; apical plate of paraphallus curved and pointed at apex, basally broad; lateral plate of paraphallus well developed with one anteriorly sclerotised process; ventralia long, curved, pointed at apex, less sclerotised distally; styli of glans long and sclerotised.

Specimens examined : 2 ♂♂ , West Bengal : Calcutta, Eden Garden, 25.i.1975, coll. B.C.Nandi; 1 ♂ , Midnapore, Salbankura, 27.xi.1974, coll. B. C. Nandi.

This species is being recorded for the first time from West Bengal.

Distribution : India : West Bengal : Calcutta, Midnapore; Bihar : Pusa; Kashmir; Tamil Nadu : Nilgiri Hills, Coonoor; Sri Lanka; Formosa; Philippine Islands; China; Japan.

Bionomics : According to Senior-White et al. (1940) this species has been bred on a gastropod and also on meat.

2. Subtribe : Heteronychiina

This is a widely distributed subtribe. Rohdendorf (1965) reported five genera under this subtribe from Eurasia. Only one genus Kozlovea Rohdendorf is known from India.

Genus : Kozlovea teshernovi Rohdendorf, 1937

Type-species: Kozlovea Rohdendorf, 1937, Faune de l' URSS, 19(1) : 300, 468.

Generic characters : Antennae long; width of frons about half that of eye; third antennal segment 2.5 - 3 times that of the 2nd; vein R_1 not setiferous; arista plumose, not so long; propleura bare; ac 0 + 1; three pairs of stout posterior dc present; R_5 open; genital tergite well developed, black; apical part of cerci pointed and notched anteriorly; theca shorter than paraphallus; lateral plate of paraphallus with short basal process; phallosome of asymmetric structure with very large funnel-shaped styli.

This genus is distributed in the Palaearctic and Oriental regions.

Kozlovea lopesi Nandi +

(+ Please see addendum-1)

3. Subtribe : Leucomyiina

This subtribe is known to be represented by only two species under the genus Leucomyia Brauer and Bergenstamm from the Oriental and Palaearctic regions. Only one of these species is being recorded for the first time from West Bengal, India.

Genus Leucomyia Brauer and Bergenstamm, 1891

Type species : Musca cinerea Fabricius, 1794

Leucomyia Brauer and Bergenstamm, 1891, Denk. nat. Akad. Wien., 57 : 368.

Sarcophila Senior-White, 1924. Rec. Ind. Mus., 26(3) : 256; Wehdendorf, 1965, Revue d' entomologie de l' URSS; 44(3) : 603, Syn.

Generic characters : Third antennal segment more than two times the second segment; arista long, basal half pubescent; frons wider than the width of eye; parafacial with faint microhairs near the eye; one pre-acrostichal bristle; four postsutural dorsocentral bristles present; ocellar very stout; presupra-alar bristles two of which the 1st one weak; two sternopleural, two laterescutellar and one short discoscutellar bristles present; R_{4+5} with setae on three-fourths its length from basal node to r-m; third abdominal tergite without median marginal bristles; 4th and 5th with marginal bristles; 1st genital tergite without marginal bristles; lateral plates of paraphallus very long, heavily sclerotised, cruciate, asymmetrical; ventralia membranous; inner forceps with short spines and hairs apically.

Leucomyia cinerea (Fabricius, 1794) // Plate V, Figs.1-5 //

Musca cinerea Fabricius, 1794, Ent. Syst., 4 : 331.

Sarcophila alba Schiner, 1868, Reise Novara, Dipt., 315; Senior-White, 1924, Rec. Ind. Mus.; 26(3) : 257, Syn.

Sarcophila cinerea (Fabricius), Senior-White, Aubertin and Smart, 1940, Fauna British India, Dipt., 6 : 277.

Leucomyia cinerea (Fabricius), Brauer and Bergenstamm,1891, Denk. nat. Akad. Wien, 57 : 368, Kano, Field and Shinonaga, 1967, Fauna Japonica, Sarcophagidae, p.36.

Male : Body length 8-9 mm.

Head : Width of frons about one and a half times that of eye; frontal vitta black, covered with silvery white pollen, its width about three times that of parafrontal; parafrontal and parafacial with silvery white pollen, the former with short hairs, the latter bare. Antennae brown, reaching to about 0.9 the distance to vibrissae, 1st and 2nd segments dark brown, with short spines; apex of 2nd segment reddish, with a long bristle; 3rd segment about two times the 2nd, silvery pollinosity; arista long, its basal three-fifths pubescent; facial ridge black with white pollen but without spines; vibrissae long, cruciate, distance between vibrissae nearly equal to parafacial width; frontal bristles 7, arranged in a row on parafrontal, lower one below base of antennae, upper one reclinate, the rest decussate and directed forwards; gena covered with silvery white pollen and numerous white hairs; postgena black, with grayish hairs; ocellar triangle black, with silvery pollen and four pairs of black divergent hairs of which the 2nd pair is stout; outer vertical well developed, about three-fifths the inner one; postvertical short, about one-fifth the inner one; ocellar and posteocellar present, the former proclinate and equal to outer vertical; one row of stout posteocular cilia present; the rest of the area with irregular black and white hairs; palpi slender brown; proboscis black.

Thorax : Black with white pollen and three black longitudinal stripes; ac 1 + 1; dc 4 + 4 (first post-sutural dc weak); ia 1 + 2; ps 1; h 1; ph 2; np 2; pa 2; sa 3; st 1 + 1 + 1; mpl 5; hpl 6; upper part of propleura bare, black; prostigmatic and propleural bristles well developed and accompanied by short hairs; pro- and metathoracic spiracles brown; apicoscutellar bristles wanting; lateroscutellar bristles 2 pairs each; discoscutellar bristles 1 pair.

Wing : Hyaline with brown veins; R_1 bare, R_{4+5} with 8-9 short setae located dorsally and extending to about three-fourths the distance from the basal node to r-m; three setae on ventral surface of basal node of R_{4+5}; third sector of costa slightly shorter than the fifth; costal spines moderately stout; epaulet brown, with short spines, basicostal scale light brown; squama creamy white; haltere brown.

Legs : Black; fore femur with two rows of bristles on posterodorsal surface and a row of long bristles on the posterior margin of ventral surface; fore tibia with 3 bristles on the basal half on anterodorsal surface at about one-third the distance from the distal end; mid-femur with 4 bristles along middle portion of antero-dorsal surface, 1 bristle each on posterodorsal and posterolateral surfaces distally, a row of bristles on anterior and posterior margins of ventral surface in the basal half, a row on the ventral surface in the basal half and a row of short setae on the anterior and posterior margins of ventral surface in the distal half; mid tibia with 2 bristles

on anterolateral, 3 on posterolateral, 1 on posterodorsal and 1 on the ventral surfaces, the last two at about one-third the distance from the distal end; hind femur with a row of bristles on anterodorsal surface, a row each on the anterior and posterior margins of ventral surface and 1 bristle each on posterodorsal and posterolateral surfaces distally; hind tibia with 3 bristles on the anterodorsal, 2 on the posterodorsal and 1 on the anteroventral surfaces the last one at about one-third the distance from the distal end.

Abdomen : Black and silvery white checkered pattern; 2nd and 3rd abdominal tergites without median marginal bristles but both with one pair of lateral marginal bristles; 4th segment with 1 pair of median and 2 pairs of lateral marginal bristles; 5th segment with a row of about 16-18 marginal bristles; first four sternites with black hairs but without distinct bristles; 5th sternite V-shaped, with stout spines laterally on each arm and short hairs in the distal end; 1st genital tergite black, with long hairs; 2nd tergite black, with short hairs but without marginal bristles; inner forceps almost straight, curved, pointed at apex, with stout spines and short hairs distally and with long hairs basally; outer forceps elongated, with hairs; anterior and posterior parameres long and slender, the former with a small projection apically, the latter with short hairs distally; theca and paraphallus almost equal in length, both almost sclerotized; apical plate of paraphallus well developed, long and curved anteriorly; lateral plate of paraphallus long, blackish, emuniate, asymmetrical;

styli of glans long, transversely striated, not crossing the apical plate of paraphallus; ventralia single, short, membraneous.

Specimens examined : 2 ♂♂, West Bengal : Midnapore, Digha Sea shore, 28.xi.1974, coll. B.C.Nandi; 2 ♂♂, Midnapore, Digha Mohana, 30.xi.1974, coll. B.C.Nandi.

This species is being recorded for the first time from West Bengal.

Distribution : India : West Bengal : Midnapore; Orissa : Puri; Bihar : Pusa; Tamil Nadu: Madras; Andhra Pradesh : Visakhapatam; Kerala: Varkalay (Trivancore Coast); Uttar Pradesh : Agra; Sri Lanka; Colombo, Trincomalee, Thailand; Patani, Cape; Japan : Honshu, Kyushu, Amami-Oshima Island, Okinawa Main Island and Sakishima Islands.

Bionomics : It is confined to sea-shore. Senior-White et al. (1940) recorded that this species is preyed upon by Cicindela birmana. Kano et al. (1967) reported that this species can be reared on from dead fish, birds and mammals.

4. Subtribe : Sarcosolemonina

Three genera viz, Sarcosolemonia Baranov, Fengia Rehdenderf and Takeraia Kano and Field are known under this subtribe from the Oriental Palaearctic and Australian regions. Of these only Sarcosolemonia Baranov has been reported from India which occurs also in West Bengal.

Sarcophagula (Parkerimyia) indica Nandi*

" " rohdendorfi Nandi*

" " crinita (Parker)*

" " malhani Lopes and Kano *

(* please see addendum - 2)

5. Subtribe : Senierwhitеina

This subtribe is distributed in the Oriental, Palaearctic, and Ethiopian regions. Only one genus Senierwhitea Rohdendorf is known under this subtribe.

Genus Senierwhitea Rohdendorf, 1937

Type-species : Sarcophaga krameri Böettcher, 1912

Senierwhitea Rohdendorf, 1937, Faune de l' URSS, 19(1) : 297, 467.

Generic characters : Medium sized g species; antennae long, 3rd segment long and slender, about 2½ - 3 times that of the 2nd; frons wide, about ⅓ - 2/5 the width of eye; arista long and plumose on basal half; propleura bare; R_1 bare; ac 0 + 1; 4 or 5 postsutural dorsocentral bristles, only the two hindermost ones well developed; cerci long, pointed and with a preapical tuft of hairs; paraphallus with distinct theca; apical plate of paraphallus extensively membranous or with a membranous cylindrical apical process, always with conspicuous projections; lateral plates of paraphallus chitinous and well pigmented; ventralia small, chitinous; styli of glans directed

anteriorly; genital tergite without bristles; female with tergite 6th and 7th entire, large; a large pigmented plate present between genital and anal tergite; sternite 9th very small.

The genus Seniorwhitea Rohdendorf is known by only three species. Out of these only one species is hitherto represented from India which is also available from West Bengal. One new species is being described from West Bengal.

Key to the male species of Seniorwhitea from India

Apical plate of paraphallus with a pointed projection; styli of glass with a membranous outgrowth

... lopesi, sp. nov.

Apical plate of paraphallus with a blunt projection; styli of glans remain invaginated within the paraphallus

... krameri (Böettcher)

Seniorwhitea krameri (Böettcher, 1912)
// Plate VI, Figs. 1-6 //

Sarcophaga krameri Böettcher, 1912, Ent. Mitt., 1 : 166

Sarcophaga orientaloides Senior-White, 1930, Fas. Ind. Mus., 32:73; Lopes, 1964, Mem.Inst.Oswaldo Cruz., 62 : 162, Syn.

Sarcophaga sinica Rohdendorf, 1930, Bull. Ent. Res., 21 : 315; Lopes 1964, Mem. Inst. Oswaldo Cruz., 62 : 162, Syn.

Seniorwhitea orientaloides (Senior-White) Rohdendorf, 1937, Faune de l' URSS, 19(1) : 297, 407

Seniorwhitea krameri (Böettchr), Lopes, 1964, Mem. Inst. Oswaldo Cruz, 62 : 162.

Male : Body length 6-15 mm.

Head : Width of frons about one-third that of eye; frontal vitta black, slightly diverging below, its width at narrowest point more than that of parafrontal; parafrontal and parafacial black, with silvery to golden pollen, the former with numerous scattered black hairs, the latter with 3 long hairs below the eye margin. Antennae brown, reaching to about 0.85 the distance to vibrissae; 1st segment brownish-black, with black hairs; 2nd segment black but for the reddish apex, with short black spines; 3rd segment brown, with silvery pollen, its length about three times that of the 2nd; basal two-thirds of arista plumose; facial ridge brown, silvery pollinosity, with short black spines in the lower half; vibrissae long, cruciate; distance between vibrissae about half the parafacial width; frontal bristles 9, arranged in a row on parafrontal, upper two reclinate, lower three below base of antennae and reaching to about two-thirds of 2nd antennal segment, the rest decussate and directed a forwards; gena black, with silvery pollen and black hairs; postgena black, with black and white hairs; ocellar triangle black, shiny, pollinose, with four pairs of proclinate short black hairs; outer vertical bristle indistinct; inner vertical well developed; post vertical short, about half the length of inner vertical; ocellar and postocellar present, the latter stouter than ocellar and about two-fifths the length of inner vertical; besides postocular cilia two rows of postocular setae are present of which the 1st row is regular and with intermittent black hairs and the 2nd is irregular with black and white hairs, the rest of the area with white hairs.

Thorax : Grey with three black longitudinal stripes; ac 0 + 1; dc 5 + 5 (posterior two dc stout); ia 1 + 2; pa 1; h 3; ph 2; mp 4; pa 2; sa 3; st 1 + 1 + 1; mpl 6; hpl 9; upper part of propleura black; bare, with silvery pollen; prostigmatic and propleural bristles well developed and accompanied by short hairs; apiscoscutellar and discoscutellar bristles 1 pair each, the former cruciate; laterascutellar bristles 3 pairs.

Wing : Hyaline with brown veins; R_1 bare; R_{4+5} with a row of about 9-10 short setae located dorsally and extending to two-thirds the distance from basal node to r-m; several setae present on ventral surface of R_{4+5}; third sector of costa one and half times the fifth, the latter with short spines on the anterior margin on two-fifths its length basally; costal spine stout; epaulet black, with short spines and 2 long bristles; basicostal scale light brown; squama white; haltere brown.

Legs : Black; fore femur with two rows of long bristles on posterodorsal surface and a row of long bristles on posterior margin of ventral surface; fore tibia with 3 bristles in the basal half of anterodorsal surface and 1 on the posterolateral surface at about one-third the distance from the distal end; mid femur with 4 bristles along the middle portion of anterolateral surface, a row of short setae in the distal half of anteroventral and posteroventral surfaces, a row of about 5 bristles in the basal half of anteroventral surface, a row of long tuft of hairs in the basal half of postero-

ventral surface and 1 bristle on posterodorsal and 1 on posterolateral surfaces distally; mid tibia with 3 bristles in the basal two-thirds of posterodorsal surface, 1 on posterolateral surface at about one-third the distance from the distal end and 2 in the middle of anterodorsal surface besides a tuft of long hairs in the distal half on the anterior and posterior margins of ventral surface; hind femur with two rows of bristles on anterodorsal surface, a row on anteroventral surface and a tuft of long hairs on the posterior margin of ventral surface distally; hind tibia with a row of bristles on anterodorsal surface, 2 bristles on middle of posterodorsal surface and a tuft of long hairs on anterior and posterior margins of ventral surface.

Abdomen : Black and silvery chekered pattern, median marginal bristles on 2nd and 3rd abdominal tergites absent but each with one pair of lateral marginal bristles; 4th tergite with a pair of median and two pairs of lateral marginal bristles; 5th segment with a row of about 12 marginal bristles; 1st four sternites with black hairs; 3rd and 4th sternites besides the normal hairs with a tuft of hairs on the posterior margin; 5th sternite V-shaped, with short hairs laterally on each arm and short spines at its apical margin; 1st genital tergite brownish-black, with short hairs but without bristles; 2nd genital tergite black with long hairs but without distinct bristles; inner forceps curved, pointed at apex, with a tuft of long hairs near the apex; outer one mostly triangular, with short hairs; anterior paramere long, pointed

sharply, curved distally with short hairs posteriorly in the distal half; theca shorter than paraphallus, with two rounded lateral lobes and a small median elongated lobe; lateral plate of paraphallus asymmetrical, strongly chitinised, bearing ventral apophysis; ventralia small, well chitinised, inserted internally between apophysis of paraphallus; styli of glans with a pair of rounded membranous lateral lobes, a long median process and a pair of long and well chitinised styli.

Specimens examined : 5 ♂♂ , West Bengal : Howrah, Botanical Garden, 30.iii.1975, coll. B.C.Nandi; 1 ♂ ; Nadia, Hijli Forest, 3.viii.1974, coll. B.C.Nandi; 1 ♂ , Nadia, Hijli Forest, 28.ix.1974, coll.B.C.Nandi; 1 ♂ , Purulia, Digha Forest, 17.ix.1974, coll. B.C. Nandi; 2 ♂♂ , Midnapore, Arabari Forest, 26.xi.1974, coll. B.C.Nandi; 2 ♂♂ , Birbhum, Chandrapur Forest, 9.xi.1974, coll. B.C.Nandi; 1 ♂, Birbhum, Kenduah, 9.xi.1974, coll. B.C.Nandi; 1 ♂ , Jalpaiguri, Jayanti Forest, 28.x.1974, coll. B.C.Nandi; 1 ♂ , Jalpaiguri, Chilapata Forest, 26.iv.1975, coll. B.C.Nandi; 2 ♂♂ , Bankura, Susunia Forest, 21.xi.1975 coll. B.C.Nandi; 1 ♂ , Jalpaiguri, Gorumara Forest, 3.v.1975, coll. B.C. Nandi; 1 ♂ , Jalpaiguri, Madaribat, 1.v.1975, coll. B.C.Nandi; 1 ♂ , Murshidabad, C.S.P.R. Campus, 5.xi.1974, coll. B. C. Nandi.

This species is being recorded for the first time from West Bengal.

Distribution : India : West Bengal : Howrah, Nadia, Purulia, Midnapore, Birbhum, Jalpaiguri, Bankura, Murshidabad; Uttar Pradesh; Dehra Dun; Maharashtra: Bombay; Tamil Nadu : Coimbatore; Bihar : Pusa,

Chapra, Konar; Assam; Shibsagar; Orissa: Barkuda Island; Sri Lanka Colombo; Hawaii: Honolulu, China; Formosa; Burma : Maymyo; Thailand; Malayesia : Malacca; Singapore.

Bionomics : Senior-White et al. (1940) reported that it has been reared on dead Achatina fulica, grasshoppers, sphingid and other lepidopterous larvae, beef and human excrement. According to Senior-White et al. (1940) this species is parasitic on other insects. It is attracted to Aristolochia reticula.

Seniorwhitea lepesi, sp.nov. (Plate VII, Figs.1-8)

Male : Body length 6 mm.

Head : Width of frons about one-third that of eye; frontal vitta black, its width at narrowest point more than that of parafrontal; parafrontal and parafacial brownish-black, the former with short hairs, the latter with a row of 8 hairs below the eye margin, lower four long. Antennae black, reaching to about 0.85 the distance to vibrissae; 1st and 2nd segments with short hairs; 3rd segment with scattered silvery pollen, its length about three times that of the 2nd; basal three-fifths of arista plumose; facial ridge brown, with black spines on one-fourth of its length from the vibrissal end; vibrissae long, cruciate; frontal bristles 8, arranged in a row on parafrontal, upper two reclinate, lower three below base of antennae and reaching to about the tip of 2nd antennal segment, the rest directed forwards.

Gena greyish, with black hairs; postgena black, with long silvery hairs; ocellar triangle black, with four pairs of black, proclinate hairs. Outer vertical not differentiated; inner vertical well developed; post vertical, ocellar and postocellar bristles short; besides postocular cilia two rows of postocular setae present of which 1st row is regular and is with intermittent black hairs and the 2nd is irregular with intermittent black and white hairs, the rest of the area with greyish hairs.

Thorax : Grey, with three black longitudinal stripes; ac 0 + 1; dc 5 + 5 (posterior two dc stout); ia 1 + 2; pa 1; h 3; ph 2; np 4; pa 2; sa 3; st 1 + 1 : 1; hpl 6; hpl 8; upper part of propleura black, bare; prestigmatic and prepleural bristles well developed and accompanied by short hairs; apicoscutellar and discoscutellar bristles 1 pair each; lateroscutellar bristles 3 pairs of which the pair near scutellar is not stout.

Wing : Hyaline with brown veins; R_1 bare; R_{4+5} with a row of 9 short setae located dorsally and extending to about two-thirds the distance from the basal node to r-m; several setae present on ventral surface of R_{4+5}; 3rd sector of costa a little longer than the fifth, the latter on the anterior margin with short spines on more than half its length basally; costal spine stout; epaulet black, with short spines; basicostal scale brown; squama slightly brown; haltere brown.

Legs : Black; fore femur with two rows of bristles on anterodorsal surface and a row of long bristles on posterior margin of ventral surface; fore tibia with 2 bristles on the basal part of anterodorsal surface and 1 bristle on posterolateral surface at about one-third the distance from the distal end; mid femur with 3 bristles along the middle portion of anterolateral surface, a row of short setae each in the distal half of anteroventral and posteroventral surfaces, a row of long bristles in the basal half of anteroventral surface, a row of long hairs in the basal half of posteroventral surface and 1 bristle on posterodorsal and 1 on posterolateral surfaces distally; mid tibia with 1 bristle each on posterodorsal and posterolateral surfaces at about one-third the distance from the distal end, 2 bristles in the middle of anterodorsal surface and a row of long hairs on the anterior and posterior margins of ventral surface at about four-fifths the distance from the distal end; hind femur with two rows of long hairs on anterior and posterior margins of ventral surface and 1 bristle each on dorsal and posterodorsal surfaces distally; hind tibia with a row of bristles on anterodorsal surface, 2 bristles in the middle of posterodorsal surface and a tuft of long hairs on anterior and posterior margins of ventral surface.

Abdomen : Black and silvery chekkered pattern; median marginal bristles on 2nd and 3rd abdominal tergites absent but both with one pair each of stout lateral marginal bristles; 4th segment with a pair of median and 2 pairs of lateral marginal bristles; 5th with a row of

16 marginal bristles; 1st and 2nd sternites with black hairs; 4th and 5th sternites with a tuft of black hairs; 5th sternite V-shaped, with short spines at the apex of both internal margins; 1st and 2nd genital tergites brownish, with short hairs but without marginal bristles; inner forceps curved, pointed at apex, with a tuft of long hairs near the apex; outer one triangular with short hairs; anterior paramere long, pointed, sharply curved at end, with short hairs posteriorly at the distal end; posterior paramere elongated, curved at apex; theca shorter than paraphallus, both heavily chitinised but for the somewhat membranous distal end of paraphallus; paraphallus with two asymmetrical lateral lobes; lateral plate of paraphallus asymmetrical, heavily chitinised, its posterior end hookshaped; ventralia short and well chitinised and inserted internally between apophysis of paraphallus; styli of glans with a pair of rounded lateral lobes, a median process and a pair of elongated and pointed hooks, the median process at its tip with a pair of slender elongated processes.

Holotype : 1 ♂, West Bengal: Jalpaighri, Chilapata Forest, 24.iv.1975, coll. B.C.Nandi.

Discussion : Senierwhitea lopesi, sp. nov. comes close to S.kraemeri (Beettcher) but differs from it in the structural details of lateral plate of paraphallus and the styli of glans. Moreover unlike kraemeri in lopesi the eyes are reddish and the antennae are wholly black.

Distribution : India : West Bengal : Jalpaiguri.

Bionomics : This specimen was collected by sweeping thek bushes.

6. Subtribe Parasarcophagina

This is a widely distributed subtribe represented by 17 genera. Out of these only 6 genera are known from India all of which have been reported from West Bengal also.

Key to the genera of the subtribe Parasarcophagina from ~~the~~ India

1. Upper part of propleura covered with black hairs, often rather densely so ... 2

   Upper part of propleura devoid of hairs ... 3

2. Presutural ac bristles distinct; 4th abdominal sternite of male with a dark spot made up of dense, short, black bristles; anterior paramere apically bifurcate; cerci in profile slender and geniculate ... Tricholioproctia Baranov

   Presutural ac wanting; 4th abdominal sternite without setiferous spots; anterior paramere apically simple; cerci not slender or curved ... Boettcherisca Rohdendorf

3. ac absent; phallosome very large; lateral plate of paraphallus forming a single pair of very large, sharp, markedly forward-protruding processes; 6th tergite of female abdomen completely divided into two convex plates, bright red, nitid ... Boreaca Robineau-Desvoidy

Invariably one pair of postsutural ac present before scutellum; phallosome rarely longer than theca; lateral plate of paraphallus of varied structure; 6th tergite of female entire or incised in the middle of posterior margin, if divided it is not red but is covered with light bloom ... 4

4. Fourth, and sometimes third, abdominal sternite of male with short appressed hairs; second sternite always covered with long, dense, erect hairs; apical part of paraphallus always smaller than remainder or phallosome, if almost the same size the membranous processes are long and lamellate, membranous processes pedunculate ... Paraserephaga Johnston and Tiegs

Second, third and fourth abdominal sternites of male densely covered with slender erect bristles; apical part of paraphallus very large; lateral plate of paraphallus comprising of paired processes that are not pedunculate ... 5

5. Apical part of paraphallus very large, divided into two large lateral processes, median part poorly defined, sometimes entirely absent ... Robineauella Enderlein

Apical part of paraphallus always with a large median section, sometimes almost entire and not subdvided ... 6

6. Pre-acrostichal and pre-dorsocentral bristles well differentiated; styli of glans stout; lateral plate of paraphallus very large and intricately constructed, consisting of two pairs of branching and erect, highly sclerotised processes; apical part of paraphallus with lateral processes

... Liopreckia Enderlein

Either pre-acrostichal or pre-dorsocentral bristles not differentiated; styli of glans slender; lateral plate of paraphallus simply constructed, usually consisting of a single pair of only slightly projecting angular processes; apical part of paraphallus without slender processes

... Simonipponia Rohdendorf

Genus Tricholiopreckia Baranov, 1938

Type-species : Sarcophaga antilope Boettcher, 1913

Tricholiopreckia Baranov, 1938, Bull. ent. Pog., 29:414

Chrysosarcophaga (Townsend, 1932) Rohdendorf, 1937.

Faune de l' URSS. 19(1):227, Rondendorf, 1965,

Revue d' entomologie de l' URSS., 44(3) : 604. Syn.

Generic characters : Antennae long, length of third segment three to four times that of the second; arista long plumose along basal two-thirds; frontal bristles divergent; parafacilia with short hairs; postautural dorsocentral bristles 4 (only two well developed); anterior acrostichal bristles differentiated from the surrounding hairs; propleura densely pilose; veins R_1 bare, cell R_5 widely open;

inner forceps knee-shaped, bent at the distal one-third; 4th abdominal sternite of male with a dark spot made up of dense, short, black bristles; fifth abdominal sternite in male V-shaped and internally bristles; male genital segments elongated; penis with very conspicuous theca and large membraneous region between theca and paraphallus; paraphallus well differentiated; ventralia well developed; cerci in profile slender and geniculate.

This genus is distributed in the Oriental and Australian regions. From India only three species are known of which two are available in West Bengal.

Key to the male species of Tricholioproctia from West Bengal

1. Base of wings yellow; ventralia with a chitinous hook-shaped process; outer forceps curved and pointed at apex
... flavinervis (Senior-White)

Base of wings hyaline; anterior end of ventralia with serration but without any process; outer forceps almost straight, blunt and slightly notched at apex
... pusana (Senior-White)

Tricholioproctia flavinervis (Senior-White, 1924)

// Plate VIII, Figs. 1-6 //

Sarcophaga flavinervis Senior-White, 1924, Rec. Ind. Mus., 26(3) : 229, S.basalis Walker, 1859, nec. Walker, 1852.

Sarcophaga basalis Walker 1859, Proc. Linn. Soc. Lond., 4 : 129.

Sarcophaga seniorwhitei Bo, 1938, Ann. Trop. Med. Parasit., 32 : 117; Lopes, 1954, Ann. Acad. Bras. Ciene., 26(2) : 251, Syn.

Tricholioproctia flavinervis (Senior-White), Lopes, 1954, Ann. Acad. Bras. Ciene., 26(2) : 251; Kano, Field and Shinonaga, 1967, Fauna Japonica, Sarcophagidae, P. 126.

Tricholioproctia basalis (Walker), Fan, 1965, Key to the common synanthropic flies in China, P. 244.

Male : Body length 14 mm.

Head : Width of frons about half that of eye; frontal vitta black, its width at narrowest point less than half the width of parafrontal; parafrontal and parafacial black with golden pollen, the former with short, scattered, black hairs, the latter with a row of black hairs (lower five stout) below the eye margin. Antennae black, reaching to about 0.9 the distance to vibrissae; 1st and 2nd segments black, with numerous short black hairs; 3rd segment black with pollen, length about four times that of the 2nd; arista long, plumose on basal three-fifths; facial ridge black, golden pollinosity, with short spines in the lower half; vibrissae long cruciate, distance between vibrissae about two times the width of parafacial; frontal bristles 13, arranged in a row on parafacial,

[illegible]
upper two reclinate, lower three below base of antennae reaching to about the apical end of 2nd antennal segment, the rest decussate and directed forwards; gena black, with short black hairs; postgena black, with black and white hairs. Outer vertical not differentiated inner one well developed; postvertical half the length of inner vertical; ocellar bristle differentiated from ocellar hairs; post-ocellar stout, longer than postvertical; two rows of postocular setae present besides postocular cilia of which the 1st row is regular while the 2nd is irregular, with intermittent hairs, the rest of the area with brownish hairs; palpi long; proboscis blackish.

Thorax : Yellowish-grey with three black longitudinal stripes with yellow pollen at their sides; ac 5 + 1; dc 5 + 4 (posterior two stout); ia 1 + 3; pa 1; h 3; ph 2; np 4; sa 4; pa 2; st 1 + 1 + 1; mpl 6; hpl 9; upper part of propleura black, hairy; prostigmatic and propleural bristles well developed and accompanied by short hairs; pro- and metathoracic spiracles brown; apicoscutellar and discoscutellar bristles 1 pair each, the former stout and cruciate; lateroscutellar bristles 3 pairs.

Wing : Yellowish with yellow veins; R_1 bare; R_{4+5} with a row of about 8 short setae located dorsally and extending to about half the distance from the basal node to r-m; four to five short setae seen on ventral surface of basal node of R_{4+5}; third costal sector about one and a half times the fifth, the latter with short spines along its basal one-third in the anterior margin; costal

spines not so stout; epaulet black, with spines; basicostal scale yellow; squama yellowish; haltere brown.

Legs : Black; fore femur with two rows of bristles on posterodorsal surface and a row of long bristles on posterior margin of ventral surface; fore tibia with 3 bristles in the basal one-third of anterodorsal surface and 1 bristle on the posterodorsal surface at about one-third the distance from the distal end; mid femur with 4 bristles along the middle portion of anterolateral surface, a row of short setae in the distal half of anteroventral and posteroventral surfaces, a row of 4 bristles in the basal half of anteroventral surface, some short hairs in the basal half of posteroventral surface and 1 bristle on posterodorsal and 1 on posterolateral surfaces distally; mid tibia with a row of 4 long and several short bristles on posterodorsal surface, 1 bristle on anteroventral and 1 on posteroventral surfaces both at about one-fourth the distance from its distal end and 1 bristle on anterodorsal surface at about one-third the distance from the distal end; hind femur with two rows of bristles on the anterodorsal surface, a row of bristles on anteroventral and posteroventral surfaces in the distal half and some short hairs in the basal half ventrally and 1 bristle on posterolateral surface in the distal end; hind tibia with 2 long and a row of short bristles on anterodorsal surface, 2 bristles on posterodorsal surface medially, 1 bristle on anteroventral surface

at about one-fifth the distance from the distal end and a row of long hairs on anterior and posterior margins of ventral surface.

Abdomen : Grey, silvery pollinosity, with checkered pattern; median marginal bristles on 2nd and 3rd abdominal tergites absent; 4th tergite with a pair of median and four pairs of lateral marginal bristles; 5th tergite with long hairs at the sides and a row of about 20 marginal bristles; 1st and 2nd sternites with long and 3rd with slightly short black hairs; 4th sternite with a brush of spines occupying almost the whole of apical half; 5th sternite with long bristles on the inner side of each arm and with hairs distally; 1st genital tergite reddish-black with hairs which are long and bristly at the sides; 2nd tergite somewhat blackish, with short hairs but without bristles; inner forceps curved and pointed at apex, with stout spines near the distal end and long hairs basally; outer forceps elongated, with short hairs; anterior paramere curved and bifurcated at the end; posterior paramere nut-shaped, curved and pointed apically, with one stout spine at the anterior end; theca is almost equal to paraphallus, both sclerotised; apical plate of paraphallus not so sclerotised, curved and pointed at apex, with a blunt lateral outgrowth; lateral plate of paraphallus short; styli of glans short, curved and serrated anteriorly; ventralia with a chitinous hook and nonserrate membranous lobe.

Female : Unknown.

Specimen examined : 1 ♂, West Bengal : Jalpaiguri, Joyanti Forest, 20.x.1974, coll. B.C.Nandi.

This species is being recorded for the first time from W.Bengal.

Distribution : India : West Bengal : Jalpaiguri; Assam : Sadiya; Bihar : Chota Nagpur, Saranda Forest; Java; Kei Islands; North Queensland.

Bionomics : Unknown.

Tricholioproctia pusana (Senior-White, 1924)

// Plate IX, Figs.1-5 //

Sarcophaga pusana Senior-White, 1924, Rec. Ind. Mus., 26(3) : 245.

Tricholioproctia pusana (Senior-White), Lopes, 1954, Ann. Acad. Bras. Ciene., 26(2) : 274.

Male : Body length 12 mm.

Head : Width of frons about one-third that of eye; frontal vitta greyish black, its width at narrowest point less than two times that of parafrontal; parafrontal and parafacial black with silvery pollen, the former with numerous short scattered black hairs, the latter with a row of black hairs below the eye margin of which the lower three are stout. Antennae blackish-brown, reaching to about 0.9 the distance to vibrissae; 1st and 2nd segments black, with numerous short hairs, the latter with a long bristle at the tip; 3rd segment brownish with silvery pollen, its

length about three times that of the 2nd; arista long and plumose in the basal half; facial ridge black silvery pollinosity with short black spines in the lower half; vibrissae long, cruciate, distance between vibrissae less than two times the parafacial width; frontal bristles 12, arranged in a row on parafrontal, upper three reclinate, lower four below base of antennae reaching to about the apical end of 2nd antennal segment, the rest cruciate and directed forwards; gena black, with silvery pollen and long greyish hairs; postgena black, with long whitish hairs; ocellar triangle black with four pairs of short, divergent hairs; outer vertical not differentiated; inner vertical well developed; postvertical half the inner vertical; ocellar bristles shorter than the shortest parafrontal; postocellar longer than the ocellar, about three-fifths of the inner vertical; one row of irregular postocular setae besides postocular cilia; rest of the area with black and white hairs.

Thorax : Greyish with three black longitudinal stripes with silvery pollen at their sides; ac 5 + 1, dc 5 + 4 (posterior two stout); la 1 + 2; pa 1; h 3; ph 3; ap 4; sa 4; pa 2; st 1 + 1 + 1; mpl 7-8; hpl 11; upper part of propleura black, with silvery pollen and black hairs; prestigmatic and propleural bristles well developed and accompanied by long black hairs; pro- and metathoracic spiracles brown; apicoscutellar and discoscutellar bristles 1 pair each, the former stout, cruciate; lateroscutellar bristles 2 pairs.

Wing : Hyaline with blackish veins; R_1 bare; R_{4+5} with about 8 short setae located dorsally and extending to about half the distance from the basal node to r-m, three to four short setae present on ventral surface of basal node of R_{4+5}; third costal sector longer than the fifth, the latter on the anterior margin with short spines along its basal two-fifths; costal spines not so stout; epaulet black, with short black spines and two long bristly hairs; basicostal scale yellowish; squama white; haltered brown.

Legs : Black; fore femur with two rows of bristles on posterodorsal surface and a row of bristles on posterior margin of ventral surface; fore tibia with 3-4 bristles on the basal one-third of anterodorsal surface and 1 bristle on the posterodorsal surface at about one-third the distance from the distal end; mid femur with 2 bristles along the middle portion of anterolateral surface, a row of long hairs in the basal half of posteroventral surface, a row of about 5 bristles in the basal half of anteroventral surface and 1 bristle on posterodorsal and 1 on posterolateral surfaces; mid tibia with a row of 3 long and several short bristles on posterodorsal surface, 1 bristle each on anterodorsal and posteroventral surfaces at about one-third the distance from the distal end and moderately long hairs on anterior and posterior margins of ventral surface in the distal half; hind femur with two rows of bristles on anterodorsal and a row on anteroventral surfaces, 1 bristle on posterodorsal surface at about one-fifth the length from the ma

distal end and a row of long hairs on posterior margin of ventral surface; hind tibia with 3 long and a row of short bristles on anterodorsal surface, 2 long bristles on posterodorsal surface medially, 1 bristle on anteroventral surface at about one-fifth the distance from the distal end and a row of long hairs on anterior and posterior margins of ventral surface at about three-fifths the distance from the distal end.

Abdomen : Grey, with silvery checkered pattern; median marginal bristles on 2nd and 3rd abdominal tergites absent, but each with one pair of lateral marginal bristle; 4th tergite with a pair of median and three pairs of lateral marginal bristles; 5th with a row of about 24 marginal bristles and with long hairs on ventral side; first three sternites with short greyish hairs in the basal and with black hairs in the distal end;4th sternite without any differentiated bristles but with a tuft of black hairs in the distal end; 5th sternite V-shaped , cup-like structure with long bristles and hairs on the inner side of each arm and long hairs distally; 1st genital segment reddish, with short hairs; 2nd segment red, with long hairs but without differentiated bristles; inner forceps almost straight, slightly pointed and curved at apex, with short hairs at the subapical end and with spines in the anterior end; outer forceps almost triangular in the distal half; anterior paramere elongated, almost straight; posterior paramere bifurcated

at end, posteriorly bare but with one hair anteriorly; theca almost equal to paraphallus, both sclerotised; apical plate of paraphallus long, curved and pointed at apex with pointed lateral outgrowth and with one stout, pointed spine at the distal end posteriorly; lateral plate of paraphallus short; styli of glans short, curved, serrated anteriorly and with short hairs posteriorly; ventralia curved posteriorly, slender basally and with median serrations anteriorly, a slender process is seen at its base.

Specimens examined : 1 ♂ , West Bengal : Nadia, Hijli Forest, 20.ix.1976, coll.B.C.Nandi; 5 ♂♂ , Calcutta, Zoo-Garden, 3.iii.1975 coll. B. C. Nandi.

Female : Body length 9-11 mm. // Plate X, Figs. 1-4 //

Head : Width of frons slightly less than that of eye; outer vertical well developed, about three-fourths the inner one; two preclinate fronto-orbital bristles; frontal bristles 10-11.

Thorax : Similar to that of male but for the presence of only three scutellar bristles and the absence of apicoscutellar bristle.

Wing : Same as in male.

Legs : Chaetotaxy same as in male but for the following differences : Mid femur in the basal half with 2-3 bristles in the ventral and 5 bristly hairs on posteroventral surfaces, hairs on posteroventral surface absent; mid tibia with 2 stout bristles in

the middle of anterolateral surface, 1 bristle on the anteroventral surface at about one-third the distance from the distal end and without long bristles on the anterior and posterior margins of ventral surface in the distal half; hind femur with a row of bristles on anterodorsal surface; hind tibia without long hairs on anterior and posterior margins of ventral surface, but with two bristles on anteroventral surface at the distal end.

Abdomen : 2nd and 3rd sternites without bristles but with long hairs; 4th sternite with 4 stout bristles; 5th with a row of 10 bristles; 6th with a row of 16 bristles, each longer than on the any first five sternites; 7th longer than 6th, with hairs at the slightly concave distal end; 8th bare, membranous, concave distally; anal sternite with a tuft of long hairs; 7th tergite medially bifurcated and with stout marginal bristles and hairs; spermatheca 3, slightly oval, with transverse striations throughout its length.

Female described from 5 reared specimens.

This is the first record of this species from West Bengal.

Distribution : India : West Bengal : Nadia, Calcutta; Bihar : Pusa; Sri Lanka : Matale.

Bionomics : Nothing is known. The present specimens were reared in the laboratory from meat.

Genus Boettcheriana Rohdendorf, 1937

Type-species : Myophora peregrina Robineau-Desvoidy, 1830

Boettcheriana Rohdendorf, 1937, Faune de l' URSS, 19(1) : 270.

Metochaetomima Rohdendorf, 1937, Faune de l' URSS., 19(1) : 273; Rohdendorf, 1965, Revue d' entomologie de l' URSS., 44(3) : 604, Syn.

Athyroiela Baranov, 1938, Vet. Arh. Zagreb., 8(4):174; Lopes, 1961, Mems. Inst. Oswaldo Cruz., 59(1) : 70, Syn.

Generic characters : Frons very narrow, its width about one-third that of eye; antennae slender, length of 3rd segment about two and a half times that of the 2nd; propleura hairy in the middle; postsutural dorsocentral bristles 4-5 (only posterior two well developed); presutural acrostical bristles wanting; parafacialia with short hairs; vein R_1 bare; hind tibia of male without a taft of long hairs; 3rd abdominal tergite without median marginal bristles; 4th abdominal sternite without setiferous spots; theca shorter than paraphallus; apical plate of paraphallus distinct; lateral plate of paraphallus elongated, bifurcated distally, each of the bifurcation ending sharply; styli of glans with short and very stout lateral processes bearing spines; ventralia well developed, bilobed, with numerous short spines; cerci not slender.

This genus is fairly widely distributed. H.S. Lopes (1961) reported a total of six species under this genus. Only three species of t is genus are hitherto known from India. One new species is described here and the known ones are redescribed. Only three species are available in West Bengal.

Key to the male species of Boettcherisca from West Bengal.

1. Anterior margin of ventralia rounded; apical plate of paraphallus with pointed apex, its lateral plate with two elongated processes

... 2

Anterior margin of ventralia elongated; apical plate of paraphallus with blunt apex, its lateral plate with two short processes

... bengalensis, sp. nov.

2. Spines at the apex of inner forceps extending to the dorsal side; styli of glans with apical incision

... nathani Lopes

Spines at the apex of inner forceps not extending to the dorsal side; styli of glans without apical incision

... peregrina
(Robineau-Desvoidy)

Boettcherisca peregrina (Robineau-Desvoidy, 1830)

// Plate XI, Figs. 1-5 //

Myophora peregrina Robineau-Desvoidy, 1830, Essai Myodaires, p : 356

Myophora subrotunda Robineau-Desvoidy, 1830, Essai Myodaires, p : 357; Lopes, 1958, Ins. Micron., 13(2) : 30, Syn.

Myophora rapida Robineau-Desvoidy, 1830, Essai Myodaires, p. 360; Lopes, 1958, Ins. Micron., 13(2) : 30, Syn.

Sarcophaga tritonia Macquart, 1850, Mem. Soc. Sci. Lille., 4 : 234; Lopes, 1958, Ins. Micron., 13(2) : 30, Syn.

Sarcophaga fuscicauda Boettcher, 1912. Ent. Mitt., 1: 168; Rohdendorf, 1937, Faune de l'URSS; 19(1) : 271, 450, Syn.

Sarcophaga schripalpis Thomson, 1868, Kongl. Svens Freg. Eugen. Resa. p : 537; Johnson and Tiegs, 1922, Rec. Aust. Mus., 13 : 177, Syn.

Sarcophaga frontalis Johnston and Bancrofti, 1920, Proc. Roy. Soc. Qudl., 32 : 23; Lopes, 1958, Ins. Micron., 13(2) : 30, Syn.

Sarcophaga hustoni Parker, 1923, Ann. Mag. Nat. Hist., London 9(11) : 127; Senior-White et al. 1940, Fauna British India, Diptera, 6 : 272, Syn.

Sarcophaga irrequieta Johnston and Tiegs, 1921. Proc. Roy Soc. Qudl., 33(4) : 63, Lopes, 1958, Ins. Micron., 13(2) : 30, Syn.

Sarcophaga meriani Zumpt, 1951, J. ent. Soc. Sth. Afr., 14 : 182; Zumpt, 1964, Verh. naturf Ges. Basel, 75 : 61, Syn.

Boettcherisca peregrina (Robineau-Desvoidy), Pohdendorf, 1937, Faune de l' URSS, 19(1) : 271, 458; Pohdendorf, 1937, Faune de l' URSS, 19(1) : 271, 459, Syn.

Male : Body length 9-12 mm.

Head : Width of frons about two-fifths that of eye; frontal vitta black, its width at narrowest point more than two times the width of parafrontal; parafrontal and parafacial black, with silvery to golden pollen, the former with short, scattered black hairs, the latter with a row of black hairs below the eye margin (lower 3-4 short). Antennae blackish-brown, reaching to about 0.8 the distance to vibrissae; 1st and 2nd segments black, with numerous short hairs; 3rd segment brown with whitish pollen, its length about two and a half times that of the 2nd; arista long and plumose on two thirds its length basally; facial ridge black, white pollinosity with short spines on one-third its length from the vibrissal angle; vibrissae long, cruciate, distance between vibrissae more than the width of parafacial; frontal bristles 10-12, arranged in a row on parafrontal, upper two to three reclinate, lower two below base of antennae reaching to about half the length of 2nd antennal segment, the rest directed forwards; gena black, with numerous

black hairs; postgena black, with numerous long brownish hairs; ocellar triangle black, with three pairs of divergent black hairs; outer vertical absent; inner vertical well developed; post vertical short, about one-third the length of inner vertical; ocellar bristles short, and shorter than the shortest parafrontal; postocellar stouter than ocellar and shorter than inner vertical; besides postocular cilia two rows of postocular setae present of which the 1st row is well developed and regular and 2nd row is irregular, the rest of the area with black and white hairs; palpi slender, dark brown; proboscis black.

Thorax : Blackish, with silvery to golden pollen and three black longitudinal stripes; ac 0 + 1; dc 5 + 5 (posterior two stout) ia 1 + 2; h 3; ph 2; pa 1; np 4; sa 3; pa 2; st 1 + 1 + 1; mpl 7; hpl 8; upper part of propleura brownish-black, with black hairs; prestigmatic and propleural bristles well developed and accompanied by short hairs; pro- and metathoracic spiracles brown; apicoscutella and discoscutellar bristles 1 pair each, the former stout and cruciate; lateroscutellar bristles 2 pairs.

Wing : Hyaline with brown veins; R_1 bare; R_{4+5} with a row of about 8-9 short setae located dorsally and extending to more than half the distance from the basal node to r-m; three to five short setae present on ventral surface of basal node of R_{4+5}; third sector of costa a little longer than the fifth, the latter with

short spines on its anterior margin; costal spine not stout; epaulet black, with spines basicostal scale light brown; squama whitish; haltere brown.

Legs : Black; fore femur with two rows of bristles on posterodorsal surface and a row of long bristles on posterior margin of ventral surface; fore tibia with 2-3 short bristles in the basal one-third on anterodorsal surface and 1 bristle in the posteroventral surface at about one-third the distance from the distal end; mid femur with 3-4 bristles along the middle portion of anterolateral surface, a row of short setae in the distal half of anteroventral and posteroventral surfaces, a row of about 3-4 bristles in the basal half of anteroventral surface, numerous long hairs in the basal half of posteroventral surface and 1 bristle on posterodorsal and 1 on posterolateral surfaces distally; mid tibia with 3 long and a short bristle on the posterodorsal surface, 1 bristle each on anteroventral and posterolateral surfaces at about one-third the distance from the distal end and 1 bristle on anterolateral surface at about twofifths the distance from the distal end; hind femur with two rows of bristles on the anterodorsal surface, a row of bristles on anteroventral surface and 2-3 bristles in the distal half of posterodorsal surface; hind tibia without tuft of hairs but with 2 long and a row of short bristles on anterodorsal surface, 2 bristles medially on posterodorsal surface and 1 bristle in the distal half of anteroventral surface.

Abdomen : Black, with silvery checkered pattern; 2nd and 3rd abdominal tergites without median marginal bristles but each with one pair of lateral marginal bristles; 4th tergite with a pair of median and three pairs of lateral marginal bristles; 5th tergite with a row of about 18-20 marginal bristles; first four sternites without bristles but with dense, short, black hairs; 5th sternite Y-shaped, with a double row of closely set bristles laterally on each arm; 1st genital tergite black, pollinose, with black hairs; 2nd blackish brown, with black hairs but without marginal bristles; inner forceps curved and notched at apex and with lateral subapical spines; outer forceps almost triangular, broad at apex, with hairs in the distal half; anterior paramere with pointed apex; posterior paramere curved at apex, with two preapical hairs; theca shorter than paraphallus, both heavily sclerotised; apical plate of the latter curved and pointed at apex and with a pair of long, slender lateral processes; lateral plate of paraphallus well developed, with a pair of large, two-pointed lateral plates; styli of glans composed of a median and two lateral processes; ventralia bilobed, spinous, with a membranous projection in the anterior margin of each lobe.

Specimens examined : 2 ♂♂, West Bengal : Jalpaiguri, Falakata 11.x.1974, coll. B.C.Nandi; 1 ♂, Jalpaiguri, Chapramari Forest, 2.v.1975, coll. B.C.Nandi; 1 ♂, Birbhum, B.F.C. Campus, 11.xi.1974, coll. B.C.Nandi; 1 ♂, 24-Parganas, Sagar Island, 24.iii.1975, coll. B.C.Nandi; 1 ♂, Calcutta, Zoo-Garden, 1.iv.1975, coll. B.C.Nandi; 1 ♂ Murshidabad, C.S.F.S.Campus, 3.xii.1974, coll. B.C.Nandi; 3 ♂♂; Malda, Gour, 10.v.1975, coll.B.C.Nandi.

Distribution : India : West Bengal : Jalpaiguri, Birbhum, 24-Parganas, Murshidabad, Calcutta, Malda; Uttar Pradesh : Mussoorie, Dehra Dun; Maharashtra : Bombay, Nagpur; Tamil Nadu : Coimbatore; Bihar : Pusa, Konar; Assam : Gauhati; Andaman Islands; Port Blair, Sri Lanka; Burma : Rangoon; Singapore; Java; Palau Archipelago; Philippine Islands; Formosa; Tsushima Island; Japan : Hokkaido, Honshu Shikoku, Kyushu and Ryukyu Islands; China; New Guinea; Hawaii; Samoa, Malaya; Australia; Volcano Islands; Bonin Islands; South Mariana Islands; New Britain; Gilbert Islands.

Bionomics : Kano et al. (1967) reported that the species can be reared in animal carcasses, garbage, animal dung and human faeces. He also mentioned "this species could be considerable importance as a mechanical vector of etiologic agents of disease in areas where it is particularly abundant". Greenburg (1971) reported that this species is found in association with Proteus morganii, P. rettgeri, Dactylosternum abdominale and Salmonella pullorum.

Boettcherisca bengalensis, sp. nov.

// Plate XII, Figs. 1-5 //

Male : Body length 7-13 mm.

Head : Width of frons about two-fifths that of eye; frontal vitta black, its width at narrowest point about two times that of parafrontal; parafrontal and parafacial black with silvery pollen, the former with short, scattered black hairs, the latter with a row of black hairs below the eye margin of which lower four are stout.

Antennae blackish-brown, reaching to about 0.85 the distance to vibrissae; 1st and 2nd segments blackish-brown, with numerous short black hairs; 3rd segment brownish-black with white pollen, its length about three times that of the 2nd; arista long and plumose on three-fifths its length basally; facial ridge black, white pollinose with short spines in the lower half; vibrissae long, cruciate, distance between vibrissae more than the width of parafacial; frontal bristles 10-12, arranged in a row on parafrontal; upper three in some cases two reclinate, lower two below base of antennae and reaching to about three-fifths of 2nd antennal segment, the rest convergent and directed forwards; gena black with numerous black hairs; postgena black with numerous long brownish hairs; ocellar triangle black, with three pairs of divergent hairs; outer vertical short, about two-fifths the length of inner vertical, the latter longer than the postocellar; ocellar bristle not stout, shorter than the shortest parafrontal; postocellar stouter than ocellar; besides postocular cilia two rows of postocular setae present of which the 1st row is regular and 2nd is irregular, the rest of the area with black and white hairs; palpi slender, dark brown; proboscis black.

Thorax : Blackish with silvery pollen and three black longitudinal stripes; ac 0 + 1; dc 5 + 5 (posterior two dc stout); ia 1 + 2; pa 1; h 3; ph 2; pp 4; sa 3; pa 2; st 1 + 1 + 1; mpl 7; hpl 7-8. Upper part of propleura black, with short hairs; prostigmatic and propleural bristles well developed and accompanied by short hairs;

pre- and metathoracic spiracles brown; apicoscutellar and discoscutellar bristles 1 pair each; lateroscutellar bristles 2 pairs.

Wing : Hyaline with brown veins; R_1 bare; R_{4+5} with a row of 9-10 short setae located dorsally and extending to about three-fifths the length from the basal node to r-m; several short setae present on ventral surface of basal node of R_{4+5}; third costal sector longer than the fifth, the latter with short spines along one-third of its length basally in the anterior margin; costal spine not so stout; epaulet black, with spines; basicostal scale light brown; squamma white; haltere brownish-black.

Legs : Black; fore femur with two rows of bristles on posterodorsal surface and a row of long bristles on the posterior margin of ventral surface; fore tibia with 2 short bristles at about the basal one-third of anterodorsal surface and 1 bristle on the posterodorsal surface at about one-third the distance from the distal end; mid femur with 3 bristles along the middle portion of anterolateral surface, a row of short setae in the distal half of anteroventral and posteroventral surfaces, a row of about 3 bristles in the basal half of anteroventral surface, numerous long hairs in the basal half of posteroventral surface and 1 bristle on posterodorsal and 1 on posterolateral surfaces distally; mid tibia with 3-4 long and a row of short bristles on the posterodorsal surface, 1 bristle on posterolateral surface, 1 on anteroventral surface at about one-third

the distance from the distal end and 1 on the anterolateral surface at about two-fifths the distance from the distal end; hind femur with two rows of bristles on anterodorsal surface, a row of bristles on anteroventral surface and numerous long hairs on posteroventral surface; hind tibia without tuft of hairs but with a row of bristles on the anterodorsal surface, 2 bristles medially on posterodorsal surface and 2 bristles in the distal half of anteroventral surface.

Abdomen : Black and silvery checkered pattern, median marginal bristles on 2nd and 3rd abdominal tergites absent but each with one pair of lateral marginal bristles; 4th tergite with a pair of median and three pairs of lateral marginal bristles; 5th with a row of about 18-20 marginal bristles; sternites without bristles but with short, dense, black hairs; 5th sternite Y-shaped. With a double row of closely set bristles laterally on each arm. 1st genital tergite black, with pollen and black hairs; 2nd black, with hairs but without marginal bristles; inner forceps curved and notched at apex and with 4-6 lateral subapical spines; outer forceps almost triangular, broad at apex, with hairs almost on its entire length; anterior paramere pointed at apex; posterior paramere curved at apex, with 2 short preapical hairs; theca shorter than paraphallus, both heavily sclerotised; apical plate of paraphallus curved and blunt at apex and with a pair of lateral processes of which anterior process is long and slender while the posterior one is blunt; lateral plate of

paraphallus well sclerotised, with a pair of short, pointed processes; styli of glans pointed, composed of a median pair of bars and two lateral processes spines on outside; ventralia bilobed, spinous, with a short membranous projection on anterior margin of each lobe.

Female : Unknown.

Holotype : 1 ♂ , West Bengal : Midnapore, Arabari Forest, 26.xi.1974, coll. B. C. Nandi, Paratypes : 2 ♂ ♂, Midnapore, Arabari Forest, 26.xi.1975, coll. B.C.Nandi; 2 ♂ ♂ , Bankura, Bhatpur, 20.xi.1974, coll. B.C.Nandi; 1 ♂ , Bankura, Susumi Falls, 21.xi.1974 coll. B.C.Nandi; 1 ♂, Birbhum, Charicha Forest, 15.xi.1974, coll. B.C.Nandi; 1 ♂ , Birbhum, Suri D.I.C. Campus, 9.xi.1974, coll. B.C. Nandi.

Discussion : In its external features the species closely resembles to Boettcherisca peregrina (Robineau-Desvoidy) but differs from it in the detailed structures of apical and lateral plate of paraphallus.

Distribution : India : West Bengal : Midnapore, Bankura, Birbhum.

Boettcherisca nathani Lopes, 1961

// Plate XIII, Figs. 1-5 //

Boettcherisca nathani Lopes, 1961. Mem. Inst. Oswaldo Cruz, 59(1) : 70.

Male : Body length 10 mm.

Head : Width of frons about three-fifths that of eye; frontal vitta black, its width at narrowest point more than two times the width of parafrontal; parafrontal and parafacial black with golden pollen, the former with numerous scattered hairs, the latter with a row of black hairs, below the eye margin, of which lower five are stout. Antennae blackish-brown, reaching to about 0.85 the distance to vibrissae; 1st and 2nd segments black, with numerous short, black hairs; 3rd segment brown, with silvery pollen, its length about two and a half times that of the 2nd; arista long and plumose on three-fifths its length basally; facial ridge black, with golden pollen and with a few short black spines near the vibrissal base; vibrissae long, erueiate, distance between vibrissae more than the width of parafacial; frontal bristles 12, arranged in a row on parafrontal, upper two reclinate, lower four below base of antennae and reaching to about the apical end of 2nd antennal segment, the rest decussate and directed forwards; gena black, with numerous black hairs; postgena black, with numerous long, brownish hairs; ocellar triangle black, with golden pollen and with three pairs of short black, divergent hairs. Outer vertical short; inner one well developed; postvertical short, about one-third the inner vertical; ocellar and postocellar one pair each, the former shorter than the shortest parafrontal; besides postocular cilia two rows of postocular setae present of which the 1st row is regular while the 2nd is irregular and with intermittent black and brownish hairs, the rest of the area with brownish hairs; palpi slender, black; proboscis black.

Thorax : Blackish-brown with three black longitudinal stripes; ac 0 + 1; dc 5 + 5 (posterior two stout) ia 1 + 2; ps 1; h 3; ph 2; np 4; sa 3; pa 2; st 1 + 1 + 1; mpl 6; hpl 8; upper part of propleura bare; prostigmatic and propleural bristles well developed, accompanied by short hairs; pro- and metathoracic spiracles brown; spicoscutellar and discoscutellar bristles 1 pair each, the former stout and cruciate; laterescutellar bristles 2 pairs.

Wing : Hyaline, with brown veins; R_1 bare; R_{4+5} with a row of about 10 short setae located dorsally and extending to about two-thirds the length from the basal node to r-m; four short setae present ventrally on the basal node of R_{4+5}; third sector of costa a little longer than the fifth, the latter with short spines along its anterior margin in the basal half; costal spines not stout; epaulet black, with spines; basicostal scale light brown; squama white; haltere brown.

Legs : Black; fore femur with two rows of bristles on posterodorsal surface and a row of long bristles on posterior margin of ventral surface; fore tibia with 2 bristles on about basal one-third of anterodorsal surface and 1 bristle on the posterodorsal surface at about one-third its length from the distal end; mid femur with 4 bristles along the middle portion of anterolateral surface, a row of short setae in the distal half of anteroventral and posteroventral surfaces, a row of about four bristles in the

basal half of anteroventral surface, numerous long hairs in the basal half of posteroventral surface and 1 bristle on posterodorsal and 1 on posterolateral surfaces; mid tibia with 3 long and a row of short bristles on the posterodorsal surface, 1 bristle on posterodorsal and 1 on posteroventral surfaces both at about one-third the length from the distal end and 1 bristle on anterodorsal surface at about two-fifths the length from the distal end; hind femur without a tuft of hairs but with two rows of bristles on the anteroventral and numerous long hairs on the posteroventral surfaces, 2 bristles medially on posterodorsal surface and 1 bristle on anteroventral surface at about half its length from the distal end.

Abdomen : Black, silvery checkered pattern; median marginal bristles on 2nd and 3rd abdominal tergites absent but each with two pairs of lateral marginal bristles; 4th tergite with a pair of median and three pairs of lateral marginal bristles; first four sternites with short, dense, black hairs but without bristles; 5th sternite Y-shaped, with closely set bristles on the inner side of each arm and short hairs at the distal end; 1st and 2nd genital tergites black, with hairs but without marginal bristles; inner forceps dorsally with numerous spines on one-third its length apically; outer forceps almost triangular with hairs on its broad, distal end. Anterior paremere curved and pointed at apex; posterior

one tapering gradually; theca shorter than paraphallus, both heavily sclerotised; apical plate of paraphallus membraneous, curved and pointed at apex, with a pair of long, lateral processes each of which is slightly notched in the middle; lateral plate of paraphallus sclerotised, with two pointed processes; styli of glans with excised apex, with comb-like processes anteriorly; ventralia large, with short digitiform processes.

Specimens examined : 1 ♂, West Bengal : Darjeeling, Gooke, 12.v.1975, coll. B. C. Nandi.

This species is being recorded for the first time from West Bengal.

Distribution : India : Tamil Nadu : Karikal (Karumbagaram); West Bengal : Darjeeling.

Bionomics : Nothing is known.

Genus Bercaea Robineau-Desvoidy, 1863

Type-species : Musca haemorrhoidalis Fallèn, 1816.

Bercaea Robineau-Desvoidy, 1863, Hist. Dipt., 2 : 540,

Mesothyraia Enderlein, 1928. Arch. Klass. Phyl. Ent., 1 : 37; Zumpt, 1972, Explor. Prac. natn. Virunga, 101 : 42, Syn.

Cepreasarcophaga Rohdendorf, 1937, Faune de l' URSS, 19(1) : 293, 467; Rohdendorf, 1963, Stuttg. Beitr. Naturk., 124 : 11, Syn.

Stephanostoma (Lenz. 1794) Townsend, 1938. Manu. Myio., 6: 70; Rohdendorf, 1963, Stuttg. Beitr. Naturk., 124 : 11, Syn.

Sarcophaga (Bercaea) Robineau-Desvoidy, Zumpt, 1972, Explor. Prac. natn. Virunga, 101 : 42.

Generic characters : Length of third antennal segment about two times that of the second; arista long and plumose; upper part of propleura bare; acrostichal bristles absent; apicoscutellar and discoscutellar bristles 1 pair each; lateroscutellar bristles 2 pairs; vein R_1 bare; cell R_5 widely open; mid tibia with a tuft of long hairs; third abdominal tergite without median marginal bristles; first genital tergite with marginal bristles; inner forceps divided at the basal one-third, both arms elongate, widely divergent and with claw-like tips; theca very short; paraphallus very long, with lateral process apically; a pair of claw-like ventralia present which are large and heavily pigmented; styli of glans slender and bent forwards.

This genus is known only by a single species and is distributed in the Oriental, Palaearctic and Ethiopian regions.

Boreaca haemorrhoidalis (Fallèn, 1816)

// Plate XIV, Figs. 1-5 //

Musca haemorrhoidalis Fallèn, 1816, Svensk. Vet. Akad. Handle, p. 236

Sarcophaga haemorrhoidalis (Fallèn), Macquart, 1834, Histoire Naturelle des Insectes Diptères, 2 : 224.

Sarcophaga aurea Rondani, 1860. Atti. Soc. Ital. Sci. Nat., 3 : 379; Seguy, 1941, Encyl. ent., 21 : 105, Syn.

Sarcophaga erventata Meigen, 1826, Archen and Hamm., 5 : 28, 23; Seguy, 1941, Encycl. ent., 21 : 105, Syn.

Sarcophaga georgina Wiedemann, 1830, Auss. Zweifl., 2 : 357; Seguy, 1941, Encycl. ent., 21 : 105, Syn.

Bellieria haemorrhoidalis (Fallèn), Enderlein, 1928. Arch. Klass. Phyl. Ent., 1 : 37.

Caprosarcophaga haemorrhoidalis (Fallèn), Rohdendorf, 1937, Faune de l' URSS., 19(1) : 205.

Sarcophaga (Boreaca) haemorrhoidalis (Fallèn), Zumpt, 1972, Explor. Prac. natn. Virunga, Part IV. Sarcophagidae: p.103.

Boreaca haemorrhoidalis (Fallèn), Lopes, 1961. Proc. Hawaiian ent. Soc., 17(3) : 425; Rohdendorf, 1975, Steenstrupia, 3 : 202.

Male : Body length 9-14 mm.

Head : Width of frons about three-fifths that of eye; frontal vitta black, its width at narrowest point about two times that of parafrontal; parafrontal and parafacial black, with golden pollen, the former with scattered black hairs, the latter with 4-5 long black hairs below the eye margin. Antennae dark brown, reaching to about 0.8 the distance to vibrissae; 1st segment black; 2nd blackish, with short spines; 3rd brown, pollinose, its length about two and a half times that of the second; arista long and plumose on more than half of its length basally; facial ridge black, entirely with golden pollen and with short black spines in the lower half; vibrissae long, cruciate, distance between vibrissae about one and a half times the parafacial width; frontal bristles 12-15, arranged in a row on parafrontal, upper two reclinate, lower three below base of antennae reaching to about two-thirds the 2nd antennal segment, the rest decussate and directed forwards; gena black, with black hairs; postgena black, with whitish hairs; ocellar triangle black, with about four pairs of divergent, long, blak hairs. Outer vertical short; inner one well developed; postvertical moderately stout, about half the length of inner vertical; ocellar and postocellar one pair each, the former proclinate; one row of irregular post-ocular setae present besides posteocular cilia, the rest of the area with irregular black and white hairs; palpi slender, black; proboscis black.

Thorax : Grey, with yellowish pollen and three black, longitudinal stripes; ac 0 + 0; dc 6 + 6(anterior four post dc very stout); ia 1 + 3; pa 1; h 3; ph 3; np 4; pa 2; sa 4; st 1 + 1 + 1; mpl 7; hpl 11; upper part of propleura black, bare, with white pollen; prestigmatic and propleural bristles well developed and accompanied by short hairs; apicoscutellar and discoscutellar bristles 1 pair each; laterocutellar bristles 2 pairs.

Wing : Hyaline, with brown veins; R_1 bare; R_{4+5} with a row of about 9-10 short setae located dorsally and extending to half the distance from basal node to r-m; several setae present on ventral surface of basal node of R_{4+5}; fifth sector of costa one and a half times the third, the former with short spines along basal one-third of its length on anterior margin; costal spines stout; epaulet black, with short spines; basicostal scale light brown; squama creamy white; haltere brown.

Legs : Black; fore femur with two rows of long bristles on posterodorsal surface and a row of long bristles on the posterior margin of ventral surface; fore tibia with 3 bristles in the basal half of anterodorsal surface, 1 bristle on the posterolateral surface at about one-third the distance from the distal end and a row of short bristles on the posterodorsal surface; mid femur with 3-5 short bristles along the middle portion of anterolateral surface, a row of short setae in the distal one-third of anteroventral and posteroventral surfaces, a row of bristles in the basal half of

anteroventral surface and numerous long hairs in the basal half of posteroventral surface; mid tibia with 1 long and 2 short bristles basally on anterodorsal surface, a row of short bristles on the posterodorsal surface, 1 bristle on the anteroventral surface and 1 on the posterolateral surface at about one-third the distance from the distal end; hind femur with two rows of long bristles on the anterodorsal surface, a row of sparse bristles on the anteroventral surface, a row of fine bristles on the posteroventral surface, 1 bristle on the posterodorsal surface at about one-fifth the distance from the distal end, 1 to 2 bristles on the distal half of the posterolateral surface and numerous hairs on the ventral surface; hind tibia with a row of long bristles on the anterodorsal surface, 2 long bristles on posterodorsal surface, 1 long bristle on anteroventral surface at about one-fifth the distance from the distal end and with numerous long hairs on the anterior and posterior margins of ventral surface.

Abdomen : Black and silvery grey checkered pattern; median marginal bristles on 2nd and 3rd abdominal tergites absent but each with one pair of lateral marginal bristle; 4th with a pair of median and three pairs of lateral marginal bristles; 5th with a row of about 18 marginal bristles. Sternites 1st and 2nd with long hairs; 3rd and 4th with short, scattered hairs; 5th sternite Y-shaped, with stout spines on the inner side of each arm and short hairs distally. 1st genital tergite brown, with 2-3 pairs of

marginal bristles; 2nd brown to orange, without bristles but with long hairs; inner forceps long, curved and pointed at apex, with short hairs along the distal half and with a tuft of long hairs in the basal half; outer one short, its apex rounded and hairy; anterior paramere long, pointed at apex, with short hairs on outer side distally; posterior paramere short, pointed at apex, with two short subapical hairs; theca very short; paraphallus very long, heavily sclerotised, blunt at apex, its lateral process short, curved, and pointed; lateral plate of paraphallus short; styli of glans long, curved; ventralia large and pointed at apex.

Specimens examined : 32 ♂ ♂, West Bengal : Darjeeling, Algara, alt. 5,800 ft., 20.iv.1974, coll. B.C.Nandi; 24 ♂ ♂, Darjeeling, Kalimpong, alt. 4,000 ft., 21.iv.1974, coll. B.C.Nandi; 33 ♂ ♂, Darjeeling, Lebong, alt. 6,000 ft., 14-16.iv.1974, coll. B.C.Nandi; 11 ♂♂ , Darjeeling, Zoological Park, alt. 6,500 ft. 16.iv.1974, coll. B.C.Nandi; 13 ♂ ♂, Darjeeling, Ghoom, alt. 7,400 ft., 12.iv.1974 coll.B.C.Nandi; 25 ♂ ♂, Darjeeling, Dow Hills, alt. 5,700 ft., 15.iv.1974, coll. B.C.Nandi; 58 ♂ ♂ , Darjeeling, Kurseong, alt.5,500 ft., coll. B.C.Nandi, 21 ♂ ♂ , Darjeeling, Bijanbari, alt. 2,500 ft., 16.iv.1974, coll. B.C.Nandi; 2 ♂ ♂, Jalpaiguri, Chalsa, alt. 555 ft., 1.v.1974, coll. B.C.Nandi.

Female : Body length 8-12 mm // Plate XV, Figs.1-4 //

Head : Width of frons about the same as that of eye; frontal bristle 10-12; fronto-orbital bristles 2, proclinate; outer vertical bristle well developed, about three-fourths the inner vertical.

Thorax : Similar to that of male but for the absence of spinoscutellar bristles.

Wing : Same as in male.

Legs : Chaetotaxy same as in male but for the following differences : Mid femur without long hairs in the basal half of posteroventral surface; hind femur with a row of bristles on anterodorsal surface; hind tibia with 2 bristles on anteroventral surface, long hairs on anterior and posterior margins of ventral surface absent.

Abdomen : 2nd sternite with 5-7, 3rd with 6 and 4th with 4 short bristles; 5th with 4 stout bristles; 6th broader than the rest and with a row of about 6 bristles proximally; 7th broader than 6th and with 4 bristles distally; 8th short, membranous; anal sternite with long hairs, 7th tergite composed of two plates, with hairs and stout marginal bristles; spermatheca 3, barrel-shaped, broad in the middle, with numerous striations throughout its length.

Described from one female collected in copula from Kurseong, Darjeeling, 16.iv.1974, coll. B. C. Nandi.

Distribution : India : West Bengal : Jalpaiguri, Darjeeling, Kalimpong, Kurseong, Mongpu, Pangbee Jhora, Siliguri; Himachal Pradesh : Simla, Kulu; Uttar Pradesh : Mukteswar, Almora, Naini Tal, Mussoorie; Nepal; Korea, Baluchistan; Ireland; England : Portugal;

Spain; France, Netherlands; Italy; Sweden; Denmark; Germany; Austria; Hungary; Yogoslavia; Rumania; Bulgaria; Greece; Georgia; Canary Islands; Morocco; Algeria; Libya; Egypt; Turkey; Palestine; Arabia; Iraq; Canada; Alberta, British Columbia, U.S.A.; New York, Pennsylvania, Maryland, Virginia, North Carolina, Georgia, Florda, Michigan, Illinois, Texas, Colorado, Oregon, California; Brazil; Argentina; San Salvador; Honduras; Liberia; Ghana; Nigeria; East Africa, Zaire; Angola; Uganda; Kenya; Southern Rhodesia; South Africa; Seychelles Islands; New South Wales; Hawaii

Bionomics : It is attracted to human excrement and is found mainly on animal carcasses and human feces. It can be breed in such media. The larvae are found also in decaying organic matter such as decaying meat and different kinds of rotten food-stuff. This species is mainly responsible for causing myiasis in man and animals. Onorato (1922) recorded two cases of myiasis in Tripolitania caused by their fly. Townsend (1938) suggested that this species probably completed its development in the human intestine. Symes and Roberts (1932) recorded a case in Kenya where larvae were taken from the brain substance exposed by chronic ulcer in a woman. This species is also parasitized by Nasonia brevicornis in South Africa.

Greenburg (1971) recorded that these flies were found associated with the following organisms : Polio virus, Escherichia coli, Proteus morganii, P. vulgaris, Salmonella enteritidis, S.paratyphi A and B., S. typhi and Bacillus megaterium.

Genus Parasarcophaga Johnston and Tiegs,1921

Type-species : Sarcophaga omega Johnston and Tiegs, 1921.

Parasarcophaga Johnston and Tiegs, 1921, Proc. Roy. Soc. Qudl., 33(4) : 86.

Generic characters : 3rd antennal segment 2 to 3 times the 2nd; anal tergite sometimes red; acrostichal bristles 0 + 1 (rarely prescrostichal bristles present); post sutural dorsocentral bristles variable in number, only the posterior ones stout; P_1 bare; 1st genital tergite of male usually without marginal bristles; third abdominal tergite normally without long bristles; apical plate of paraphallus always shorter than remainder of paraphallus, if almost the same size, the membranous processes are long and lamellate; styli of glans stout and slender, never closely adjacent to apical part.

This genus is widely distributed in the Oriental, Palaearctic, Australian, Ethiopian and Nearctic regions. Six subgenera and more than forty species of this genus are known from the Oriental region of which five subgenera are reported from India. All this five subgenera are represented in West Bengal also.

Key to the subgenera of Parasarcophaga from India

1. Lateral plate of paraphallus in the form of an unpaired, pedunculate process

... subgenus Parasarcophaga s.str. Johnston and Tiegs

Lateral plate of paraphallus either short and tuberculate or in the form of broad lamellate hook-shaped or narrow and slender paired processes

... 2

2. Lateral plate of paraphallus in the form of rudimentary tubercle; posterior parts of phallosome membranous owing to division along median line of basal part of paraphallus; apical part narrow at rear, almost without a median division but with two lateral processes with sharp teeth extending proximad

... subgenus Liopygia Enderlein

Lateral plate of paraphallus well developed; posterior part of phallosome invariably sclerotized; lateral processes of apical part without teeth extending proximad

... 3

3. Lateral plate of paraphallus in the form of narrow, stout process extending forward; basal part of paraphallus long, apical part plate-like, narrow in profile and extending forwards

... subgenus Curranea Rohdendorf

Lateral plate of paraphallus lamellate or slender and sharp, not erect and stout; apical part extending distad, not pointed forwards

... 4

4. Two pairs of slender, sharp membranous processes; basal part of paraphallus long; anal tergite black

... subgenus Pandelleisca Rohdendorf

Lateral plate of paraphallus comprising a single pair of lamellate processes; basal part of paraphallus only moderately elongate; anal tergite sometimes red

... subgenus Liosarcophaga Enderlein

Subgenus : Parasarcophaga Johnston and Tiegs

Type-species : Sarcophaga omega Johnston and Tiegs, 1921

Parasarcophaga Johnston and Tiegs, 1921, Proc. Pow. Soc. (Sdl., 33(4) : 86.

Subgeneric characters : Penis with long stalked ventralis; apical plate of paraphallus more or less transparent or slightly sclerotised and cleft; lateral plate of paraphallus unpaired and short stalked; genital tergite without bristles.

This subgenus is widely distributed. Rohdendorf (1965) reported a total of approximately ten species from Europe and Asia. Only five species are known from India all of which are available in West Bengal. However, the author could not collect one of these five species viz., macroauriculata Ho.

Key to the male species of the subgenus Parasarcophaga from India

1. Hind tibia without bristles on the anterior margin of ventral side in addition to the long villosity ... 2

   Hind tibia with bristles on the anterior margin of ventral side in addition to the long villosity ... 3

2. Apical plate of paraphallus slender, sharply pointed at apex ... knabi (Parker)

   Apical plate of paraphallus broad, blunt at apex ... hirtipes (Wiedemann)

3. Apical plate of paraphallus long, sharply pointed at apex; inner forceps moderately broad ... albiceps (Meigen)

   Apical plate of paraphallus short, blunt at apex; inner forceps long and slender ... orchidea (Böettcher)

Parasarcophaga (s.str.) knabi (Parker, 1917)

// Plate XVI, Figs.1-6 //

Sarcophaga knabi Parker, 1917, Proc. U.S. natn. Mus., 54 : 96.

Parasarcophaga knabi (Parker), Kano, Field and Shinonaga, 1967, Fauna Japonica, Sarcophagidae, p. 42.

Parasarcophaga (s.str.) knabi (Parker), Rohdendorf, 1937, Faune de l'URSS., 19(1) : 208; Lopes, 1967, Ent. Meddl., 35 : 176.

Male : Body length 8-14 mm.

Head : Width of frons about three-fourths that of eye; frontal vitta black, its width at narrowest point lesser than two times that of parafrontal; parafrontal and parafacial black, entirely with silvery to golden pollen and with short black hairs near the eye margin. Antennae reaching to about 0.8 the distance to vibrissae; 1st two segments black; base of 3rd reddish-brown and the rest greyish, its length two and a half times that of the 2nd; arista long and plumose in the basal half; facial ridge light brown, golden pollinosity with short black spines in the lower half; vibrissae long, cruciate, distance between vibrissae about half the parafacial width; frontal bristles 10-11, arranged in a row on parafrontal, upper 2 reclinate, lower 2 below base of antennae and reaching to about half the length of 2nd antennal segment, the rest directed forwards; gena black, of golden to silvery pollonosity, with short yellowish to white hairs; postgena black, with white hairs; ocellar triangle black, with silvery pollen and with 5 pairs of black, divergent hairs. Outer vertical absent; inner one well developed; postvertical short, about half the inner vertical; ocellar and postocellar short; one row of regular, black postocellar setae present, the rest of the area with yellowish hairs; palpi slender, brown; proboscis black.

Thorax : Greyish with silvery pollen and with 3 black longitudinal stripes; ac 0 + 1; dc 5 +5 (posterior 1 stout); ia 1 +3; pa 1; h 3; ph 2; np 4; pa 2; sa 3; st 1 + 1 +1; mpl 6; hpl 7; prostigmatic

and propleural bristles well developed and accompanied by short hairs; upper part of propleura bare, with white pollen; pro- and metathoracic spiracles brown, the latter with whitish pollen; apicoscutellar and discoscutellar bristles 1 pair each, the former crossed; lateroscutellar bristles 2 pairs each.

Wing : Hyaline with brown veins; R_1 bare; R_{4+5} with a row of about 9 short setae located dorsally and extending to about two-thirds the distance from the basal node to r-m; several setae present on ventral surface of basal node of R_{4+5}; third sector of costa a little longer than the fifth, the latter with short spines along the basal half on the anterior margin; costal spines stout; epaulet black, with short spines; basicostal scale light brown; squama white; haltere brown.

Legs : Black; fore femur with two rows of long bristles on posterodorsal surface and a row of long bristles on posterior margin of ventral surface; fore tibia with 3 bristles on the basal part of anterodorsal surface, 1 bristle on the posterolateral surface at about one-third the distance from the distal end and a row of bristles on posterodorsal surface; mid femur with 3-4 short bristles along the middle portion of anterolateral surface, a row of short setae on the distal half of anteroventral and posteroventral surfaces, a row of bristles on the basal half of anteroventral surface, 2 bristles on the distal part of posterodorsal surface and a row of short hairs on basal part of posteroventral surface; mid tibia with 1 long and a row

short bristles on the posterodorsal surface, 2 long bristles in the middle portion of anterodorsal surface and 1 bristle each on the posterolateral and posteroventral surfaces at about one-third the distance from the distal end; hind femur with 2 rows of long bristles on the anterodorsal surface, a row of bristles on the anteroventral surface, 2 bristles on the distal part of posterodorsal surface and 1 bristle on the distal part of posterolateral surface; hind tibia with 3 long and a row of short bristles on the anterodorsal surface, 2 bristles in the middle of posterodorsal surface, and numerous long hairs on the anterior and posterior margins of ventral surface at about three-fourths the distance from the distal end.

Abdomen : Black and silvery grey checkered pattern; median marginal bristles on 2nd and 3rd tergites absent (in some specimens weak bristles present on 3rd tergite) but both with well developed lateral marginal bristles; 4th with a pair of median and several pairs of lateral marginal bristles; 5th with a row of about 18 marginal bristles; sternites 1st and 2nd with long and 3rd and 4th with short hairs but none with differentiated bristles; 5th sternite Y-shaped, each arm with short hairs distally and spines on the inner margin laterally; 1st genital tergites black, with greyish pollen and with numerous hairs; 2nd shiny black, with long hairs; inner forcep short and stout, with hairs only on basal half; outer forcep triangular, with hairs only in the posterior half; anterior paramere long, curved

and pointed at apex; posterior paramere short and pointed; apical plate of paraphallus long, curved and pointed; theca and paraphallus almost of equal length, both sclerotised; lateral plate of paraphallus broad and pointed; styli of glans short; ventralia stalked.

All the specimens under "Specimens examined" were collected by the author from West Bengal.

Specimens examined : 8 ♂ ♂, 24-Parganas, Diamond Harbour, 25.iii.1975; 6 ♂ ♂, 24-Parganas, Bamankhali (Sagar Island), 24.iii.1975; 24-Parganas, Ratneswarpur, 24.iii.1975; 3 ♂ ♂, 24-Parganas, Lakshmikantapur, 24.viii.1974; 3 ♂ ♂, Calcutta, Zoo garden, 21.iii.1975; 4 ♂ ♂, Calcutta, Eden Garden, 25.i.1975; 5 ♂ ♂, Calcutta, Brace Bridge, 22.ii.1974; 1 ♂ , 24-Parganas, Budge Budge, 20.xii.1974; 5 ♂ ♂, Howrah, Sankrail, 30.iii.1975; 2 ♂ ♂, Hooghly, Tarakeswar, 20.ix.1974; 18 ♂ ♂, Midnapore, Digha Mohana, 30.xi.1974; 24 ♂ ♂, Midnapore, Arabari Forest, 26.xi.1974; 4 ♂ ♂, Midnapore, Salboni, 20.xi.1974; 3 ♂ ♂, Midnapore, Chandrakona Road, 27.xi.1974, 24 ♂ ♂, Birbhum, Kanduah, 7.xi.1974; 4 ♂ ♂, Birbhum, Kachujur, 8.xi.1974; 2 ♂ ♂, Birbhum, Suri, D.F.O. Campus, 8.xi.1974, 8 ♂ ♂ , Birbhum, Chandrapur Forest, 11.xi.1974; 1 ♂, Birbhum, Suri D.F.O. Campus, 12.xi.1974; 8 ♂ ♂, Bankura, Bhatpur, 20.xi.1974; 14 ♂ ♂, Bankura, Susunia Forest, 21.xi.1974; 15 ♂ ♂, Bankura, Panchubagha, 22.xi.1974; 1 ♂, Bankura, Bankura D.M.Bunglow, 23.xi.1974; 2 ♂ ♂, Bankura, Joypur Forest, 23.xi.1974; 6 ♂ ♂, Bankura, Bishnupur, 24.xi.1974; 7 ♂ ♂, Bankura, Bishnupur, 24.xi.1974; 4 ♂ ♂,

Purulia, Ketka, 14.xi.1974; 1 ♂, Purulia, Sasankali, 18.xi.1974; 3 ♂ ♂, Purulia, Ajodhya Forest, alt. 1095 ft., 15.xi.1974; 1 ♂, Purulia, Matha Forest, 15.xi.1974; 2 ♂ ♂, Purulia, D.F.O.Campus, 18.xi.1974; 1 ♂, Purulia, Bumdwan, 17.xi.1974; 3 ♂ ♂, Purulia, Dulmi West, 14.xi.1974; 1 ♂, Purulia, Digha Forest, 17.xi.1974; 5 ♂ ♂, Jalpaiguri, Chalsa, 1.xi.1974; 6 ♂ ♂, Jalpaiguri, Madarihat, 27.xi.1975; 2 ♂ ♂, Jalpaiguri, Falakata, 2.v.1975; 2 ♂ ♂, Coochbehar, Chilapata Forest, 26.iv.1975; 1 ♂, Jalpaiguri, Rajabhatkhawa Forest, 28.ix.1974; 2 ♂ ♂, Coochbehar, Patlkhawa Forest, 25.iv.1975; 2 ♂ ♂, Darjeeling, Kalimpóng, 24.iv.1975; 3 ♂ ♂, Darjeeling, N.B.U.Campus, 23.iv.1975; 2 ♂ ♂, Darjeeling, Bijanbari, 18.iv.1975; 2 ♂ ♂, Darjeeling, Nakxalbari, (Tokariajhar Forest), 23.ix.1975; 1 ♂, Darjeeling, Teeta Bazar, 22.iv.1975; 2 ♂ ♂, West Dinajpur, Raiganj, (Kornojhora), 5.v.1975; 2 ♂ ♂, West Dinajpur, Raigunj, 6.v.1975; 3 ♂ ♂, Nadia, Ranaghat, 3.viii.1975; 1 ♂, Murshidabad, C.S.R.S. Campus, 3.xi.1974; 1 ♂, Murshidabad, Tikatuli, 4.xi.1974; 1 ♂ , Murshidabad, Beldanga, 5.xi.1974.

Female : Body length 7-12 mm.// Plate XVII, Figs.1-4 //

Head : Width of frons almost equal to that of eye; frontal bristles 10; 2 proclinate fronto-orbital bristles present; outer vertical bristle well developed, four-sixths the inner vertical.

Thorax : Similar to that of male but for the absence of apico-scutellar bristles.

Wing : Same as in the male.

Legs : Chaetotaxy same as in male but for the following differences : Mid femur without short hairs in the basal part of postero-ventral surface; mid tibia with one additional short bristle on posteroventral surface at about one-third the distance from the distal end; hind tibia with one row of bristles in the distal half of anteroventral surface but without tufts of long hairs on the anterior and posterior margins of ventral surface.

Abdomen : Sternites 2nd, 4th and 5th with 2 bristles each; 3rd with 4 bristles, 6th broader than the rest, with 4 stout bristles; 7th slightly concave distally and with 2 stout bristles medially; 8th membranous slightly concave, without hairs or bristles; anal sternite covered with short hairs; 7th tergite with marginal bristles, longitudinally divided in two plates which are joined by a membranous region; spermatheca 3, each broad distally and slightly striated at basal half. The specimens examined were collected by the author in copula.

Specimens examined : 1♂,1 ♀, West Bengal : Midnapore, Arabari Forest, 26.xi.1974; 1 ♂ and 1 ♀, Bankura, Joypur Forest, 23.xi.1974; 1 ♂ and 1 ♀, 24-Parganas, Sagar Island, 24.iii.1975; 1 ♂, 1 ♀, Bankura, Bisunia Falls, 21.xi.1974; 1 ♂, 1 ♀, Bankura, Panchubaga, 20.xi.1974; 1 ♂, 1 ♀, Purulia, Sasankali, 14.xi.1974; 1 ♂, 1 ♀, Purulia, Matha Forest, 18.xi.1974; 1 ♂, 1 ♀, Birbhum, Kanddaha, 7.xi.1974; 1 ♂, 1 ♀ Jalpaiguri, Chalsa, 2.v.1975; 1 ♂, 1 ♀, 24-Parganas, Budranagar,

24.iii.1974, 1 ♂, 1 ♀, 24-Parganas, Sagar Island, 24.iii.1975; 1 ♂, 1 ♀, Purulia, Sahebbundh, 16.xi.1974; 1 ♂, 1 ♀, Purulia, Ketka, 14.xi.1974; 1 ♂, 1 ♀, Purulia, Dulmi West, 14.xi.1974.

Distribution : India : West Bengal : Malda, Midnapore, Calcutta, 24-Parganas, Hooghly, Birbhum, Bankura, Jalpaiguri, Coochbehar, Hooghly, Nadia, Darjeeling, Uttar Pradesh : Dehra Dun, Allahabad; Haryana : Ambala; Gujarat: Ahmedabad, Surat; Maharastra: Bombay; Tamil Nadu: Coimbatore; Orissa: Barkuda Island, Balasore; Bihar : Pusa; Assam; Gauhati, Dibrugarh; Andaman Islands; Port Blair; Sri Lanka; Australia; Micronesia; China; Korea ; Malaysia; Java; Bali; Fiouw Archipelago; Nepal; Bismark Islands and Philippine Islands.

Bionomics : This species is attracted towards human faeces and dead animals and is known to breed (Kano et all., 1957) in such media in nature and in the laboratory. It has been bred on dead rabbit and it is also attracted to Aristolochia ridicula (Senior-White et al. 1940). During the present investigations they were bred in meat in the laboratory.

Parasarcophaga (s.str.) hirtipes (Widemann, 1830)

// Plate XVIII, Figs. 1-6 //

Sarcophaga hirtipes Wiedemann, 1830, Ausser Zweifl. Ins., 2: 661

Sarcophaga dura Curran, 1934, Am. Mus. Novit., 727 : 12; Zumpt, 1951, J. ent. Soc. Sth. Afr., 14 : 198, Syn.

Sarcophaga flavipalpis Macquart, 1843, Dipt. exot., 2 : 98; Seguy, 1941, Encyl. ent., (A) 21 : 109, Syn.

Sarcophaga rufipes Wiedemann, 1830, Ausser. Zweifl. Ins., 2 : 662; Zumpt, 1951, J. ent. Soc. Sth. Afr., 14: 197,Syn.

Parasarcophaga (s.str.) hirtipes (Wiedemann), Rohdendorf, 1937, Faune de l'URSS., 19(1) : 198; Zumpt, 1972, Explor. Prac. natn. Virunga,101 : 79.

Parasarcophaga (s.str.) africana Rohdendrof, 1963, Stuttg. Beitr Naturk., 124 : 15; Zumpt, 1972, Explor. Prac natn. Virunga, 101 : p. 79, Syn.

Male : Body length 9-14 mm.

Head : Width of frons about one-third that of eye; frontal witta brownish-black, its width at narrowest point about two times that of parafrontal; parafrontal and parafacial black with silvery to golden pollen, the latter with short black hairs near the eye margin. Antennae brown, reaching to about 0.8 the distance to vibrissae; 1st segment blackish-brown; 2nd dark brown; 3rd brown with silvery pollen, its length two and a half times that of the 2nd; arista long and plumose on basal two thirds; facial ridge brownish-black, with short black spines on its lower two-thirds; vibrissae long, crossed, distance between vibrissae more than parafacial width; frontal bristles 9-11, arranged in a row of parafrontal, upper 2 reclinate, lower 2 below base of antennae and reaching to the level of about half the length of 2nd antennal segment, the rest directed forwards; gena black, with golden pollen and short whitish hairs; postgena blackish with long

whitish hairs; ocellar triangle brownish-black, with short black hairs. Outer vertical well developed; inner one more developed than outer one; postvertical short, about one-fourth the inner vertical; ocellar and postocellar short; one row of short postocular setae present; the rest of the area with irregular black and white hairs; palpi slender, yellowish; proboscis black.

Thorax : Greyish with silvery pollen and three black longitudinal stripes; ac 0 + 1 (sometimes one weak presutural present) dc 5 + 5 (posterior 2 stout); ia 1 + 3; pa 1; h 4; ph 2; np 4; ps 2; sa 3; st 1 + 1+ 1; mpl 6; hpl 8-11; prostigmatic and propleural bristles well developed and accompanied by short hairs and bristles; upper part of propleura brown, with silvery pollen; pro- and meta-thoracic spiracles brown; apicoscutellar and discoscutellar bristles 1 pair each; lateroscutellar bristles 2 pairs; 1 pair of short basiscutellar present.

Wing : Hyaline, with brown veins; R_1 bare; R_{4+5} with a row of 6 short setae located dorsally and extending to two-thirds the distance from the basal node to r-m; several short setae are seen on ventral surface of R_{4+5}; fifth sector of costa a little shorter than the third, the former with short spines on the anterior margin on half of its length basally; costal spines stout; epaulet blackish-brown, with short spines; basicostal scale brown; squama white with a brownish tinge; haltere brown.

Legs : Brownish-black; fore femur with two rows of bristles on posterodorsal surface and a row of bristles on the posterior margin of ventral surface; fore tibia with 3 short bristles in the basal part of anterodorsal surface, 1 bristle on the posterodorsal surface at about one-fourth the distance from the distal end and a row of bristles on posterodorsal surface; mid femur with 3 bristles along the middle portion of anterolateral surface, a row of short setae on the distal half of posteroventral and anteroventral surfaces, a row of bristles on the basal half of anteroventral surface, 2 bristles in the distal half of posterodorsal and posterolateral surfaces and numerous long hairs on the basal half of posteroventral surface; mid tibia with a row of bristles on posterodorsal surface, 2 long bristles on middle portion of anterodorsal surface and 1 bristle each on anteroventral and posteroventral surfaces at about one-third the distance from the distal end; hind femur with 2 rows of bristles on anterodorsal surface, a row of bristles on anteroventral surface, 2 bristles on the distal part of posterodorsal surface, 1 bristle on anterior margin of ventral surface at about one-third the distance from the distal end and numerous long bristly hairs on the posterior margin of ventral surface; hind tibia with 2 long and a row of long bristles on the anterodorsal surface, 2 bristles on the middle of posterodorsal surface, 1 bristle on the anteroventral surface at about one-third the distance from the distal end and numerous long hairs on the anterior and posterior margins of ventral surface at about three-fourths the distance from the distal end.

Abdomen : Black and silvery checkered pattern; median marginal bristles on 2nd and 3rd tergites absent but each with lateral marginal bristles. Sternites 1st and 2nd with long hairs; 3rd and 4th with short hairs; 5th sternite Y-shaped, each arm with short spines laterally and short hairs at the distal end; 1st genital tergite brown, with short black hairs; 2nd blackish-brown, with hairs but without marginal bristles; inner forceps long, with a tuft of long hairs in the basal hair; outer forceps triangular, with hairs on the distal end; anterior paramere long, with curved apex; posterior one abruptly curved at apex, with 2 short hairs on its anterior surface apically; apical plate of paraphallus well developed, curved but not so pointed at apex; lateral plate of paraphallus poorly developed, pointed apically; styli of glans short; ventralia with stalked lobes. All the specimens examined were collected by the author from West Bengal.

Specimens examined : 1 ♂, Calcutta, Dum Dum, 17.viii.1974; 1 ♂, Calcutta, Eden Garden, 3.xii.1974; 2 ♂ ♂, Nadia, Ranaghat, 3.viii.1974; 2 ♂ ♂, Nadia, Ranaghat, 3.viii.1974, 1 ♂, Calcutta, Kakurgachi, 10.i.1974; 1 ♂, Jalpaiguri, Chilapata Forest, 26.iv.1975; 1 ♂, Purulia, Latapara, 17.xi.1974.

N This is the first record of the species from the West Bengal.

Distribution : India : West Bengal : Calcutta, Nadia, Jalpaiguri, Purulia; Rajasthan : Dharwar, Ajmer; Punjab : Ludhiana; Gujarat : Ahmedabad; Tamil Nadu : Coimbatore; Delhi; Germany; Syria; Palestine;

Arabia; Iraq; Iran; Uzbekistan; Turkmenistan; Tadzhikistan; China ; Baluchistan; Guinea; Sudan; Ghana; Eritrea; Somalia; Socotra; Mozambique; Southern Rhodesia, South Africa; Cape of Good Hope.

Bionomics : Salem (1935) claims to have reared it from full-grown larvae from a case of human intestinal myiasis in Egypt and Cuthbertson (1933) after found females near wounds of cattle and sheep, but the species does not appear to cause myiasis in Rhodesia (Zumpt, 1965). Senior-White et al. (1940) reported the species having been reared from melons. Greenburg (1971) recorded that it is found in association with Escherichia coli. During the present investigation specimens were collected from decaying carcases, many kind of decomposing organic matters and from the excrements of man and animals.

Parasarcophaga (s.str.) albiceps (Meigen, 1826)

// Plate XIX, Figs. 1-6 //

Sarcophaga albiceps Meigen, 1826, System. Beschr. 5 : 22

Sarcophaga cyathisana Pandellé, 1896, Revue d'entomologie, 15 : 191; Böettcher, 1912, Dt. ent. Z., Berlin, p.729. Syn.

Sarcophaga pauciseta Kramer, 1908, Z.Hym.Dipt., 5 : 331; Boettcher, 1912, Dt. ent. Z. Berlin, P.729, Syn.

Sarcophaga hypopygium Malloch, 1934, Mem. Mus. nat. Hist. Belg., 4 : 22; Seguy, 1941, Encycl. ent.,(A)21 : 71, Syn.

Thyreocnema albiceps (Meigen), Enderlein, 1928. Arch. Klass. Phyl. Ent., 1 : 43.

Parasarcophaga albiceps (Meigen), Kano Field and Shinonaga, 1967, Fauna Japonica, Sarcophagidae, p. 43.

Parasarcophaga (s.str.) albiceps (Meigen), Rohdendorf, 1937, Faune de l' URSS., 19(1) : 425; Lopes 1967, Ent. Meddl., 35 : 169.

Male : Body length 8-13 mm.

Head : Width of frons about three-fifths that of eye; frontal vitta black, its width at narrowest point about two times the width of parafrontal; parafrontal and parafacial black with silvery pollen, the latter with short hairs near the eye margin. Antennae dark brown, reaching to about 0.8 the distance to vibrissae; 1st segment blackish-brown; 2nd black; 3rd brown, with whitish pollen, its length about three times that of the 2nd; arista long plumose on basal two-thirds; facial ridge blackish-brown, entirely silvery pollinose, with short spines in the lower half; vibrissae long, crossed, distance between vibrissae about half the parafacial width; frontal bristles 12, arranged in a row on parafrontal, upper two reclinate, lower 2 below base of antennae reaching to the level of about half the 3nd antennal segment, the rest directed forwards; gena black, silvery pollinose, with numerous black hairs on upper part; postgena black, with whitish hairs; ocellar triangle black, with many divergent black hairs. Outer

vertical absent; inner one well developed; postvertical shorter than the inner vertical; ocellar and postocellar short; one row of postocular setae present, the rest of the area with irregular black and white hairs; palpi brown; proboscis dark black.

Thorax : Grey, with silvery pollen and three black longitudinal stripes; ac 0 + 1; dc 5 + 5 (posterior 1 stout); ia 1 + 3; pa 1; h 3; ph 2; np 4; pa 2; sa 4; st 1 + 1+1; mpl 6; hypl 6; prestigmatic and propleural bristles well developed and accompanied by short hairs, upper part of propleura bare; pro- and metathoracic spiracles brown; apicoscutellar and discoscutellar bristles 1 pair each, the former crossed; lateroscutellar bristles 3 pairs of which the basal one is weak.

Wing : Hyaline, with brown veins; R_1 bare; R_{4+5} with a row of about 9 short setae located dorsally and extending to more than half the distance from the basal node to r-m; several setae seen on ventral surface of R_{4+5}; fifth sector of costa a little shorter than the third, the latter with short spines along its basal half; costal spine stout; epaulet black, with short spines; basicostal scale brown; squama white; haltere brown.

Legs : Black; fore femur with two rows of bristles on posterodorsal surface and a row of long bristles on the posterior margin of ventral surface; fore tibia with 2-3 short bristles on the basal part of anterodorsal surface, 1 bristle on the posterolateral

surface at about one-third the distance from the distal end and a row of short bristles on the posterodorsal surface; mid femur with 3 bristles on the middle portion of anterolateral surface, a row of short setae on the distal part of posterodorsal surface and a row of short hairs on the basal part of posteroventral surface; mid tibia with 1 long and a row of short bristles on the dorsal surface, 2 long bristles on the middle portion of anterolateral surface and 1 bristle each at about one-third the distance from the distal end on the posterolateral and anteroventral surfaces; hind femur with 2 rows of long bristles on the anterodorsal surface, a row on anteroventral surface, 1 bristle each distally on dorsal and posterodorsal surfaces and numerous long hairs on the posterior margin of anterodorsal surface; hind tibia with 2 bristles on the middle of posterodorsal surface, 1 long bristle on anterior margin of ventral surface at about one-fourth the distance from the distal end and numerous long hairs on the anterior and posterior margins of ventral surface at about three-fourths the distance from the distal end.

Abdomen : Black and silvery grey checkered pattern; 2nd and 3rd abdominal tergites without median but with well developed lateral marginal bristles; 4th with 1 pair of stout and several pairs of ordinary lateral marginal bristles; 5th with a row of about 18 marginal bristles; sternites 1st and 2nd with long hairs, 3rd and 4th with short sparse hairs but without differentiated bristles; 5th Y-shaped, each arm with stout spines laterally and long hairs

at the distal end; 1st genital tergite dark brown, with short hairs; 2nd black, with numerous black hairs but without marginal bristles; inner forcep long, with a tuft of long hairs on basal half; outer forcep elongated and somewhat kidney-shaped, with hairs on the distal half; anterior paramere long, curved in the middle; posterior one flat in the middle, with several hairs at the apical part anteriorly; theca and paraphallus almost equal but heavily sclerotised; apical plate of paraphallus long, curved and pointed at apex; lateral plate of paraphallus not so long and pointed; styli of glans short; ventralia with long stalked lobes.

All the specimens under "specimens examined" were collected by the author from West Bengal.

Specimens examined : 5 ♂♂, Jalpaiguri, Chapramari Forest, 30.xi.1975, 1 ♂, Jalpaiguri, Falakata, 2.v.1975; 4 ♂♂, Jalpaiguri, Madarihat, 27.iv.1975; 3 ♂♂, Jalpaiguri, Rajabhatkhowa Forest, 28.iv.1975; 3 ♂♂, Jalpaiguri, Joyanti Forest, 20.x.1974; 1 ♂, Jalpaiguri, Gorumara Forest, 3.v.1975; 1 ♂, Darjeeling; Kurseong, 15.iv.1975; 2 ♂♂, Darjeeling, Bijanbari, 16.iv.1975; 1 ♂, Darjeeling, Dow Hills, 15.iv.1975; 3 ♂♂, Darjeeling, Kalimpong, 24.iv.1975; 2 ♂♂, Coochbehar, Patlakhowa Forest, 25.iv.1975; 3 ♂♂, Purulia, Matha Forest, 15.xi.1975; 4 ♂♂, Purulia, Ketka, 14.xi.1974; 1 ♂; Purulia, Ajodhya Hills, 15.xi.1974; 3 ♂♂, Purulia, Latapara, 17.xi.1974; 33 ♂♂, Purulia, Sahebbundh, 18.xi.1974; 3 ♂♂, Purulia, Sasankali, 18.xi.1974; 8 ♂♂, Bankura, Susunia Forest, 21.xi.1974;

1 ♂, Bankura, Bishnupur, 24.xi.1974; 2 ♂ ♂, Birbhum, Charicha Forest, 11.xi.1974; 5 ♂ ♂, Bankura, Bhatpur, 20.xi.1974; 2 ♂ ♂, Birbhum, Charicha Forest, 10.xi.1974; 4 ♂ ♂, Birbhum, D.F.O. Campus, 9.xi.1974; 5 ♂ ♂, Birbhum, Kenduah, 9.xi.1974; 1 ♂, Birbhum, Gonpur Forest, 10.xi.1974; 1 ♂, Murshidabad, Tikatuli, 9.xi.1974; 1 ♂, Murshidabad, C.S.F.S.Campus, 5.xi.1974; 1 ♂, Murshidabad, Beldanga, 5.xi.1974; 1 ♂, Midnapore, Digha Mohana, 30.xi.1974; 3 ♂ ♂, Midnapore, Salboni, 20.xi.1974; 4 ♂ ♂, Midnapore, Arabari Forest, 26.xi.1974; 1 ♂, Murshidabad; Hajarduari, 4.xi.1974; 1 ♂, Murshidabad, Golapbagh, 4.xi.1974; 1 ♂, Nadia, Hijli Forest (Panaghat), 3.viii.1974; 1 ♂ 24-Parganas, Dudranagar (Sagar Island), 24.xii.1975; 2 ♂ ♂, 24-Parganas, Bamankhali, 24.iii.1975; 1 ♂, 24-Parganas, Diamond Harbour, 25.iii.1975; 1 ♂, 24-Parganas, Kakdwip, 25.iii.1975; 3 ♂ ♂, Calcutta, Zoo Garden, 21.iii.1975; 2 ♂ ♂, Calcutta, Zoo Garden, 11.iii.1975; 1 ♂, Calcutta, Zoo Garden, 3.iii.1975; 1 ♂, Calcutta, Zoo-Garden, 1.iv.1975; 1 ♂, Calcutta, Eden Garden, 1 ♂, 24-Parganas, Brace Bridge, 22.xii.1974; 1 ♂, Howrah, Botanical Garden, 30.viii.1975.

Female : Body length 7-12 mm. // Plate XX Figs.1-4 //

Head : Width of frons almost equal to that of eye; frontal bristles 11-12; 2 proclinate fronto-orbital bristles present; outer vertical bristle well developed, about three-fifths the width of inner eye.

Thorax : Thorax similar to that of male but for the absence of apicoscutellar bristles.

Wing : Same as in the male.

Legs : Chaetotaxy same as in male but for the following differences : Mid femur without hairs on the basal part of postero-ventral surface at about one-third the distance from the distal end; hind femur with one row of bristles on anterodorsal surface and 2-3 long bristles hairs on posterior margin of ventral surface; hind tibia with 2 bristles on anteroventral surface at about one-third the distance from the distal end but without long hairs on the anterior and posterior margins of ventral surface.

Abdomen : 2nd, 3rd and 6th sternites each with 4 and 4th and 5th each with 2 long bristles; 6th sternites broader than each of the preceeding segments; 7th with hairs and with a row of stout marginal bristles; 8th bare, membranous, slightly concave; anal sternite with short hairs; 7th tergite with long bristles; spermatheca 3, distal half of each oval, the basal half with transverse striations.

Specimens examined : Specimens were collected in copula by the author.

1 ♂, 1 ♀, Purulia, Ajodhya Forest, 24.iv.1974; 1 ♂, 1 ♀, Darjeeling, Kalimpong, 24.iv.1975; 1 ♂, 1 ♀, Bankura, Susunia Forest, 21.xi.1974; 1 ♂, 1 ♀, Nadia, Banaghat, 3.viii.1974; 1 ♂, 1 ♀, Bankura, Bishnupur, 24.xi.1975; 1 ♂, 1 ♀, Birbhum, Kachujur, 8.xi.1974; 1 ♂, 1 ♀, Jalpaiguri, Falakata, 20.x.1974; 1 ♂, 1 ♀, Bankura, Bhatpur, 20.xi.1974; 1 ♂, 1 ♀, Purulia, Matha Forest, 15.xi.1974.

Distribution : India: Uttar Pradesh: Dehra Dun, Allahabad; Haryana: Ambala; Gujarat: Sidapur; Maharastra: Bombay; Kerala; Calicut; Tamil Nadu : Coimbatore; Bihar : Bhagalpur; Assam : Gauhati; Meghalaya; Shillong, Cherapunji; West Bengal: Calcutta, Howrah, Purulia, Nadia, Murshidabad, Jalpaiguri, Darjeeling, Bankura, Purulia, Midnapore, 24-Parganas, Burdwan; Bismark Island; Phillipine Islands; Nepal; Europe; North China; Poland; Tong-King; Formosa; Sumatra; Java; Lombak; New Guinea; Japan: Hokkaido, Honshu, Shikoku, Kyushu, Amami Islands, Ryukyu Islands and Korea.

Bionomics : This species can be bred from human excrement, dead rabbit, animal carcases and garbage. Senior-White et al (1940) recorded it as parasitic on Nonagria sp.

Parasarcophaga (s.str.) orchidea (Böettcher,1913)

// Plate XXI, Figs. 1-6 //

Sarcophaga orchidea Böettcher, 1913, Ann. Hist. Mus. Nat. Hung., 11:371

Sarcophaga brunneopalpis Johnston and Tiegs, 1922, Proc. Roy. Soc. Qudl., 34 : 184; Lopes, 1958, Ins. Micron., 13(2) : 38, Syn.

Sarcophaga hirtipes var. orchidea (Böettcher), Senior-White, 1924, Rec. Ind. Mus., 26(3) : 239.

Sarcophaga noumea Curran, 1934, Am. Mus. Novit., 727 : 11; Lopes, 1958, Ins. Micron., 13(2) : 38, Syn.

Parasarcophaga orchidea (Böettcher), Kano, Field and Shinonaga, 1967, Fauna Japonica, Sarcophagidae, p. 43.

Parasarcophaga (s.str.) orchidea (Böettcher), Rohdendorf, 1937, Faune de l' URSS, 19(1) : 203; Lopes, 1967, Ent. Meddl., 35 : 170.

Male : Body length 9-14 mm.

Head : Width of frons about half that of eye; frontal vitta black, its width at narrowest point about two times that of parafrontal; parafrontal and parafacil black, with silvery pollen, the latter with irregularly scattered hairs near the eye margin. Antennae dark brown, reaching to about 0.7 the distance to vibrissae; 1st segment black; 2nd brown; 3rd brown, its length two and a half times that of the 2nd; arista long, plumose on basal three-fifths; facial ridge light brown, silvery pollinosity, with short black spines in the lower half; vibrissae long, crossed, distance between vibrissae less than parafacial width; frontal bristles 12, arranged in a row on parafrontal, upper 2 reclinate, lower 3 below base of 2nd antennal segment, the rest directed forwards; gena black, silvery pollinosity, with short black hairs on anterior half; postgena black, with white hairs; ocellar triangle black, with many divergent black hairs. Outer vertical absent; inner one well developed; postvertical shorter than the inner vertical; ocellar and postocellar bristles short; one row of postocular setae present; the rest of the area with irregular black and white hairs; palpi slender, brown; proboscis black.

Thorax : Grey, with silvery pollen and three black longitudinal stripes; ac 0 + 1; dc 5 + 5 (posterior one stout); ia 1 + 3; ps 1; h 3; ph 2; np 4; pa 2; sa 4; mpl 6; hpl 8; prostigmatic and propleural bristles well developed and accompanied by short hairs; upper part of propleura bare, white pollinosity; protheracic spiracle with dense brown pile; metathoracic spiracle chocolate coloured; apicoscutellar and discoscutellar bristles 1 pair each; lateroscutellar bristles 2 pairs.

Wing : Hyaline with brown veins; R_1 bare; R_{4+5} with a row of about 7 setae located dorsally and extending to half the distance from the basal node to r-m; several setae present on ventral surface of R_{4+5}; fifth sector of costa shorter than the third, the former with short spines along its basal half; costal spines stout; basicostal scale light brown; epaulet black, with short spines; squama whitish; haltere brown.

Legs : Black; fore femur with two rows of bristles on posterodorsal surface and a row of long bristles on posterior margin of ventral surface; fore tibia with 3 bristles on the basal part of anterodorsal surface, 1 on the posteroventral surface at about one-third the distance from the distal end and a row of short bristles on the posterodorsal surface; mid femur with 3-4 short bristles along the middle portion of anterolateral surface, a row of short setae on the distal half of anteroventral and posteroventral surfaces, 2 bristles each on the distal part of posterodorsal and posterolateral surfaces and a row of long hairs on the basal half of posteroventral surface; mid tibia with

2 long and a row of short bristles on the posterodorsal surface, 2 bristles on middle portion of anterolateral surface and 1 bristle each on the anteroventral and posteroventral surfaces at about one-third the distance from the distal end; hind femur with 2 rows of bristles on the anterodorsal surface, a row on the anteroventral surface, 2 bristles on the distal part of posterodorsal surface and numerous long hairs on the ventral surface; hind tibia with 2 long and a row of short bristles on the anterodorsal surface, 2 bristles on the posterodorsal surface, 2 bristles on the anteroventral surface and numerous long hairs on the posterior margin of ventral surface at about two-thirds the distance from the distal end.

Abdomen : Black and silvery checkered pattern; 2nd and 3rd abdominal tergites without median marginal bristles but with well developed lateral marginal bristles; 4th with a pair of well developed median and several pairs of lateral marginal bristles; 5th with a row of about 16-18 marginal bristles; sternites 1st and 2nd with dense erect hairs; 3rd and 4th with short hairs; 5th Y-shaped with divergent arms, each arm with a few short spines laterally and short hairs at the distal end; 1st genital tergite brown, with short hairs; 2nd blackish-brown with short hairs but without any marginal bristles; inner forceps long and with a tuft of long hairs on basal half; outer one triangular, with short hairs only on distal end; anterior paramere long, pointed and curved at apex, without hairs; posterior one short, blunt at apex, with short hairs anteriorly; theca and paraphallus almost of same size, the latter slightly longer; apical plate of paraphallus short; styli of glans short; ventralia of penis with stalked lobes.

All the specimens under "specimens examined" were collected by the author from West Bengal.

Specimens examined : 4 ♂♂, Calcutta, Eden Garden, 3.viii.1975; 5 ♂♂, Calcutta, Eden Garden, 25.vii.1975; 1 ♂, 24-Parganas, Budge Budge, 20.vii.1975; 1 ♂, 24-Parganas, Baruipur, 22.vii.1975; 1 ♂, Calcutta, Zoo-Garden, 6.iii.1974; 1 ♂, Calcutta, Zoo-Garden, 7.viii.1975; 1 ♂ 24-Parganas, Patneswarpur, 25.iii.1975; 4 ♂♂, 24-Parganas, Bamankhali (Sagar Island), 24.iii.1975; 1 ♂, 24-Parganas, Pudranagar (Sagar Island), 24.ii.1975, 2 ♂♂, 24-Parganas, Kakdwip, 25.iii.1975; 6 ♂♂, 24-Parganas, Lakshmikantapur, 24.vii.1974; 4 ♂♂, Hooghly, Tarakeswar, 21.ix.1974; 1 ♂, Birbhum, Suri D.F.Campus, 11.x.1974; 8 ♂♂, Birbhum, Chandrapur Forest, 10.xi.1974; 4 ♂♂, Birbhum, Kenduah, 9.xi.1974; 2 ♂♂, Birbhum, Charicha Forest, 11.xi.1974; 2 ♂♂, Midnapore, Digha Mohana, 30.xi.1974; 1 ♂, Midnapore, Salboni, 29.xi.1974; 16 ♂♂, Midnapore, Arabari Forest, 26.xi.1974; 1 ♂, Midnapore, Chandrakhona Road, 27.xi.1974; 1 ♂, Jalpaiguri, Falakata, 2.v.1975; 2 ♂♂, Jalpaiguri, Falakata, 11.x.1974; 2 ♂♂, Jalpaiguri, Chilapata Forest, 25.iv.1975; 1 ♂, Jalpaiguri, Joyanti Forest, 20.v.1974; 3 ♂♂, Jalpaiguri, Pajabhatkhowa Forest, 28.iv.1975; 2 ♂♂, Jalpaiguri, Chalsa, 1.v.1975; 2 ♂♂, Jalpaiguri, Madarihat, 27.iv.1975; 1 ♂, Darjeeling, N.B.U.Campus, 23.iv.1975; 1 ♂, Darjeeling, Tokariajhar Forest (Nakalbari), 23.iv.1975; 2 ♂♂, Coochbehar, Patlakhawa Forest, 23.iv.1975; 4 ♂♂, Nadia, Ranaghat, 3.viii.1974; 1 ♂, Malda, Gour, 10.viii.1974; 2 ♂♂, Bankura, Susunia Forest, 21.xi.1974; 1 ♂, Bankura, Bishnupur, 24.xi.1974; 5 ♂♂, Bankura, Joypur Forest, 23.xi.1974; 13 ♂♂, Bankura, Bhatpur, 20.xi. 1974; 2 ♂♂, Purulia, Sahebbundh, 21.xi.1974; 10 ♂♂, Purulia,

Sashankali, 14.xi.1974; 3 ♂♂, Purulia, Ketka, 14.xi.1974; 1 ♂, Purulia, Ketka, 14.xi.1974; 1 ♂, Purulia, Latapara, 17.xi.1974; 3 ♂♂, Purulia, Matha Forest, 15.xi.1974; 4 ♂♂, Purulia, Digha Forest, 17.xi.1974; 2 ♂♂, Purulia, Burdwan, 17.xi.1974; 4 ♂♂, Purulia, Ajodhya Forest, 15.xi.1974; 8 ♂♂, Murshidabad, C.S.P.S.Campus, 3.xi.1974; 2 ♂♂, Murshidabad, Hazarduari, 4.xi.1974; 1 ♂, Murshidabad, Golapbagh, 4.xi.1974; 3 ♂♂, Murshidabad, Beldanga, 5.xi.1974; 3 ♂♂, Howrah, Sankrail, 30.iii.1975; 1 ♂, Malda, Gour, 10.v.1975.

Female : Body length 8-12 mm // Plate XXII, Figs. 1-4 //

Head : Width of frons almost equal to that of eye; frontal bristles 10; 2 preclimate frontoorbital bristles present; outer vertical bristles well developed, four-fifths the inner one.

Thorax : Similar to that of male but for the presence of 3 pairs of and the absence of apicoscutellar bristles.

Wing : Same as in male.

Legs : Chaetotaxy same as in male but for the following difference Mid femur without hairs on basal part of posteroventral surface; mid tibia with one additional bristle on the anteroventral surface at about one-third the distance from the distal end; hind femur with 1 bristle on anterodorsal surface; hind tibia without long hairs on the posterior margin of ventral surface.

Abdomen : 2nd, 3rd and 5th sternites with 4, 4th with 4 and 6th with a row of 6, long bristles; 6th sternites broader than each of the preceeding one; 7th with short marginal bristles and hairs. 8th membranous, without hairs; anal sternite with short hairs; 7th stergite with two plates, with bristles; spermatheca 3, ♀ distal half a little shorter than the distal half, the former with a few transverse striations.

All the specimens under "specimens examined" were collected in copula by the author from West Bengal.

Specimens examined : 1 ♂, 1 ♀, Jalpaiguri, Pajabhatkhawa, 28.iv.1975; 1 ♂, and 1 ♀, 24-Parganas, Lakshmikantapur, 24.viii.1974; 1 ♂ and 1 ♀, 24-Parganas, Baruipur, 22.viii.1974, coll. B.C.Nandi; 1 ♂ and 1 ♀, 24-Parganas, Canning, 13.viii.1974, coll. B. C. Nandi.

Distribution : India : W Darjeeling, Midnapore, Hooghly, Birbhum, Bankura, Purulia, Murshidabad, Nadia, Bandel, Majerhat, Jalpaiguri; Maharashtra : Bombay, Parel; Karnatak; Mangalore, Bihar; Pusa; Assam : Gauhati; Andaman Islands : Port Blair; Malaya; Java; Sumatra, Burma; Ceylon; Formosa, Philippines, China; U.S.S.R.; Japan : Amami Islands, Ryukyu Islands; Australia; Lombak; New Guinea; Pago, Samoa; New Hebrides Manus Islands; New Caledonia; Caroline Islands; Mariana Islands; Palau; Bismark; Nepal.

Bionomics : The larvae of this species breed on dead animals, human faeces in nature and can be reared in the laboratory in such media. According to Senior-White et al.(1940) it has been recorded from cases of human intestnal myiasis. Experimentally it has been reared from dead Achatina fulica.

Subgenus : Liopygia Enderlein, 1928

Type-species : Musca ruficornis Fabricius, 1794.

Liopygia Enderlein, 1928, Arch. Klass. Phyl. Ent., 1 : 13.

Jantia Rohdendorf, 1937, Faune de l' URSS., 19(1) : 451; Zumpt. 1972, Explor. Prac. natn. Virunga, 101 : 44, Syn.

Sclerophalla Rohdendorf, 1963, Stuttg. Beitr. Naturk., 124 : 9; Zumpt 1972, Explor. Prac. natn. Virunga, 101 : 44, Syn.

Subgeneric characters : Antennae and palpi red; propleura bare or setose; lateral plate of paraphallus relatively short; ventralia short, its proximal end knob-like; styli of glans not stout; apical plate of paraphallus well developed, in most cases terminating in a pair of processes; cerci without spines.

Only one species of this subgenus has been reported from the Oriental region which is also found in West Bengal, India.

Parasarcophaga (Liopygia) ruficornis (Fabricius, 1794)

// Plate XXIII, Figs. 1-6 //

Musca ruficornis Fabricius, 1794, Ent. Syst., 4 : 314

Sarcophaga ruficornis (Fabricius), Wiedemann, 1830, Aussereur. Zweifl. Ins., 2 : 358.

Sarcophaga muspratti Zumpt, 1950, Proc. R. ent. Soc., London, (B) 19 : 165; Zumpt, 1964, Verh. naturf. Ges. Basel., 75 : 77, Syn.

Liopygia ruficornis (Fabricius), Enderlein, 1928, Arch. Klass. Phyl. Ent., 1 : 41.

Parasarcophaga ruficornis (Fabricius), Kano, Field and Shinonaga, 1967, Fauna Japonica, Sarcophagidae, p. 73.

Parasarcophaga (Jantia) ruficornis (Fabricius), Lopes, 1958 Ins. Micron., 13(2) : 48.

Sarcophaga (Parasarcophaga) ruficornis (Fabricius), Hardy, 1943, Proc. Linn. Soc. N.S.W., 68 : 29

Sarcophaga (Liopygia) ruficornis (Fabricius), Zumpt, 1972, Explor. Prac. natn. Virunga, 101 : 176.

Parasarcophaga (Liopygia) ruficornis (Fabricius), Pohdendorf, 1963, Stuttg. Beitr. Naturk., 124 : 9.

Male : Body length 7-13 mm.

Head : Width of frons about two fifths that of eye; frontal vitta black, slightly diverging below, its width at narrowest point more than two times that of parafrontal; parafrontal and parafacial black, with golden pollen, the former with numerous irregularly scattered short black hairs, the latter with a row of about 7-8 long black hairs below the eye margin. Antennae orange, reaching about 0.8 the distance to vibrissae; 1st and 2nd segments black, with short black hairs; 3rd segment reddish-brown, its length two and a half times that of the 2nd; arista long and plumose on basal half; vibrissae long, crossed, distance between vibrissae about twice that of parafacial width; facial ridge light brown, bare; gena black with silvery pollen and numerous yellowish-white hairs; postgena black, with long white hairs; frontal bristles 12, arranged in a row on parafrontal, lower 3 below base of

antennae and reaching to about the level of half the length of 2nd antennal segment, upper 2 reclinate, the remaining ones directed inwards; ocellar triangle black, with six pairs of long proclinate, divergent black hairs. Outer vertical bristle short; inner one well developed, the former a little more than half the inner one; postvertical and postocellar well developed, each about two-thirds the inner vertical; postocular cilia present besides two rows of postocular setae of which the 1st row is regular while the 2nd is with irregular black hairs in between; palpi slender and brown; probescis brownish-black.

Thorax : Black, silvery pollinose, with three longitudinal black stripes; ac 0 + 1; dc 6 + 6 (posterior two well developed) ia 1 + 3; pa 1; h 3; ph 2; sa 3; pa 2; st ♂ +1 +1; mpl 4; hpl 9; upper part of propleura bare, black, with white pollen; prostigmatic and propleural bristles well developed and accompanied by short black hairs; apicoscutellar and discoscutellar bristles short, 1 pair each, the former cruciate; lateroscutellar bristles 2 pairs; pro- and metathoracic spiracles brown.

Wing : Hyaline with brown veins; R_1 bare; R_{4+5} with about 10 short setae dorsally and extending to more than half the distance from the basal node to r-m, about 4 short setae present on ventral surface of R_{4+5}; third section of costa about two times the fifth, the latter with short spines along its basal half on anterior margin; basicostal scale light brown; costal spines not stout; epaulet black, with 2 lon and many short black spines; squama whitish; haltere brown.

Legs : Black; fore femur with two rows of long bristles on posterodorsal surface and a row of bristles on the posterior margin of ventral surface; fore tibia with 2 or 3 bristles on the basal half of anterodorsal surface and 1 bristle on the posterolateral surface at about one-third the distance from distal end; mid femur with 3 bristles along the middle portion of anterodorsal surface, 1 bristle on posterodorsal and 2 bristles on posterolateral surfaces distally, a row of bristles on posteroventral surface on basal half, several bristles on anterior margin on basal half, a row of short setae on anterior and posterior margins on distal half and short hairs in the middle, of ventral surface; mid tibia with a row of short bristles on posterodorsal surface, 1 bristle on anterodorsal surface at about one-third the distance from the distal end, and 1 bristle each on posterolateral and anteroventral surfaces at about one-fourth the distance from the distal end; hind femur with two rows of bristles on anterodorsal surface, a row on posteroventral surface and 1 bristle each on distal part of dorsal and posterodorsal surfaces; hind tibia with 2 bristles on posterodorsal surface, 3 long and a row of short bristles on anterodorsal surface and 1 bristle (in some cases 2) on anteroventral surface at about one-fourth the distance from the distal end besides short hairs on anterior and posterior margins on ventral surface.

Abdomen : Black and silvery checkered pattern; 2nd and 3rd abdominal tergites without median but each with one pair of well developed lateral marginal bristles; 4th with a pair of well developed median and three pairs of lateral marginal bristles; 5th with a row of

about 20 marginal bristles; 1st five sternites with black hairs but without any differentiated bristles; 2nd genital tergite orange, with black hairs but without marginal bristles; 5th sternite V-shaped with spines at the side on each arm and long hairs at the distal end; outer forceps somewhat oval, with hairs only on distal half; inner forceps densely covered with long hairs, bare at apex, ending in an acute point at apex; anterior paramere bent, pointed at apex, with short hairs on posterior side; posterior one curved and pointed at apex; styli of glans greatly developed, divided into a pointed membranous portion and another area having a rosette-like structure; theca and paraphallus sclerotised, the former is shorter than the latter; ventralia bulbous, much sclerotised at apex, with a long stalk and a subbasal spinous portion; apical plate of paraphallus not sclerotised, composed of two plates of which one is with a backwardly projecting spine.

Specimens examined : 1 ♂, West Bengal : 24-Parganas, Bamankhali, (Sagar Island), 25.iii.1975, coll. B.C.Nandi; 1 ♂, 24-Parganas, Rudranagar (Sagar Island), 24.iii.1975, coll. B.C.Nandi; 1 ♂, Bankura, Panchbagha, 22.xi.1974, coll. B.C.Nandi; 1 ♂, Calcutta, Zoo-Garden, 2.i.1974, coll. B.C.Nandi; 1 ♂, Darjeeling, Kalimpong Hospital Campus, 21.iv.1975, coll. B.C.Nandi; 1 ♂, Darjeeling, Bijanbari, 18.iv.1975, coll. B.C.Nandi; 1 ♂, Calcutta, Z.S.I. office, 12.xii.1974, coll. B.C.Nandi.

Female : Body length 8-12 mm // Plate XXIV, Figs. 1-4 //

Head : Width of frons nearly equal to that of eye; frontal bristles 8-9; fronto-orbital bristles 2, proclinate; outer vertical bristle moderately developed, about three-fifths the inner one.

Thorax : Similar to that of male but for the absence of apico-scutellar bristles.

Wing : Same as in male.

Legs : Chaetotaxy same as in male but for the following differences : Mid tibia with three bristles medially on antero-dorsal surface and 2 bristles on the anteroventral surface along about half the distance from the distal end; hind femur with 1 row of bristles on anterodorsal surface; hind tibia with hairs on anterior and posterior margins of ventral surface.

Abdomen : 2nd and 3rd sternites with 4 bristles each; 4th and 5th with 6 bristles each; 6th with a row of about 10 bristles; 7th deeply concave with short bristly hairs on distal end; 8th sternite membranous, without any hairs, concave on distal end; tergite 7 entire, with stout marginal bristles and hairs; spermatheca 3, long, proximal and distal sections equal in length, the former with numerous and the latter with a few striations.

Described from 8 ♀ ♀ specimens reared in the laboratory.

Distribution : India : West Bengal : Calcutta, Canning, 24-Parganas, Bankura, Darjeeling; Uttar Pradesh : Dehra Dun; Haryana: Ambala; Gujarat : Surat; Maharashtra : Nagpur; Tamil Nadu : Madras, Coimbatore; Andhra Pradesh : Waltair; Orissa : Cuttack, Barkuda Island;

Bihar : Purnea, Pusa; Sri Lanka; Malaya; Philippine Islands; China : Taiwan, Hong Kong; North East Africa; Secrota Island; Chagos Archipelago and Madagascar.

Bionomics : Castellani and Chalmers (1919) reported that the species occasionally causes dermal myasis in animals in India, Sinton (1921) recorded a case of tissue myiasis behind the ear of a dog caused by this species. James (1947) reported a case of intestinal myasis in man caused by it. Houdemer (1936) reported the presence of larvae of this species in the hoof-wounds of horses and mules. Zumpt (1965) mentioned that it produces facultative myiasis. Greenburg (1971) recorded its association with Dirhinus pachycerus.

This species has been bred on dead grasshoppers, snakes, rabbits, squirrels and rats and it has also been reared experimentally on dead Achatina fulica (Senior-White et al. 1940).

The present author reared this species from meat.

Subgenus Curranea Rohdendorf, 1937

Type-species : Sarcophaga tibialis Macquart, 1850

Curranea Rohdendorf, 1937, Faune de l' URSS, 19(1) : 255, 452.

Batissophalla Rohdendorf, 1963, Stuttg. Beitr. Naturk; 124 : 6, Zumpt, 1972, Explor. Prac. natn. Virunga, 101 : 43, Syn.

Subgeneric characters : Basal part of paraphallus long; apical part more or less reduced or short or plate-like; lateral plate of paraphallus with a short process; ventralia long, thorn-shaped or hook like; styli of glans long and rod-shaped; cerci without spines; anal tergite red.

It is a very little known subgenus. Only one species is known from the Oriental region. This subgenus was not hitherto reported from India. One new species is described here and scoopariformis (Senior-White) being reported for the first time from India.

Key to the male species of the subgenus Curranea from India

1. Ventralia hook-shaped; apical plate of paraphallus ending in three processes; lateral plate of paraphallus bifurcated
... kalimpongensis, sp.nov.

Ventralia horn-shaped; apical plate of paraphallus ending in two long, pointed processes; lateral plate of paraphallus not bifurcated
.... scoopariformis (Senior-White

Parasarcophaga (Curranea) kalimpongensis, sp. nov.

// Plate XXV, Figs. 1-4 //

Male : Body length 10 mm.

Head : Width of frons about two-fifths that of eye; frontal vitta black, its width at narrowest point about two times that of parafrontal; parafrontal and parafacial black, with golden pollen, the former with numerous scattered short black hairs and the latter with a row of long black hairs, near the eye margin, of which the lowermost 5 are longer than the rest. Antennae black, reaching to about 0.9 the distance to vibrissae; 1st and 2nd segments deeply black with black hairs; 3rd segment black, with black pollen, length two and a half times that of the 2nd; arista long and plumose on basal three-fifths; facial ridge black, with golden pollen and short black spines in the vibrissal half; vibrissae long, crossed, distance between vibrissae about half the parafacial width; frontal bristles 9, arranged in a row on parafrontal, upper 2 reclinate, lower 3 below base of antennae and reaching to about the level of half the length of 2nd antennal segment, the rest directed forwards; ocellar triangle black, with proclinate short, black hairs. Outer vertical short; inner one well developed, about three times the outer one; postvertical short; only one pair of ocellar well developed; postocellar present; besides post-ocular cilia two rows of postocular setae present of which the lst row is regular and 2nd row is irregular with intermittent black and white hairs, the rest of the area with long brownish hairs; palpi slender, black; proboscis black.

Thorax : Blackish with three black longitudinal stripes; ac 0 + 1; dc 5 +5 (posterior two post dc well developed); ia 1 + 3; pg 1; h 3; ph 2; np 4; sa 3; pa 2; st 1 +1 +1; mpl 6; hpl 9; upper part of propleura bare, black; prostigmatic and propleural bristles well developed and accompanied by short, black hairs; apicoscutellar and

discoscutellar bristles 1 pair each; lateroscutellar bristles 2 pairs, well developed; pro- and metathoracic spiracles brown.

Wing : Hyaline with black veins; R_1 bare; R_{4+5} with a row of short setae located dorsally and extending to two-thirds the distance from the basal node to r-m and several short setae on ventral surface of R_{4+5}; fifth costal sector equal to the third, the former with short spines along its basal two-thirds in the anterior margin; costal spine stout; epaulet black, with many long and short spines; basicostal scale yellowish; squama white; haltere brown.

Legs : Wholly black; fore femur with two rows of long bristles on posterodorsal surface and a row of bristles on posterior margin of ventral surface; fore tibia with 2 short bristles on the basal one-third of anterodorsal surface and 1 bristle on posterodorsal surface at about one-third the distance from the distal end; mid femur with 3 bristles along the middle portion of anterolateral surface, 1 bristle on posterodorsal surface and 1 on posterolateral surface distally, a row of bristles on basal half of posteroventral surface, 3 bristles on basal half of ventral surface and a row of bristles on distal half on anterior margin of ventral surface; mid tibia with 3 long and a row of short bristles on posterodorsal surface and 1 bristle each on anterodorsal and posterolateral surfaces at about one-third the distance from the distal end; hind femur with two rows of bristles on anterodorsal surface (2nd row short), a row on anteroventral surface and 1 bristle each on distal part of dorsal and posterodorsal surfaces; hind femur

without tuft of hair but with 2 long bristles on posterodorsal surface, a row of 3 long and several short bristles on anterodorsal surface and 1 bristle on anteroventral surface a about one-fourth the distance from the distal end.

Abdomen : Black and silvery checkered pattern; 2nd abdominal tergite without and 3rd with median marginal bristles; 4th with a pair of median and 3 pairs of lateral marginal bristles; 5th with a row of about 18 marginal bristles; sternites 1st to 5th with short hairs but without marginal bristles; outer forceps almost straight, slightly curved at apex, with hairs arranged almost up to the tip; inner one triangular, with hairs on distal half; anterior paramere curved, with fine hairs on distal end; posterior one curved, with 2 hairs on anterior side; theca shorter than paraphallus, both heavily sclerotised; apical plate of paraphallus long, curved, with 1 median and 3 lateral apical processes, median one blunt at apex, anterior one of lateral processes blunt and almost equal in length to median, posterior two of lateral processes less sclerotised, elongated, 1st one blunt at end and curved backwards, the last one pointed and directed anteriorly; lateral plate of paraphallus short, chitineus and with two pointed processes; styli of glans short, without serrations; ventralia almost membranous, with a hook-like process which is curved backwards apically, the basal process pointed and short.

Holotype : ♂, West Bengal : Darjeeling, Kalimpong, 21.iv.1975, coll. B. C. Nandi.

Discussion : This species closely resembles C.scoparifermis (Senior-White) but differs in the structure of apical and lateral plates of paraphallus and also in the details of the structure of ventralia.

Distribution : India : West Bengal : Darjeeling, Kalimpong.

Parasarcophaga (Curranea) scoparifermis (Senior-White,1927)

// Plate XXVI, Figs. 1-5 //

Sarcophaga dux Thomson var. scoparifermis Senior-White, 1927 Spolia Zeylan, 14 : 82.

Sarcophaga idmais Seguy, 1933, Encycl. ent., (B)2, 7 : 24; Senior-White et al. Fauna British India, Diptera, 6:269,Syn.

Sarcophaga pingiana Hsieh, 1958, Acta ent. Sin., 8(1) : 80; Fan, 1965, Key to common synanthropic flies in China, P. 276, Syn.

Parasarcophaga (Curranea) scoparifermis (Senior-White), Fan,1965 Key to common synanthropic flies in China, p. 276.

Male : Body length 8-10 mm.

Head : Width of frons about two-fifths that of eye; frontal vitta black, its width at narrowest point of front about two times that of parafrontal; parafrontal and parafacial black, with golden pollen, the former with numerous scattered black hairs, the latter with a row of about 4-5 blackish-brown hairs below the eye margin. Antennae blackish-brown, reaching to about 0.85 the distance to vibrissae; 1st and 2nd segments with numerous black hairs, black but tip of the 2nd segment slightly brown;

3rd segment brown, with silvery pollen, its length about three times that of the 2nd; arista long and plumose on basal three-fifths; facial ridge black, bare, with silvery to golden pollen; vibrissae long, crossed, distance between vibrissae about two times that of parafacial width; frontal bristles 10, arranged in a row on parafrontal upper two reclinate, lower three below base of antennae and reaching to about the level of half the length of 2nd antennal segment, the rest decussate and directed forwards; gena and postgena black, with short black hairs; ocellar triangle brownish-black, with five pairs of anteriorly directed, short, divergent black hairs. Outer vertical bristles well developed; inner one about two times the outer one; post-vertical short, shorter than inner vertical; 1 pair of ocellar well developed; two rows of postocular setae present besides postocular cilia; 1st row black and regular, 2nd row irregular with intermittant hairs, the rest of the area with brownish hairs; palpi slender, black; probescis brownish black.

Thorax : Brownish-black with three, black longitudinal stripes; ac 0 +1; dc 6 +6 (posterior two post dc well developed); ia 1 +3; pa 1; h 3; ph 2; np 4; sa 3; pa 2; st 1 +1 +1; mpl 6; bpl 8; upper part of propleura bare, black, white pollinosity; prostigmatic and propleural bristles well developed and accompanied by short hairs; apicoscutellar and discoscutellar bristles 1 pair each, the former cruciate; latero-scutellar bristles 2 pairs, well developed; pro- and mesothoracic spiracles brown.

Wing : Hyaline, with brown veins; R_1 bare; R_{4+5} with a row of short setae located dorsally and extending to more than half the distance from the basal node to r-m; several setae present on ventral surface of R_{4+5}; fifth sector of costa shorter than the third, the former with short spines along basal three-fifths of its length on anterior margin; costal spine stout; epaulet black, with two long and several short black spines; basicostal scale yellowish; squama white; haltere brown.

Legs : Wholly black; fore femur with two rows of long bristles on posterodorsal surfaces and a row on posterior margin of ventral surface; fore tibia with 3 short bristles on the basal one-third of anterodorsal surface and 1 bristle on posterolateral surface at about one-third the distance ffom the distal end; mid femur with 4 bristles along the middle portion of anterolateral, 1 bristle on posterodorsal and 1 on posterolateral surfaces distally, a row of bristles on distal half and long hairs on basal half of posteroventral surface, 3 bristles on basal half and a row of short setae on distal half on anterior margin of ventral surface; mid tibia with 1 bristle on posterodorsal surface at about one-third the distance from the distal end, 3 bristles on posterolateral surface, 3 bristles along middle portion of anterolateral surface and 1 bristle on distal one-third of anteroventral surface; hind femur with two rows of bristles on anterodorsal surface, a row of bristles each on anteroventral and posteroventral surfaces and 1 bristle each on distal part of dorsal and posterodorsal surfaces; hind tibia without tuft of hairs but with 2 bristles on posterodorsal surface, a

row of 3 long and several short bristles on anterodorsal surface and 1 bristles on anteroventral surface at about one-fourth the distance from distal end.

Abdomen : Black and silvery checkered pattern; 2nd and 3rd abdominal tergites without median but the former with one pair of lateral marginal bristles; 4th with a pair of median and two pairs of lateral marginal bristles; 5th with a row of about 20 marginal bristles; sternites 1st to 4th with short hairs but without bristles; 5th Y-shaped, with stout spines at the sides on each arm and with short hairs on distal end; 1st genital tergite reddish-brown, with brown hairs; 2nd black, with black hairs; inner forceps pointed, with hairs on its basal two-thirds; outer forceps somewhat triangular, with hairs on distal end; anterior paramere curved at apex, without hairs; posterior paramere with two short hairs on distal end; theca shorter than paraphallus, both sclerotised; apical plate of paraphallus curved and bifurcated, with a short basal apophysis; lateral plate of paraphallus with a curved and pointed apex, not well sclerotised; styli of glans short, serrated anteriorly; ventralia somewhat membranous, with two curved, elongated processes.

Specimens examined : 1 ♂, West Bengal : Howrah, Sankrail, 30.iii. 1975, coll.B.C.Nandi; 3 ♂♂, 24-Parganas, Diamond Harbour, 25.iii.1975, coll. B.C.Nandi; 1 ♂, 24-Parganas, Rudranagar, 24.iii.1975, coll.B.C.Nandi; 2 ♂♂, Malda, Gour, 10.v.1975, coll. B.C.Nandi.

This species is being recorded for the first time from India.

Distribution : India : West Bengal : Howrah, 24-Parganas, Malda, Sri Lanka; Matafe; China: Chekiang; Kauling; Hainan Island.

Bionomics : Not known. The present specimens were collected from bush-sweepings near the human excreta.

Subgenus : Pandelleisca Rohdendorf, 1937

Type-species : Sarcophaga similis Pandellé, 1896

Pandelleisca Rohdendorf, 1937. Faune de l' URSS., 10(1) : 238,451.

Subgeneric characters : Apical plate of paraphallus well developed, widened in the middle and with one or two pairs of very long, slender lateral appphyses; basal part of paraphallus very long and slender; lateral plates of paraphallus long and pointed, two pairs; styli of glans thin and long; ventralia mostly filamentous; genital tergite without marginal bristles; anal tergite black.

This subgenus is widely distributed in the Palaearctic region. Rohdendorf (1965) recorded five species from this region. Only one species has so far been reported from the Oriental region which is also available in West Bengal.

Parasarcophaga (Pandelleisca) bainbriggei (Senior-White, 1925) N. Comb.

// Plate XXVII, Figs. 1-5 //

Sarcophaga bainbriggei Senior-White, 1925, [illegible] Spolia Zeylan. 13 : 212.

Sarcophaga fletcheri Senior-White, 1924, Rec. Ind. Mus., 26(b) : 254 (Preocupied, Senior-White, 1924).

Parasarcophaga (Pandelleisca) bainbriggei (Senior-White) N.Comb.

Male : Body length 7-10 mm.

Head : Width of frons about one-third that of eye; frontal vitta black, with longitudinal striations, slightly diverging below, its width at narrowest point more than twice that of parafrontal; parafrontal and parafacial black, with silvery pollen, the former with short, scattered hairs. Antennae brownish, reaching to about 0.9 the distance to vibrissae; 1st segment brownish-black, with short black hairs; 2nd segment brown, orange at tip, with short black hairs; 3rd segment brown, with silvery pollen, three times the 2nd; arista long and plumose on basal half; facial ridge bare, black (sometimes brown), with silvery pollen; vibrissae long, crossed, distance between vibrissae about one and a half times that of the parafacial width; frontal bristles 11, arranged in a row on parafrontal, upper two reclinate, lower three below base of antennae reaching to about the level of half the length of 2nd antennal segment, the rest directed forwards. Gena black, with grey (sometimes black) hairs; postgena black, with long greyish hairs; ocellar triangle black, silvery pollinosity, with five pairs of diverging, short, black hairs. Outer vertical bristle absent; inner one well developed; postvertical short, about one-third the inner one; ocellar and postocellar moderately developed, equal to post vertical; one row of postocular setae present, rest of the area with black and white hairs; palpi slender, brown; proboscis blackish-brown.

Thorax : Greyish, with three black longitudinal stripes; ac 0-1, dc 5-5 (posterior two stout) : ia 1-3; pa 1; h 3; ph 2; np 4; pa 2, sa 3; st 1 +1 +1; mpl 6, hpl 8; upper part of propleura bare, brownish-black; prostigmatic and propleural bristles well developed and accom-

panied by short black hairs; pro- and metathoracic spiracles brownish, with a white tinge; apicoscutellar and discoscutellar bristles 1 pair each, the former cruciate; lateroscutellar bristles 2 pairs.

Wing : Hyaline, with brown veins; R_1 bare; R_{4+5} with 8 short setae located dorsally and extending to about two-thirds the distance from basal mode to r-m; several setae present on ventral surface of R_{4+5} third section of costa shorter than the fifth, the latter with short spines along its basal two-thirds on anterior margin; costal spines stout; epaulet black, with two long and several short spines; basicostal scale light yellowish; squama whitish; haltere brown.

Legs : Black; fore femur with two rows of long bristles on posterodorsal surface and a row of long bristles on the posterior margin of ventral surface; fore tibia with 3 bristles on the basal part of anterodorsal surface, 1 bristle on the posterolateral surface at about one-third the distance from the distal end and a row of short setae on the posterodorsal surface; mid femur with 3 short bristles on the middle portion of anterolateral surface, a row of short setae on the distal one-third of anteroventral and posteroventral surfaces with a row of bristles on the basal half of the former and 1 bristle each on the distal half of posterodorsal and posterolateral surfaces; hind tibia with 2 bristles on middle portion of anterodorsal surface, 1 bristle on anteroventral surface at about one-third the distance from the distal end, 2 bristles on middle portion of posterodorsal surface and 1 bristle on posterolateral surface at about one-third the distance from the distal end; hind femur with two rows of bristles on anterodorsal

surface, a row of about 5 bristles on the anteroventral surface, a row of bristles on the posteroventral surface, 1 bristle at about one-fifth the distance from the distal end and 2 bristles on distal part of posterodorsal surface and short hairs on basal part of ventral surface; hind tibia with a row of bristles on anterodorsal surface, 2 bristles on the posterodorsal surface, 1 long and 2 short bristles on the anteroventral surface at about half the distance from the distal end and long hairs on ventral surface.

Abdomen : Black, silvery checkered pattern; 2nd and 3rd abdominal tergites without median but the former with two and the latter with one pair of lateral marginal bristles; 4th with 1 pair of median and 4 pairs of lateral marginal bristles; 5th with a row of about 24 marginal bristles 1st sternite with long hairs; 2nd, 3rd and 4th with short hairs but without bristles; 5th sternite cup-shaped, with stout spines at the sides and 2 long bristles on the distal end of each arm; 1st genital tergite black, with long hairs; 2nd brownish, with short hairs but without bristles; inner forceps curved forwards, pointed and with a slight notch at apex and hairs on basal fourth; outer forceps triangular, with hairs; anterior paramere long, curved and pointed at apex; posterior paramere pointed at apex, with 2 short hairs anteriorly; theca shorter than paraphallus, both heavily sclerotised; apical plate of paraphallus sclerotised, long pointed, almost straight at apex, with two slender subbasal membranous processes; lateral plate of paraphallus also chitinised, very long, shovel-shaped; styli of glans long and pointed; ventralia bifurcated at apex.

Specimens examined : 2 ♂ ♂, West Bengal : Birbhum, Bishnupur, 24.xii.1974, coll. B.C.Nandi; 2 ♂ ♂, Birbhum, Suri D.F.O. Campus, 9.xi.1974, coll. B.C.Nandi; 1 ♂, Malda, Gour, 10.v.1975, coll.B.C.Nandi.

Distribution : India : West Bengal : Calcutta, Birbhum, Malda; Tamil Nadu : Madras, Coimbatore; Orissa; Balugaon; Bihar : Pusa.

Bionomics : According to Senior-White et al. (1940) the species has been bred from human excrement.

Subgenus : Liosarcophaga Enderlein, 1928

Type-species : Sarcophaga madeirensis Schiner, 1868.

Liosarcophaga Enderlein, 1928, Arch. Klass. Phyol. Ent., 1 : 18.

Subgeneric characters : Apical plate of paraphallus somewhat sclerotised, with a pair of long lateral apophyses (projections) and a short median posterior process; lateral plate of paraphallus with 1 or 2 lamella-like processes; styli of glans long and thin, rarely thick; genital tergite without bristles; and tergite sometimes red.

This is the largest subgenus of Paraсarcophaga. Rohdendorf (1968) reported 25 species from Eurasia. Four species have so far been reported from India and of which two are available in West Bengal. One new species is also being described here.

Key to the male species of the subgenus Liosarcophaga from West Bengal

1. Lateral apophysis of apical plate of paraphallus long and slender; inner forceps tapering, pointed at apex; ventralia almost blunt ... dux (Thomson)

Lateral apophysis of apical plate of paraphallus short and stout; inner forceps rather wide and beak-shaped at apex; ventralia pointed ... 2

2. Apophysis apically divided into two equal halves; anterior paramere slender, not pointed abruptly ... brevicornis (He)

Apophysis apically divided into two unequal halves; anterior paramere broad, abruptly pointed and beakshaped at apex ... josephi, sp. nov.

Parasarcophaga (Liosarcophaga) dux (Thomson, 1868) N. Comb.

// Plate XXVII, Figs.1-5 //

Sarcophaga dux Thomson, 1868, Kongl. Seven. Frog. Eugen. Resa., P. 534.

Sarcophaga tuberosa Pandellé, 1896, Revue d'entomologie, 15 : 192.

Sarcophaga subtuberosa Parker, 1917, Proc. U.S. natn. Mus., 54 : 89; Lopes, 1958, Ins. Micron., 13(2) : 41, Syn.

Sarcophaga dux luzonensis Parker, 1919, Bull. Brooklyn ent. Soc., 14 : 43.

Sarcophaga ceylonensis Parker, 1923, Ann. Mag. nat. Hist., (9) 11 : 125.

Parasarcophaga (Liosarcophaga) dux (Thomson), N.Comb.

Male : Body length 10-14 mm.

Head : Width of frons about two-fifths that of eye; frontal vitta black, its width at narrowest point more than two times that of parafrontal; parafacial and parafrontal black, golden to silvery pollinosity, the latter with short hairs and the former with a row of about 9 short hairs near the eye margin. Antennae brownish, with silvery pollen, reaching to about 0.8 the distance to vibrissae; 1st and 2nd segments blackish-brown with short setae, tip of the 2nd reddish; 3rd segment brown, its length about two and a half times that of the 2nd; arista long and plumose on basal two-thirds; facial ridge light brown, silvery pollinosity with short scattered setae on one-fifth its length near the vibrissal angle; vibrissae long, cruciate, distance between vibrissae about two times the width of parafacial; frontal bristles 9-10 arranged in a row on parafrontal, upper two reclinate, lower three below base of antennae and reaching to about the level of half the length of 2nd antennal segment, the rest decussate and directed forwards; gena black, with black hairs; postgena black, with silvery hairs; ocellar triangle black, with four pairs of short, proclinate, black, hairs. Outer vertical short; inner one well developed, tree times the outer one; postvertical short, about one-fourth the inner one; ocellar and postocellar moderately developed, the former shorter than the

shortest frontal; endyonen row of postocular cilia developed, the other row irregular with greyish hairs; palpi slender, black; proboscis long, black.

Thorax : Blackish with three black longitudinal stripes; ac 0 +1; dc 5 +5 (posterior two stout); ia 1 +3; pa 1; h 3; ph 2; np 4; pa 2; sa 4; st 1 +1 +1; mpl 6; hpl 9; upper part of propleura bare, with silvery pollen; prestigmatic and propleural bristles well developed and accompanied by short hairs; pre- and metathoracic spiracles brown; apicoscutellar and discoscutellar bristles 1 pair each, the former short and crossed; lateroscutellar bristles two pairs.

Wing : Hyaline with black veins; R_1 bare; R_{4+5} with about 9-10 short setae located dorsally and extending to about two-thirds the distance from the basal node to r-m; several setae present on ventral surface of R_{4+5}; third sector of costa about one and a half times the fifth, the latter with spines along the basal half of anterior margin; costal spines stout; epaulet black, with short black spines; basicostal scale yellowish; squama white; haltere brown.

Legs : Black; fore femur with two rows of bristles on posterodorsal surface and a row of bristles on posterior margin of ventral surface; fore tibia with 3 bristles on the basal one-third of anterodorsal surface and 1 bristle on posterodorsal surface at about one-third the distance from the distal end; mid femur with 4-5 bristles along the middle portion of anterodorsal surface, a row each of short setae on the distal half of

anteroventral and posteroventral surfaces, a row of short bristles on basal half of anteroventral surface, 1 bristle on posterodorsal and 2 on posterolateral surfaces distally and numerous long hairs on the basal half of posteroventral surface; mid tibia with a row of short bristles on posterodorsal surface, 2-3 bristles on anterodorsal surface on the distal half and 1 bristle on the distal one-third of anteroventral and 1 on posteroventral surfaces; hind femur with 2 rows of bristles on anterodorsal surface, a row on anteroventral surface, 2 bristles distally on the posterodorsal and 1 on posterolateral surfaces and numerous short hairs on posterior margin of ventral surface; hind tibia with 2 long and a row of short bristles on anterodorsal surface, 2 bristles medially on posterodorsal surface, 1 on anteroventral surface at about one-fourth distance from the distal end and a row of long hairs on anterior and posterior margins of ventral surface at about three-fourths the distance from the distal end.

Abdomen : Black and silvery checkered pattern; 2nd and 3rd abdominal tergites without median but each with two pairs of lateral marginal bristles; 4th with one pair of median and three pairs of lateral marginal bristles; 5th with a row of about 16 marginal bristles; 1st and 2nd sternites with long hairs; 3rd and 4th with short bristles and hairs; 5th sternite V-shaped, with stout bristles on the inner side of each arm; 1st and 2nd genital tergites brownish, with short hairs but without bristles; inner forceps almost straight, pointed and slightly curved at apex; outer one nearly oval, with hairs on distal part; anterior paramere

almost slender, pointed at apex; posterior and curved with two hairs; theca shorter than paraphallus, both heavily sclerotised; apical plate of paraphallus membranous, broad in the middle and pointed at apex; styli of glans short, comb-like anteriorly; ventralia plate-like, not well sclerotised.

All the specimens under "Specimens examined" were collected by the author.

Specimens examined : 1 ♂, West Bengal; Calcutta, Zoo-Garden, 1.iv.1975; 3 ♂ ♂, Calcutta, Zoo-Garden, 21.iii.1975; 6 ♀ ♀, Calcutta, Zoo-Garden, 8.iii.1975; 1 ♂, Calcutta, Zoo-Garden, 1.ix.1975; 3 ♂ ♂, Calcutta, Zoo-Garden, 4.ii.1975; 2 ♂ ♂, Calcutta, Zoo-Garden, 6.iii. 1975; 1 ♂, 24-Parganas, Diamond Harbour, 6.vii.1974; 1 ♂, 24-Parganas, Rudranagar (Sagar Island), 24.iii.1975; 1 ♂, 24-Parganas, Baruipur, 23.v.1975; 2 ♀ ♀, 24-Parganas, Kakdwip, 2.iii.1975; 4 ♂ ♂, 24-Parganas, Rudranagar (Sagar Island), 24.iii.1975; 1 ♂, Howrah, Sankarail, 30.iii.1975; 1 ♂, Coochbehar, Patlakhawa Forest, 23.iv.1975; 1 ♂, Jalpaiguri, Chalsa, 1.v.1972; 1 ♂, Malda, Gour, 10.v.1975; 1 ♂, Purulia, Sahebbundh, 18.vi.1974; 1 ♂, Midnapore, Digha, 30.xi.1974; 3 ♂ ♂, Birbhum, Charicha Forest, 11.xi.1974; 1 ♂, Bankura, Bishnupur, 24.xi.1974; 2 ♂ ♂, Bankura, Susunia Forest, 21.xi.1974; 1 ♂, Murshidabad C.S.R.S. Campus, 5.xi.1974.

Female : Body length 7-11 mm // Plate XXIX, Figs. 1-4 //

Head : Width of frons almost same as in male; frontal bristles 10-12; 2 proclinate fronto-orbital bristles present; outer vertical bristle well developed.

Thorax : Similar to that of male but for the absence of apico-scutellar bristles.

Wing : Similar as in the male.

Legs : Chaetotaxy same as in male but for the following differences : Mid femur with 3 bristles on the anterodorsal surface; hind femur with a row of bristles on the anterodorsal surface; hind tibia only with 2 bristles on the anteroventral surface, without long hairs on the anterior and posterior margins of ventral surface.

Abdomen : 2nd and 4th sternites each with 4, 3rd with 6 and 5th with 8 bristles; 6th sternite with a row of 10 bristles; 7th and 8th weakly developed bristles and concave at the anteriorly; anal sternite nut-shaped and with short hairs; 7th tergite undivided and with strong bristles; spermatheca 3, basal half striated only and longer than the distal half.

Female described from reared specimens

Distribution : India : Birbhum, Calcutta, 24-Parganas, Malda, Jalpaiguri, Coochbehar, Bankura, Midnapore, Howrah; Uttar Pradesh ; Dehradun; Kashmir : Jhelum valley; Punjab; Jallandar; Maharashtra: Bombay, Parel; Tamil Nadu : Madras, Coimbatore, Nilgiri Hills; Orissa;

Puri, Cuttack, Sambalpur; Bihar : Pusa; Sri Lanka; Japan; Malaya; Taiwan; Philippine Islands; Java; Bali; Seychelles; Chagos Islands; Johannesburg; Mosambique; Sudan; Uganda; Zaire; South Australia; Queensland; New South Wales; Victoria, Lord Howe Island; Solomon Islands : Guam; Samoa; Fiji; Howaiian Islands, Manitoba; Connecticut; Montana; Utah; Washington; California; Madagascar.

Bionomics : Senior-white et al. (1940) recorded that this species causes human and bovine myiasis and is parasitic on locust. Alwar and Seshiah (1958) reported that this fly causes myiasis in camel, tow bullocks and cow in India. It has been reared from a variety of organic matters such as, cucumber, rotton Cajanus indicus, dead oyster (Achatina fulica), dead beetle, dead Acherontia sp., decaying toad, dead snake, dead squirrel and rotten meat.

Cuthbertson (1938) could rear the larvae on decomposing ox liver, fresh cattle dung and human feces. Greenburg (1971) reported that this species is found in association with Brachymeria argentifrons and Dirhinus pachycerus. The present author reared this species from meat.

Parasarcophaga (Liosarcophaga) brevicornis (Ho)

// Plate XXX, Figs. 1-5 //

Sarcophaga brevicornis Ho, 1934, Bull. Fan meml. Inst. Biol., 5(1) : 23.

Parasarcophaga (Liosarcophaga) brevicornis (Ho) Rohdendorf, 1937. Faune de l' URSS., 19(1) : 222; Kano, Field and Shinonaga, 1967, Fauna Japonica, Sarcophagidae, p.50

Male : Body length 8-15 mm.

Head : Width of frons about two-fifths that of eye; frontal vitta black, its width at narrowest point less than two times that of parafrontal; parafrontal and parafacial black, with golden pollen, the former with short scattered hairs, the latter with a row of about 5-6 long hairs near the eye margin. Antennae orange (black in some cases), with silvery pollen, reaching to about 0.8 the distance to vibrissae; 1st and 2nd segments blackish-brown, tip of the 2nd totally brown and with black hairs; 3rd segment orange, its length about two and a half times that of the 2nd; arista long and plumose on its basal three-fifths; facial ridge light brown, silvery pollinosity, with short scattered setae in the lower half; vibrissae long, crossed, distance between vibrissae about two times the parafacial width; frontal bristles 10, arranged in a row on parafrontal, upper one reclinate, lower three below base of antennae reaching to the level of about two-thirds the length of 2nd antennal segment, the rest decussate and directed forwards, gena black, with black hairs; postgena black, with grey hairs; ocellar triangle black, with silvery pollen and 4-5 pairs of short proclinate, black hairs. Outer vertical short; inner one well developed, one and a half times the outer one; postvertical about half the inner vertical; ocellar and postocellar longer than postvertical; one row of regular postocular setae present besides postocular cilia; the rest of the area with greyish hairs; palpi slender and black; proboscis black with a brownish tinge basally.

Thorax : Blackish, with three black longitudinal stripes; ac 0 +1; dc 5 +5 (posterior two stout); ia 1 +3; ps 1; h 3; ph 2; np 4; pa 2; sa 4; st 1 +1 +1; mpl 6; hpl 9; upper part of propleura bare, with silvery pollen; prostigmatic and propleural bristles well developed and accompanied by short hairs; pre- and metathoracic spiracles brown; apicoscutellar and discoscutellar bristles one pair each.

Wing : Hyaline with brown veins; R_1 bare; R_{4+5} with a row of about 10 short setae located dorsally and extending to about two-thirds the distance from basal node to r-m; several setae present on ventral surface of R_{4+5}; fifth sector of costa a little shorter than the third, the former on the anterior margin with short spines basally along more than half its length; costal spines stout; epaulet black, with short spines; squama white; haltere brown.

Legs : Black; fore femur with two rows of long bristles on posterodorsal surface and a row of bristles on posterior margin of ventral surface; fore tibia with 3-4 bristles on the basal one-third of anterodorsal surface and 1 bristle on posterodorsal surface at about one-third the distance from the distal end; mid femur with 6-7 bristles along the middle portion of anterodorsal surface, a row each of short setae on the distal half on anteroventral and posteroventral surfaces, a row of short bristles on the basal half of anteroventral surface, 1 bristle on posterodorsal and 2 on posterolateral surfaces distally and numerous long hairs on the basal half of posteroventral surface; mid tibia with a row of short bristles on the posterodorsal surface, 2-3 bristles on anterodorsal surface on distal

half and 1 bristle on anteroventral, 1 on posterolateral and one on posterodorsal surfaces at about one-third the distance from the distal end; hind femur with 2 rows of long bristles on anterodorsal surface, a row on anteroventral surface, 2-3 bristles on the distal part of posterodorsal surface and numerous long hairs on the posterior margin of ventral surface; hind tibia with 2 long and a row of short bristles on anterodorsal surface, 2 bristles medially on posteroventral and 1 (sometimes two) on anteroventral surfaces and a row of long hairs on anterior and posterior margins of ventral surface at about three-fourths the distance from the distal end.

Abdomen : Black and silvery chekered pattern; 2nd and 3rd abdominal tergites without median but each with one pair of lateral marginal bristles 4th with a pair of median and 3 pairs of lateral marginal bristles; 5th with a row of about 16 marginal bristles; sternites 1st to 4th with a brush of hairs but without marginal bristles; 5th sternite V-shaped with stout spines laterally on each arm and long hairs at the distal end; 1st genital tergite blackish; 2nd shiny black, with long hairs but without marginal bristles; inner forcep almost straight, curved and pointed at apex, with a notch near the apex in front; outer forcep somewhat oval, with hairs at the distal end; anterior paramere gradually curved and pointed at apex; posterior one curved at apex, with two short hairs distally; theca shorter than paraphallus, both heavily sclerotised; apical plate of paraphallus with apical process; lateral apophysis of paraphallus unequally bifurcated; lateral plate of paraphallus long, sphere-shaped,

pointed at tip; styli of glans long and comb-like; ventralia with two processes, one heavily sclerotised and the other membranous.

All the specimens under "specimens examined" were collected by the author.

Specimens examined : 1 ♂ ♂, Calcutta, Eden Garden, 25.vii.1975; 2 ♂ ♂, Calcutta, Eden Garden, 3.vii.1975; 3 ♂ ♂, Calcutta, Zoo-Garden, 21.iii.1975; 2 ♂ ♂, Howrah, Botanical Garden, 30.iii.1975; 1 ♂, Howrah, Sankrail, 30.iii.1975; 3 ♂ ♂, Malda, Gour, 10.v.1975; 5 ♂ ♂, Jalpaiguri, Chapramari Forest, 2.v.1975; 1 ♂, Jalpaiguri, Gorumara Forest, 3.v.1975; 2 ♂ ♂, Jalpaiguri, Madarihat, 2.v.1975; 1 ♂, Bankura, Susunia Forest, 21.xi.1974; 2 ♂ ♂, Birbhum, Suri *D.F.O.* Campus, 10.xi.1975; 2 ♂ ♂, West Dinajpur, Kornajhora, 5.v.1975; 8 ♂ ♂, Midnapore, Digha, 30.xi.1974; 1 ♂, Midnapore, Arabari Forest, 26.xi.1974; 1 ♂, Purulia, Sahebbundh, 27.xi.1974; 1 ♂, 24-Parganas, Baruipur, 8.xii.1974; 6 ♂ ♂, 24-Parganas, Baruipur, 25.iii.1975; 1 ♂, 24-Parganas, Kakdwip, 25.iii.1975; 1 ♂, Hooghly, Tarakeswar, 21.ix.1974; 1 ♂, [illegible] 24-Parganas, Bamankhali (Sagar Island), 25.iii.1975; 1 ♂, 24-Parganas, Ratneswarpur, 24.iii.1975,

Female : Body length 10-23 mm. // Plate XXXI, Figs. 1-4 //

Head : Width of frons nearly equal to that of eye; frontal bristles 11; fronto-orbital bristles 2, proclinate; outer vertical bristle well developed, about three-fifths the inner one.

Thorax : Similar to that of male but for the absence of apico-scutellar bristles.

Wing : Same as in male. // [redacted] //

Legs : Chaetotaxy same as in male except for the following differences : Mid femur without hairs on the basal half of posterolateral surface but with 4-5 bristles; hind femur without hairs but with one row of bristles on anterodorsal surface and 2 bristles on posterior margin of ventral surface; hind tibia without hairs on the anterior and posterior margins of ventral surfaces.

Abdomen : 2nd to 4th sternites each with 4 bristles; 5th with 6 bristles; 6th wider than the rest, with a row of about 10 bristles; 7th deeply concave anteriorly and with 6-8 short bristles; 8th sternite membranous, without hairs; anal sternite with long hairs; 7th tergite entire, with stout bristles and short hairs; spermatheca 3, distal and basal half almost equal, proximal end with numerous transverse striations.

The female is described from reared specimens.

Distribution : India : West Bengal : Siliguri, 24-Parganas, Purulia, Calcutta, Howrah, Malda, Jalpaiguri, Midnapore, Hooghly, West Dinajpur, Bankura, Birbhum; Tamil Nadu : Hainan Island; Federated Malaya States; Kuala Lumpur; Japan : Honshu, Shikoku, Hyushu.

Bionomics : The larvae of this species breed in dead fish and animal carcasses. The present author reared this species from meat.

Parasarcophaga (Liosarcophaga) josephi, sp. nov.

// Plate XXXII, Figs. 1-4 //

Male : Body length 10 mm.

Head : Width of frons about two-fifths that of eye; frontal vitta black, its width at narrowest point less than twice the width of parafrontal; parafrontal and parafacial black, with golden pollen, the former with irregular scattered hairs, the latter with a row of about 4 hairs below the eye margin. Antennae with silvery pollen, reaching to about 0.9 the distance to vibrissae; 1st segment black; 2nd segment black but brown at tip with long hairs distally; 3rd segment black but brown basally two times the second; arista long and plumose on basal half. Facial ridge black, with short spines in the lower half; vibrissae long, crossed distance between vibrissae about half the parafacial width, frontal bristles 10, arranged in a row on parafrontal, upper 2 reclinate, lower 2 below base of antennae and reaching to about half distance to 2nd antennal segment, the rest directed forwards; gena black, silvery pollinosity with short black hairs; postgena black, with greyish hairs; ocellar triangle black, with silvery pollen and 4 pairs of short hairs; outer vertical very short; inner one well developed, about three times the outer one; postvertical almost half the inner vertical; ocellar and postocellar well developed, the latter longer than the postvertical; two rows of postocular setae present besides postocular cilia of which the 1st row is regular while the 2nd is irregular with intermittant short and long black hairs, the rest of the area with short grey hairs; palpi slender, black; proboscis black.

Thorax : Blackish with three black longitudinal stripes; ac 0 + 1; dc 5 + 5; (posterior one stout); ia 1 + 3; pa 1; h 3; ph 3; ap 4; pa 2; sa 4; st 1 + 1 + 1; mpl 6; hpl 7; upper part of propleura bare with silvery pollen; prostigmatic and propleural bristles well developed and accompanied by short hairs; pro- and metathoracic spiracles brown; apicoscutellar and discoscutellar bristles 1 pair each, the former crossed; lateroscutellar bristles 2 pairs.

Wing : Hyaline with brown veins; R_1 bare; R_{4+5} with 8 short setae located dorsally and extending to about two-thirds the distance from the basal node to r-m; several setae present on ventral surface of basal node of R_{4+5}; 3rd costal sector a little longer than the fifth, the latter with short spines in the anterior margin on more than half its length basally; costal spines stout; epaulet black, with short spines; basicostal scale brown; squama white; haltere brown.

Legs : Black; fore femur with two rows of bristles on posterodorsal surface and a row of long bristles on posterior margin of ventral surface; fore tibia with 3 short bristles on the basal one-third of anterodorsal surface and 1 bristle on posterodorsal surface at about one-third the distance from the distal end; mid femur with 5 bristles along the middle portion of anterolateral surface, a row each of short setae on distal half of anteroventral and posteroventral surfaces, a row of about 5 bristles on the basal half of anteroventral surface, 1 bristle on posterodorsal and 2 on posterolateral surfaces distally and numerous long hairs on basal half of posterolateral surface; mid tibia

with a row of short and 3 long bristles on posterodorsal surface and 2 bristles on anteroventral and 1 on posterolateral surfaces at about one-third the distance from the distal end; hind femur with 2 rows of long bristles on anterodorsal surface, a row of bristles on anteroventral surface, 2 bristles in the distal half of posterodorsal surface and numerous long hairs on the posterior margin of ventral surface; hind femur with 2 rows of short bristles on anterodorsal surface, 2 bristles on posterodorsal surface medially, 1 bristle on anteroventral surface at about one-fourth the distance from the distal end and a row of long hairs on anterior and posterior margins of ventral surface at about one-fourth the distance from the distal end.

Abdomen : Black and silvery chckered pattern; 2nd and 3rd abdominal tergites without median but each with a pair of lateral marginal bristles; 4th with a pair of median and three pairs of lateral marginal bristles; 1st five sternites with short black hairs but without bristles;5th sternite V-shaped, with stout spines laterally on each arm; 1st genital tergite blackish; 2nd black, with long black hairs but without marginal bristles; inner forcep almost straight, curved and pointed at apex, with beak-like ending; outer forcep somewhat triangular with hairs only in the distal half; anterior paramere broad, with a pointed hook at apex and short hairs behind distally; posterior paramere curved at apex, with two hairs near the apex in front; theca shorter than paraphallus, both heavily sclerotised; apical plate of paraphallus with apical process; lateral apophysis unequally bifurcated of which the upper one is long;

lateral plate of paraphallus long, with a slightly sclerotised pointed end; styli of glans long and comb-like anteriorly; ventralia with two lobes of which one is more sclerotised than the other.

Female : Unknown.

Holotype : 1 ♂, West Bengal : 24-Parganas, Bokkhali, 7.ix.1974 coll. B.C.Nandi.

Discussion : This species differs from breviornis (Ho) in the structures of lateral apophysis of apical plate of paraphallus, anterior paramere and lateral plate of paraphallus. Moreover in this species the lobes of ventralia are more long and pointed.

Distribution : India : West Bengal : 24-Parganas, Bokkhali.

Bionomics : This species was collected from dried and rotten specimens of the crustacean belonging to the species Macrobrachium rosenburgi.

Genus Robineauella Enderlein, 1928

Type-species : Sarcophaga scoparia Pandellé, 1896.

Robineauella Enderlein, 1928, Arch. Klass. Phyl. Ent., 1 : 29

Digitiventra Fan, 1964, Key to the common synanthropic flies in China, p.306, Pohdendorf, 1965, Revue d- entomologie del'URSS., 44(3) : 694. Syn.

Generic characters : Width of frons about one-third that of eye; length of third antennal segment about three times that of the second;

arista long and plumose along its basal three-fifths; upper part of propleura usually bare; acrostichal bristles 0 + 1; postsutural dorsocentral bristles 4 or 5 of which two posterior ones are stout; presutellar and discoscutellar bristles one pair each; laterosecutellar bristles two pairs each; P_1 bare; third abdominal sternite of male without median marginal bristles; 5th sternite of male V-shaped; genital segments and forceps black; phallosome straight or angular on posterior margin; apical part of paraphallus very large, divided into two large lateral processes, median part poorly defined, sometimes entirely absent; lateral process of apical part of paraphallus, straight; two pairs of ventralia present; styli of glans short and slender.

This genus is distributed in the Oriental and Palaearctic regions. Pohdendorf (1965) reported seven species under this genus from Eurasia.

Robineauella Enderlein is comparatively a little known genus and so far only one species has been recorded from the Oriental region. One new species is described here and R. (Jantiella) coei Rohdendorf is recorded from India. This is the first record of this genus from India.

Subgenus : Jantiella Rohdendorf, 1937

Type-species : Parasarcophaga djakonovi Rohdendorf, 1937

Jantiella Rohdendorf, 1937, Faune de l' URSS., 19(1) : 233, 449.

"Robineauella Enderlein from India with description of a new species (Diptera: Sarcophagidae)" has been accepted for publication in Rev. Brasil. Biol., 36 : (1977)

Subgeneric characters : Apical plate of paraphallus strongly sclerotised and at the end bifurcated; lateral plate of paraphallus short and pointed at apex; styli of glans moderately short; genital tergites without marginal bristles.

This subgenus is distributed in the Oriental and Palaearctic regions.

Key to the males of Indian species of the subgenus Jantiella

1. Ventralia single; apical plate of paraphallus with a prominent median process, its lateral projection almost straight at apex; inner forceps curved and swollen subapically

... eesi Rohdendorf

2. Ventralia trilobed; apical plate of paraphallus without median process, its lateral projection curved at apex; inner forceps almost straight, tapering and pointed at apex

... kanoi, sp. nov.

Robineauella (Jantiella) eesi Rohdendorf, 1966

Robineauella (Jantiella) eesi Rohdendorf, 1966. Bull. Brit. Mus. (Nat. Hist.), Ent. 17(10) : 458.

Specimens examined : 1 ♂, West Bengal : Darjeeling, Kurseong, alt. 5,800 ft., 16.iv.1975, coll. B. C. Nandi.

This species is being recorded for the first time from India.

Distribution : India : West Bengal.

Robineauëlla (Jantiella) kanoi, sp. nov.

// Plate XXXIII, Figs. 1-5 //

Male : Body length 9-13 mm.

Head : Width of frons about two-fifths that of eye; frontal vitta black, its width at narrowest point more than twice that of parafrontal; parafrontal and parafacial blackish, with golden pollen and numerous short hairs, the latter with long hairs below the eye margin. Antennae black, reaching to about 0.85 the distance to vibrissae; 1st and 2nd segments black, with short hairs; 3rd blackish, with pollen, about three times the 2nd segment; arista long, plumose on basal two-thirds. Vibrissae long, distance between vibrissae about parafacial width; facial ridge black, with white pollen and short black hairs; gena black, with numerous black hairs; frontal bristles 12, arranged in a row on parafrontal, upper 2 reclinate, others inclinate and convergent of which the lowest 4 are below base of antennae, lowermost one reaching about three-fourths of 2nd antennal segment. Ocellar triangle black, with many divergent black hairs. Outer vertical not differentiated; inner one well developed; postvertical short, half the inner vertical; ocellar and posteocellar moderately developed; two rows of posteocular setae well developed and regular, the rest of the area with irregular black and white hairs; palpi slender, somewhat blackish-brown; proboscis black.

Thorax : Black, with three black longitudinal stripes; ag 0 +0; dc 5 +4; ia 1 +2; pa 1; h 3; ph 2; sp 4; sa 3; pa 2; st 1 +1 +1; spl 5; hpl 8; propleura blackish, bare, with white pollen; prestigmatic

and propleural bristles well developed and accompanied by short hairs; apicoscutellar and discoscutellar bristles 1 pair each; laterоscutellar bristles 2 pairs; pro- and metathoracic spiracles brown.

Wing : Hyaline with black veins; R_1 bare; R_{4+5} with 9-11 short setae located dorsally and extending to more than half the distance from the basal node to r-m; several short setae present on ventral surface of basal node of R_{4+5}; third sector of costa almost equal to the fifth, the latter with short spines on about half its length proximally; basicostal scale yellowish; costal spine not so stout; epaulet black, with many short spines; squama white, with a slight brownish tinge; haltere brown.

Legs : Black; fore femur with two rows of bristles on posterodorsal surface and a row of long bristles along posterior margin of ventral surface; fore tibia with 2 short bristles on basal part of anterodorsal surface and 1 bristle on posteroventral surface at about one-third the distance from the distal end; mid femur with a row of bristles medially on anterolateral surface, 2 bristles on posterodorsal and 1 on posterolateral surfaces distally, a row of long bristles on anterior margin, a row of short bristles on the distal half of posterior margin and a tuft of long hairs on basal half of ventral surface; mid tibia with 2 bristles on middle portion of anterolateral surface, 1 bristle distally on anterior margin of ventral surface, 2 bristles each on posterodorsal and posterolateral surfaces at about one-third the distance from the distal end and 1 bristle posterodorsally at about one-third the distance

from the basal end; hind femur with 2 rows of long bristles on anterodorsal surface, a row of bristles on anteroventral surface and a tuft of long hairs on ventral surface; hind tibia with a row of short bristles on anterodorsal surface, 2 bristles each on one-third and two-thirds the distance respectively from the basal end on posterodorsal surface and a tuft of hairs on anterior and posterior margins of ventral surface at about four-fifths the distance from the distal end.

Abdomen : Black with silvery checkered pattern; 3rd abdominal tergite without median but with 2 pairs of well developed lateral marginal bristles; 4th tergite with one pair of median and three pairs of lateral marginal bristles; 5th with only a row of marginal bristles; sternites 1st to 5th with long hairs but without differentiated bristles; 1st and 2nd genital tergites black, with black hairs but without marginal bristles; outer forceps elongated; inner one almost straight and pointed, with a small notch at apex and a row of very short setae (about 7) on its outerside; anterior paramere long, curved and pointed; posterior one deeply curved at apex, with two short hairs; theca and paraphallus of equal size, moderately sclerotised; apical plate of paraphallus without median process but with a pair of cylindrical lateral processes which are incised anteriorly before the apex; styli of glans short; lateral plate of paraphallus pointed at apex; ventralia short, membranous and trilobed.

Female : Unknown.

Holotype : 1 ♂, West Bengal : Darjeeling, Zoological Park, alt. 6,500 ft., 15.iv.1975, coll. B.C.Nandi, Paratype : 1 ♂, collection data same as that of holotype.

Discussion : Robineauella (Jantiella) kanoi differs from Robineauella (Jantiella) coei Rohdendorf in the absence of median process on apical plate of paraphallus and its lateral projection being curved at apex. Moreover in kanoi inner forceps is almost straight and pointed at apex.

This species is named after Prof. Rokuro Kano of Japan.

Distribution : India : West Bengal : Darjeeling, Zoological Park.

Genus Sinonippenia Rohdendorf, 1965

Type-species : Sarcophaga hervebazini Seguy, 1933

Sinonippenia Rohdendorf, 1965, Revue. d entomologie de l' URSS., 44(3) : 690.

Generic characters : Presutural acrostichal bristles fairly developed; postsutural dorsocentral bristles four (sometimes three); propleura usually bare, rarely with a few fine hairs; median marginal bristles on 3rd abdominal tergite weak or absent; third antennal segment about three and a half times the second; hind tibia with several long hairs on the hind margin on the ventral surface; first three abdominal sternites with numerous long hairs; anterior paramere slender, not branched; theca short; phallosome large; apical plate of paraphallus with a pair of short, reclinate spines; lateral plate of paraphallus simple, usually consisting of a pair of slightly projecting angular processes.

This is a very little known genus. Only four species are known to date from the Palaearctic and Oriental regions. One new species from India is described here. It is also the first record of the genus from India.

Sinonipponia bengalensis, sp. nov.

// Plate XXXIV, Figs.1-6 //

Male : Body length 6 to 9 mm.

Head : Width of frons about two-fifths that of eye; frontal vitta black, its width at narrowest point about twice that of parafrontal; parafrontal and parafacial black, with silvery pollen, the former with short, irregular, black hairs, the latter with a row of black hairs below the eye margin (lower four stout). Antennae black, reaching to about 0.85 the distance to vibrissae; 1st and 2nd segments black, with short, black hairs, tip of the 2nd brownish-black with one long bristle; 3rd segment blackish-brown, with silvery pollen, about two and a half times the 2nd; arista long and plumose on basal half; facial ridge blackish-brown, with short black spines on about two-fifths the vibrissal end; vibrissae very long, crossed, distance between vibrissae lesser than two times the parafacial width; frontal bristles 10, arranged in a row on parafrontal, upper two reclinate, lower three below base of antennae and reaching to about two-thirds the length of 2nd antennal segment, the rest decussate and directed forwards; gena black, with short black hairs; postgena black, with long grey hairs; ocellar triangl

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A new species of Sinonipponia Rohdendorf from West Bengal, India (Diptera:Sarcophagidae) has been accepted for publication in Rev. Brasil. Biol., 36 : (1977)

black, with 4-5 pairs of divergent short hairs. Outer vertical not differentiated; inner one well developed; postvertical about one-third the inner vertical; ocellar and postocellar short, the former shorter than the shortest parafrontal bristle and proclinate; two rows of postocular setae present besides postocular cilia of which the 1st row is regular and 2nd is irregular, the rest of the area with irregular white hairs; palpi slender, black; proboscis blackish-brown moderately long.

Thorax : Black, with three black longitudinal stripes; ac 0 + 1; d dc 5 + 4 (posterior two dc very stout); ia 1 + 3; ps 1; h 3; ph 2; np 4; sa 4; pa 2; sti-pa 1 + 1; mpl 6; hpl 8-9; upper part of propleura bare, black; prostigmatic and propleural bristles well developed and accompanied by short hairs; pro- and metathoracic spiracles brown; apicoscutellar and discoscutellar bristles 1 pair each, the former very stout and cruciate, lateroscutellar bristles 2 pairs.

Wing : Hyaline with brown veins; R_1 bare; R_{4+5} with a row of 8-10 short setae located dorsally and extending to more than two-thirds the distance from the basal node to r-m; 3-4 setae present on ventral surface of basal node of R_{4+5}; third sector of costa almost equal to the fifth, the latter with short spines along its basal two-thirds on anterior margin; costal spines stout; epaulet black, with spines; basicostal scale yellow; squama white; haltere brown.

Legs : Black; fore femur with two rows of bristles on posterodorsal surface and a row of long bristles on posterior margin of ventral surface; fore tibia with 3 bristles on the basal one-third

of anterodorsal surface and 1 bristle on the posterodorsal surface at about one-third the distance from the distal end; mid femur with 3-4 bristles along middle portion of anterolateral surface, a row each of short setae on the distal half of anteroventral and posteroventral surfaces, a row of about 3-4 bristles on basal half of anteroventral surface, 6 long bristly hairs and several short hairs on the basal half of posteroventral surface and 1 bristle on posterodorsal and 2 on posterolateral surfaces distally; mid tibia with 2 long and a row of short bristles on the posterodorsal surface and 1 bristle on anteroventral and 1 on posteroventral surfaces at about one-third the distance from the distal end; hind femur with two rows of bristles on the anterodorsal surface, 3 long and a row of short bristles on anteroventral surface,2 bristles on distal part of posterodorsal surface and a row of about 4 bristly hairs on the posteroventral surface; hind tibia with a row of short and 2 long bristles on the anterodorsal surface, 2 bristles on posterodorsal surface medially, 1 on anteroventral surface at about one-fourth the distance from the distal end and a row of long hairs on anterior and posterior margins of ventral surface on the distal half.

Abdomen : Black, with silvery grey checkered pattern; 2nd abdominal tergite without and 3rd with a pair of weak median and each with a pair of laberal marginal bristles; 4th with a pair of median and 3 pairs of lateral marginal bristles; 5th with a row of about 18 marginal bristles and several long hairs on ventral side; sternites 1st to 3rd with long hairs; 4th with short hairs; 5th Y-shaped, with short spine

laterally and 1 long bristle and several short hairs distally on each arms; 1st genital tergite brownish-black, with long hairs but without marginal bristles; 2nd segment black, with long hairs; inner forcep almost straight, slightly curved and notched distally and with long hairs on four-fifths its length basally; outer forcep dumb-bell shaped, with hairs on distal half; anterior paramere slender, almost straight, not so pointed apically; posterior one curved at apex, with 2 short hairs on anterior margin apically; theca shorter than paraphallus, both heavily sclerotised; apical plate of paraphallus pointed at end with a backward projection, its lateral process membranous and crosses the apical end; lateral plate of paraphallus almost pointed, sclerotised, with a basal membranous outgrowth; styli of glans long, crosses the apical part of paraphallus which is serrated anteriorly; ventralia black, hook-shaped.

Female : Unknown.

Holotype : 1 ♂, West Bengal : Bankura, Panchubaga, from bush-sweeping, 22.ii.1974, coll. B.C.Nandi. Paratypes : 3 ♂♂, Bankura, Panchubaga, From bush-sweeping, 22.ii.1974, coll. B.C.Nandi; 1 ♂, Midnapore, Arabari Forest, from bush-sweeping, 26.ii.1974, coll. B.C. Nandi; 3 ♂♂, 24-Parganas, Diamond Harbour, from grass-sweeping, 25.iii.1975, coll. B.C.Nandi.

Discussion : This species closely resembles Sinonippemia hainanensis (Ho), but differs from it in the detailed structure of male genitalia. Moreover in this species the structure of parameres also differ from that of hainanensis.

Distribution : India : West Bengal: Bankura, Midnapre, 24-Parganas.

Genus : *Lioproctia* Enderlein, 1928

Type-species : *Lioproctia enderleini* Kano and Lopes, 1970

(*Lioproctia aurifrons* (Doleschall) of Enderlein, 1928, nec *Sarcophaga aurifrons* Doleschall,

Lioproctia Enderlein, 1928. *Arch. Klass. Phyl. Ent.*, *1* : 26.

Ceratophalla Rohdendorf, 1963, *Stuttg. Beitr. Naturk.*, *124*(1) : 11; Rohdendorf, 1965, *Revue d' entomologie de l'URSS.*, *44*(3) : 694, syn.

Burmanomyia Fan., 1964, *Acta Zool. Sin.*, *1*(2):305; Kano and Lopes, 1970, *Rev. Brasil Biol.*, *30*(2) : 313, Syn.

Generic characters : Preacrostichal and predorsocentral bristles well differentiated; apical plate of paraphallus very much enlarged, broad and with lateral processes; ventralia very large and intricately constructed consisting of two pairs of branching highly sclerotised processes; styli of glans stout.

This genus is distributed in the Oriental, Palaearctic and Ethiopian regions. Only a few species have so far been reported from these regions. Only one species, of *annandalei* (Senior-White), is hitherto known from India. One new species is described here.

Lioprosta midnaporensis, sp. nov.

// Plate XXXV, Figs. 1-5 //

Male : Body length 14 mm.

Head : Width of frons about three-fourths that of eye; frontal vitta black, its width at narrowest point of front less than half that of parafrontal; parafrontal and parafacial black, with silvery pollen, the former with scattered hairs, the latter with two rows of hairs below the eye margin of which the lowermost six are long. Antennae brownish-black, reaching to about 0.85 the distance to vibrissae; 1st and 2nd segments blackish-brown, with short black hairs, the latter with a long bristle at the tip; 3rd segment brown, with silvery pollen, its length about four times that of the 2nd; arista long, plumose on basal three-fifths; facial ridge black, silvery pollinosity with black spines on lower half; vibrissae long, crossed, distance between vibrissae less than two times the parafacial width; frontal bristles 13, arranged in a row on parafrontal, upper three reclinate, lower four below base of antennae and reaching to the level of about two-thirds the length of 2nd antennal segment, the rest decussate and directed forwards; gena black, with brownish hairs; postgena black, with long silvery hairs; ocellar triangle black, with five pairs of anteriorly directed short hairs; outer vertical short; inner one well developed; postvertical half the inner vertical; ocellar and postocellar short, the former shorter than the shortest parafrontal; only one row of postocular cilia present, the rest of the area with long silvery hairs; palpi long, black; proboscis short, black.

Thorax : Greyish with three black longitudinal stripes; ac 1 + 1; dc 3 + 4 (posterior two post dc stout); ia 1 + 3; pa 1; h 3; ph 2; sp 4; pa 2; sa 4; st 1 + 1 + 1; mpl 8; hpl 11; upper part of propleura bare, black; prestigmatic and propleural bristles well developed and accompanied by short, black hairs; pro- and metathoracic spiracles dark brown; apicoscutellar and discoscutellar bristles 1 pair each, the former crossed; lateroscutellar bristles 2 pairs.

Wing : Hyaline, with brown veins; R_1 bare; R_{4+5} with a row of 10 short setae located dorsally and extending to more than half the distance from basal mode to r-m; several setae present on ventral surface of R_{4+5}; 5th sector of costa about half the third, the former with short spines along its basal one-fourth on anterior margin; costal spine not stout; epaulet black, with short spines; basicostal scale yellowish; squama white; haltere brown.

Legs : Black; fore femur with two rows of long bristles on posterodorsal surface and a row of bristles on posterior margin of ventral surface; fore tibia with 4 short bristles on basal one-third of anterodorsal surface and 1 bristle on the posterodorsal surface at about one-third the distance from the distal end; mid femur with a row of 5 bristles along middle portion of anterolateral surface, a row of short setae on the distal half of anteroventral and posteroventral surfaces, a row of short bristles on the basal half of anteroventral and posteroventral surfaces, short hairs on basal half of posterior margin of ventral surface and 1 bristle each on

posterodorsal and posteroventral surfaces distally; mid tibia with 1 long and a row of short bristles on the posterodorsal surface, 1 bristle on anterolateral and 1 on posterolateral surfaces at about one-third the distance from the distal end and with a tuft of long hairs on distal half ventrally; hind femur with 2 rows of bristles on anterodorsal surface, a row of bristles on anteroventral surface, 2 bristles on distal one-fourth of posterodorsal surface, 1 bristle distally on posterolateral surface and a row of long hairs on the distal half of posteroventral surface; hind tibia with a row of 2 long and several short bristles on anterodorsal surface, 2 bristles on posterodorsal surface medially and with numerous long hairs on anterior and posterior margins of ventral surface on four-fifths of distal half.

Abdomen : Black and silvery chckered pattern; 2nd and 3rd abdominal tergites without median but each with 1 pair of lateral marginal bristles; 4th with a pair of median and 3 pairs of lateral marginal bristles; 5th with a row of 10 marginal bristles; sternite 1st and 2nd with long black hairs; 3rd and 4th with short hairs; 5th sternite V-shaped, with a curved projection bearing long bristles on basal end and long hairs on distal end of each arm; 1st genital segment grey; 2nd brownish-black, with long hairs but without marginal bristles; inner forcep almost triangular with hairs on distal end; outer forcep curved with scattered short spines on

much of its distal half and dense hairs in the basal half; anterior paramere curved at the distal end, with lateral process on the inner side and short hairs on the outer side; posterior paramere curved, sharply pointed at apex, with long and 1 short hairs; theca almost equal to paraphallus, both sclerotised; apical plate of paraphallus long, curved and almost obtuse at apex, mostly membranous; lateral plate of paraphallus sclerotised, with two unequal pointed processes; ventralia membranous, bifurcated; styli of glans large and stout.

Holotype : 1 ♂, West Bengal : Midnapore, Digha, 28.xi. 1974, coll. B.C.Nandi.

Discussion : This species resembles annandalei (Senior-White) (Dr.H.S.Lopes in a personal communication in August 1976 informed me that annandalei belongs to the genus Lioproctica Enderlein) from which it differs in the styli of glans being large and stout and the apex of the apical plate of paraphallus being almost obtuse.

Distribution : India : West Bengal, Midnapore.

7. Subtribe Harpagophallina

This subtribe is distributed in the Oriental, Australian and Palaearctic regions. It is represented by three genera of which two viz. Harpagophalla and Iranihindia are known from India. Both the genera occur in West Bengal also.

Key to the genera of Harrassowhallina from India

1. Paraphallus strongly sclerotised, consisting of a very large ventral process that is recurved forwards; apical part of paraphallus forming a pair of slender threads; lateral plate of paraphallus in the form of a single pair of moderately large, sharp processes; styli short, curved; antennae and palpi black

.... Harrassowhallia Rohdendorf

Paraphallus without large hooks; apical part of paraphallus forming a pair of anchor-like transparent, membranous processes; lateral plate of paraphallus consisting of three, short, sharp hooks; styli extending distally in the form of large, straight, cultrate processes; antennae and palpi orange-yellow

.... Iranohindia Rohdendorf

Genus : Harrassowhallia Rohdendorf, 1937

Type-species : Harrassowhallia aera Rohdendorf, 1938

Harrassowhallia Rohdendorf, 1937, Fauna de l'URSS., 19(1) : 276.

Generic characters : Third antennal segment about two and a half times the second; antennae and palpi black; frons narrow, about half the length of eye; upper part of propleura bare; prosternal acrostichal bristles not differentiated; postsutural

dorsocentral bristles 3-5, posterior one more stout, R_1 bare; cell R_5 open; third abdominal tergite without median marginal bristles; inner forceps long, slender and hook-like apically, with a tuft of hairs at the sides posteriorly; hind tibia with hairs; theca broad, bent distally and narrow basally; apical plate of paraphallus with two very long, cylindrical apophyses; lateral plate of paraphallus very stout and pointed apically; ventralia long, cylindrical and pointed; styli of glans short, curved.

This genus is known from the Oriental and Palaearctic regions. Only one species is represented in India.

Harpagophalla kempi (Senior-White, 1924)

// Plate XXXVI, Figs. 1-5 //

Sarcophaga kempi Senior-White, 1924. Rec. Ind. Mus., 26(3):247

Sarcophaga kempoides Baranov, 1931. Konvrio. (2) 10 : 114;

Senior-White, Aubertin and Smart, 1940. Fauna British India. Diptera, 8 : 264, Syn.

Harpagophalla kempi (Senior-White), Fan. 1965. Key to the common sarcophagid flies in China. p.261.

Male : Body length 8 to 11 mm.

Head : Width of front about two-fifths that of eye; frontal vitta black, its width at narrowest point about two times that of parafrontal; parafrontal and parafacial black, with golden pollen, the former with scattered hairs, the latter with a row of black

hairs below the eye margin (lower four stout). Antennae brownish-black, reaching to about 0.8 the distance to vibrissae; 1st segment brownish-black, with short hairs; 2nd segment black at base and reddish-brown at apex, with 1 long bristle and numerous short, black hairs; 3rd segment brown, with silvery pollen, about three times the 2nd; arista long, plumose on basal two-thirds; facial ridge brown with silvery pollen and with short black spines on one-fourth its length in the vibrissal end; vibrissae long, crossed, distance between vibrissae about twice that of parafacial width; frontal bristles 9-10 arranged in a row on parafrontal, upper three reclinate, lower three below base of antennae and reaching to about half the length of 2nd antennal segment, the rest decussate and directed forward; gena black, with many short black hairs; postgena black, with long grey hairs; ocellar triangle black, with 3 pairs of divergent short hairs. Outer vertical absent; inner one well developed; postvertical about one-third the inner vertical; ocellar and postocellar short, proclinate, stouter than postvertical, both equal and equal to shortest parafrontal bristle; two rows of postocular setae present besides postocular cilia of which the 1st row is regular and 2nd is irregular and is with black and white hairs; palpi slender, brown; proboscis black.

Thorax : Black with silvery pollen and with three black longitudinal stripes; ac 0 + 1; dc 3 + 3 (posterior one more stout); ia 0 + 2; pa 1; h 3; sh 3; pr 4; sa 3; ps 2; st 1 + 1 + 1; sml 0, hml 0-0;

upper part of propleura bare, black, with silvery pollen; prestigmatic and propleural bristles well developed, the former accompanied by long bristly hairs, the latter with short hairs; prothoracic spiracle blackish-brown; metathoracic spiracle brown; spiscutellar and discutellar bristles 1 pair each, the former very stout and erectate; laterocutellar bristles 2 pairs.

Wing : Hyaline with brown veins; R_1 bare; R_{4+5} with a row of 8-9 short setae located dorsally and extending to about two-thirds the distance from the basal node to r-m; 3-5 short setae present on ventral surface of R_{4+5}; third costal sector equal to the fifth, the latter with short spines along basal two-thirds of its length on anterior margin; costal spines almost stout; epaulet black, with spines; basicostal scale yellow; squama white; haltere brown.

Legs : Black; fore femur with two rows of bristles on posterodorsal surface and a row of long bristles on posterior margin of ventral surface; fore tibia with 3 short bristles on basal one-third of anterodorsal surface and 1 short bristle on posterodorsal and 1 long bristle on posterolateral surfaces at about one-third of anterodorsal surface and 1 short bristle on posterodorsal and 1 long bristle on posterolateral surface at about one-third the distance from the distal end; mid femur with 3 bristles along the middle portion of anterolateral surface, a row of short setae on the distal half of anteroventral and posteroventral surfaces, a row of about 3-4 long hairs on the basal half of posterodorsal surface and 1 bristle each

on posterodorsal and posterolateral surfaces distally; mid tibia with 3 bristles on the posterodorsal surface, 2 bristles on the middle of anterodorsal surface and 1 bristle on anteroventral and 1 on posteroventral surfaces at about one-third the distance from the distal end; hind femur with a row of bristles and long hairs on anteroventral surface, a row of long hairs on anterior and posterior margins of ventral surface and 1 bristle each on distal part of dorsal and posterodorsal surfaces; hind tibia with a row of bristles on the anterodorsal surface, 2 bristles on posterodorsal surface medially, 1 bristle on anteroventral surface at about one-fifth the distance from the distal end and a row of long hairs on anterior and posterior margins of ventral surface on about three-fourths its length distally.

Abdomen : Black; silvery checkered pattern; 2nd and 3rd abdominal tergites without median but each with a pair of lateral marginal bristles; 4th with 1 pair of median and 2 pairs of lateral marginal bristles; 5th with a row of about 16 marginal bristles; sternites 1st to 3rd each with a tuft of long hairs; 4th with short hairs basally and numerous short spines distally; 5th V-shaped, with a tuft of short setae anterolaterally on each arm and short hairs distally; 1st genital tergite brown, with short hairs on distal end; 2nd black, with long hairs but without differentiated bristles; inner forceps almost straight, curved and pointed at apex, with long hairs on its basal three-fifths and a tuft of short hairs on subapical end;

outer one somewhat triangular with long hairs distally; anterior paramere pointed apically, broad distally and with short hairs posteriorly; posterior one curved and pointed at apex, with three long hairs; theca shorter and more chitinous than paraphallus; apical plate of paraphallus not well sclerotised, with two long, slender and pointed cruciate processes which extend beyond the tip of lateral plate of paraphallus; lateral plate of paraphallus broad and well chitinised, almost reddish, curved and pointed at end; styli of gland short; ventralia long and pointed.

Specimens examined : 3 ♂ ♂, West Bengal : Birbhum, Chandrapur Forest, 9.xi.1974, coll. B.C.Nandi; 1 ♂, Birbhum, Suaunia Forest, 21.xi.1974, coll. B.C.Nandi; 2 ♂ ♂, Birbhum, Kendush, 7.xi.1974, coll. B.C.Nandi; 1 ♂, Bankura, Bhatpur, 20.xi.1974, coll. B. C. Nandi; 1 ♂, Midnapore, Arabari Forest, 26.xi.1974, coll. B.C.Nandi; 1 ♂, Purulia, Ketka, 14.xi.1974, coll.B.C.Nandi; 2 ♂ ♂, Jalpaiguri, Gorumara Forest, 3.v.1975, coll. B.C.Nandi.

Distribution : India : West Bengal : Calcutta; Jalpaiguri, Birbhum, Bankura, Midnapore, Purulia; Kerala : Travancore; Sri Lanka: Peradeniya, Matale; China.

Bionomics : According to Senior-White et al. (1940) it has been bred from dead Achatina fulica and a dead Sphingid larva. The female is known to be attracted to Aristolochia reticula.

Genus *Iranihindia* Rohdendorf, 1961

Type-species : *Sarcophaga futilis* Senior-White, 1924.

Iranihindia Rohdendorf, 1961, *Stuttg. Beitr. Naturk.*, *58* : 2.

Generic characters : Third antennal segment long, about three times or more than 2nd; antennae and palpi orange or yellow; arista long and plumose; proboscis short; upper part of propleura bare; *dc* 5 + 5 (anterior three post *dc* short); R_1 bare; setae on middle legs well developed; abdominal sternite with long hairs and short and stout bristles; genital tergite without bristles; inner forceps deeply cleft in middle and with spines apically; theca shorter than paraphallus, both sclerotised; paraphallus without hooks; apical plate of paraphallus bearing long, posteriorly bent, armature-shaped membranous, transparent processes, basal process simple and flap-like; lateral plate of paraphallus short and with processes; styli of glans long and extending distally; ventralia short and serrated.

Iranihindia is a very small genus represented by only five species from the Oriental and Palaearctic regions. Of these only two *viz.* *I. futilis* (Senior-White) and *I. martellata* (Senior-White) are hitherto known from India. Two new species are described here and *I. martellatoides* (Baranov) is being recorded for the first time from India.

Key to the male species of Iranthindia from India

1. 3rd abdominal tergite with median marginal bristles; styli of glans long and blunt

... 2

3rd abdominal tergite without or with weak median marginal bristle; styli of glans short or pointed

... nartillata (Semior-White)

2. Inner forceps with a single row of spines

... 3

One of the inner forceps with a double row of spines

... jamei, sp.nov.

3. Styli of glans long and slender

... 4

Styli of glans short, not very slender

... futilis (Semior-White)

4. Lateral plate of paraphallus with equal processes

... nartillatoides (Ramamoy)

Lateral plate of paraphallus with unequal processes

... indica, sp.nov.

Iranihindia martellata (Senior-White, 1924)

// Plate XXXVII, Figs. 1-6 //

Sarcophaga martellata Senior-White, 1924, *Rec. Ind. Mus.*, 26(3) : 247.

Iranihindia martellata (Senior-White) Rohdendorf, 1961, *Stuttg. Beitr. Natruk.*, 58 : 2.

Male : Body length 9-11 mm.

Head : Width of frons about two-fifths that of eye; frontal vitta black, its width at narrowest point about twice that of parafrontal; parafrontal and parafacial black, both with short black hairs and the latter in addition with 3-4 long hairs below the eye margin. Antennae yellowish-red to orange, reaching to about 0.8 the distance to vibrissae; 1st segment brown; 2nd more reddish than the 3rd; the latter about three times the 2nd; arista long, plumose on basal three-fifths; facial ridge brown with silvery pollen and with short spines near the vibrissae; vibrissae long, crossed, distance between vibrissae slightly more than the parafacial width; frontal bristles 8-11, arranged in a row on parafrontal, upper one proclinate, lower two below base of antennae and reaching to about one-third the length of 2nd antennal segment, the rest directed forwards, decussate; gena and postgena black, with silvery hairs; ocellar triangle black, with about four to five pairs of diverging hairs; outer vertical very weak; inner one well developed; postvertical short, about two-fifths the inner vertical; ocellar and postocellar bristles moderately

developed, one pair each, the former preclinate; one row of black regular postocular setae present, rest of the area with scattered hairs; palpi slender, black; probescis short, black.

Thorax : Black, with three, black longitudinal stripes, pa 0 + 1 da 5 + 5 (anterior three post da very slender); ia 1 + 2; pa 1; h 3; ph 2; pp 4; sa 3; pa 2; si 1 + 1 + 1; sai 6; hai 8-10; upper part of propleura bare, black; prestigmatic and propleural bristles well developed and accompanied by short hairs; pro- and metathoracic spiracles brown; spicoscutellar and discoscutellar bristles 1 pair each, the former short and erucicte; latercscutellar bristles 2 pairs.

Wing : Hyaline, with brown veins; R_1 bare; R_{4+5} with 8-9 short setae located dorsally and extending to three-fifths the distance from the basal node to r-m; several short setae present on ventral surface of R_{4+5}; fifth section of costa a little shorter than the third, the former with short spines along its basal three-fifths on anterior margin; costal spine stout; epaulet black, with short spines; basicostal scale yellow; squama white; haltere brown.

Legs : Black; fore femur with two rows of long bristles on posterodorsal surface and a row of long bristles on posterior margin of ventral surface; fore tibia with 2 short bristles on the basal part of anterodorsal surface and 1 bristle on posteroventral surface at about one-third the distance from the distal end; mid femur with a

row of about 3-5 short bristles along the middle portion of anterolateral surface, 1 bristle each on distal part of posterodorsal and posterolateral surfaces, a row of short setae on the distal half of anteroventral and posteroventral surfaces, a row of about 4-5 bristles on the basal half of anteroventral surface and many long and several bristles hairs on ventral and posteroventral surfaces on the basal half; mid tibia with 2 bristles medially on anterolateral surface, 1 bristle on posterodorsal surface at about one-third the distance from the distal end, 2 short bristles posterolaterally at one-third the distance from the basal end and 1 bristle each on distal one-third of anteroventral and posteroventral surfaces; hind femur with two rows of long bristles on the anterodorsal surface, 1 bristle each on distal part of dorsal and posterodorsal surfaces, several long and bristly hairs on anterior and posterior margins of ventral surface and 1 bristle distally on anterior margin of ventral surface; hind tibia with a row of long bristles on the anterodorsal surface, 2 long bristles medially on posterodorsal surface, 1 bristle on anteroventral surface at about one-third the distance from the distal end and a row of several long hairs on anterior and posterior margins of ventral surface at two-thirds the distance from the distal end.

Abdomen : Black and silvery checkered pattern; 2nd and 3rd abdominal tergites without median marginal bristles but the former with 1 and the latter with 2 pairs of lateral marginal bristles; 4th with a pair of median and 3 pairs of lateral marginal bristles; 5th

with a row of 16-18 marginal bristles; sternites 1st to 4th each with a tuft of long, black hairs but without bristles; 5th sternite V-shaped, with brush of spines laterally on each arm and long hairs distally; 1st genital tergite brownish-black, without marginal bristles; 2nd blackish, with long hairs; outer forceps with numerous long hairs apically; inner forceps with long hairs on basal part and a row of short, comb-like spines on distal part; anterior paramere bifurcated at the distal end and with short hairs posteriorly; posterior paramere long, slender, pointed at apex, with hairs anteriorly; theca sclerotised, shorter than paraphallus; apical plate of paraphallus membraneous, not so curved, plough-shaped at apex; lateral plate of paraphallus short, bifurcated and pointed at apex; styli of glans short and pointed at apex; ventralia curved inwards and serrated.

Specimens examined : 1 ♂, West Bengal : Purulia, Sesamkali, 17.xi.1974, coll. B.C.Nandi; 2 ♂♂, Purulia, Bhatpur, 20.xi.1974, coll. B.C.Nandi; 1 ♂, Purulia, Sahebbundh, 18.xi.1974, coll. B.C. Nandi; 1 ♂, Birbhum, Kachujur, 8.xi.1974, coll. B.C.Nandi; 2 ♂♂, Birbhum, Kachujur, 8.xi.1974, coll.B.C.Nandi; 1 ♂, Bankura, Bishnupur, 24.xi.1974, coll.B.C.Nandi; 1 ♂, Purulia, Dulmi West, 14.xi.1974, coll. B.C.Nandi.

Distribution : India : West Bengal : Calcutta, Purulia, Birbhum, Bankura; Maharastra: Nagpur; Karnataka : Kolar; Tamil Nadu : Madras, Coimbatore; Kerala: Calicut; Bihar: Patna; Sri Lanka, Matale; Niroddumunai.

Bionomics : It has been bred on dead rabbit and human excrement. According to Senior-White et al.(1940) this species feeds on 'Him' fruits.

Female : Body length 6 mm. // Plate XXXVIII, Figs.1-4 //

Head : Width almost equal to that of eye; 3rd segment of antenna more than two and a half times the second, the former reaching to about 0.85 the distance to vibrissae; frontal bristles 8; fronto-orbital bristles 2, 1 proclinate; ocellar bristles more developed than in male; outer vertical stout, about three-fifths the inner one.

Thorax : Similar to that of male but for the absence of apico-scutellar bristle.

Wing : Same as in male.

Legs : Chaetotaxy same as in male but for the following differences : hind femur without long hairs and with only one pair of bristles on anterodorsal surface, several bristles on anterior and posterior margins of ventral surface, and 1 bristle at about the middle of anteroventral surface.

Abdomen : Sternites 2nd, 3rd and 5th each with 4 marginal bristles; 4th with only 2, stout, marginal bristles; 6th segment broader than the rest, with a row of 8 stout marginal bristles; 7th oval, with short marginal bristles; 8th membranous, without hairs and bristles; anal sternite covered with numerous short and

long hairs; 7th tergite entire with stout marginal bristles and hairs; spermatheca 3, each almost oval, without any prominent striation.

Described from 1 female collected in copula from West Bengal : Susunia Forest, Birbhum, 21.xi.1974, coll. B.C.Nandi.

Iranihindia martellatoides (Baranov, 1931)

// Plate XXXIX, Figs. 1-5 //

Sarcophaga martellatoides Baranov, 1931, *Konowia*, *10* : 114.

Iranihindia martellatoides (Baranov), Rohdendorf, 1961, *Stuttg. Beitr. Naturk.*, *58* : 2.

Male : Body length 6-8 mm.

Head : Width of frons about two-fifths that of eye; frontal vitta black, its width at narrowest point about twice that of parafrontal; parafrontal and parafacial golden, with silvery pollen and short, scattered hairs, the latter in addition with 4-5 long hairs near the eye margin. Antennae brown, reaching to about 0.8 the distance to vibrissae; 1st segment blackish-brown; 2nd brown basally and reddish-brown distally; 3rd brown, with silvery pollen, about three times the 2nd; arista long, plumose on basal four-fifths; facial ridge light brown, wholly with silvery pollen and with short spines near the vibrissal edge. Gena black, with silvery pollen and

with short, black hairs; postgena black, with whitish hairs; frontal bristles 9-11, arranged in a row on parafrontal, upper 1 reclinate, lower 2 below base of antennae reaching to about the basal half of 2nd antennal segment, the rest convergent and directed forwards; ocellar triangle with 5 pairs of divergent, black hairs; outer vertical weak; inner one well developed, shorter than postvertical; ocellar and postocellar bristles moderately developed; 1st row of postocular setae black and regular, 2nd row black and irregular, rest of the area with black and white irregular hairs; palpi slender, dark brown; proboscis black.

Thorax : Greyish with silvery pollen and with three, black longitudinal stripes; ag 0 + 1; dc 5 + 5 (three anterior postsutural dc short); ia 1 + 2; pa 1; h 3; ph 2; sa 4 (1st and 3rd slender); sa 3; pa 2; st 1 + 1 + 1; sml 0; hal 0; propleura bare, with white pollen; prestigmatic and proplemral bristles well developed and accompanied by short hairs; prothoracic spiracle brownish; metathoracic spiracle blackish-brown, with a reddish tinge in the middle; apicoscutellar and discoscutellar bristles 1 pair each, well developed; lateroscutellar bristles 2 pairs.

Wing : Hyaline, with brown veins; R_1 bare; R_{4+5} with 7-10 short setae located dorsally and extending to more than three-fifths the distance from the basal node to r-m and several setae on the ventral surface of the basal node of R_{4+5}; 5th sector of costa shorter than

the 3rd, the former with short spines on about four-fifths its length on anterior margin; costal spine stout; epaulet black, with short black spines; basicostal scale yellowish-brown; squama white; haltere brown.

Legs : Black; fore femur with two rows of bristles on posterodorsal surface (1st row with long and 2nd row with short bristles) and a row of long bristles along posterior margin of ventral surface; fore tibia with 3 short bristles on the basal part of anterodorsal surface and 1 bristle on posteroventral surface at about one-third the distance from the distal end; mid femur with a row of several short bristles medially on the anterolateral surface, 2 bristles each on distal part of posterodorsal and posteroventral surfaces, a row of short bristles along basal half of anteroventral surface, a row of short and long hairs on the basal half of posteroventral surface and a row of short spines each on distal half of anteroventral and posteroventral surfaces; mid tibia with 2 bristles almost medially on the anterolateral surface, 1 bristle on posterodorsal surface at about one-third the distance from the distal end, 2 short bristles posterolaterally on one-third the distance from the basal end and 1 bristle each on the anteroventral and posteroventral surfaces at one-third the distance from the distal end; hind femur with two rows of long bristles on anterodorsal surface, 1 bristle each distally on the dorsal and posterodorsal surfaces, numerous long hairs on posterior margin of ventral surface and about 5 long bristles and several

hairs along anterior margin of ventral surface; hind tibia with a row of bristles on anterodorsal surface, 2 bristles medially on posterodorsal surface, 1 bristles on distal one-fourth of anteroventral surface and two rows each of long hairs along anterior and posterior margins of ventral surface.

Abdomen : Black and silvery checkered pattern; 2nd tergite with only 1 pair of lateral marginal bristles; median marginal bristles on 3rd tergite well developed; 4th with a pair of median and three pairs of lateral marginal bristles, 5th with a well developed row of 12-14 marginal bristles; sternites 1 to 4 with well developed long, black hairs; 1st genital tergite brownish-black, without any marginal bristle; 2nd black, with long hairs; 5th sternite V-shaped, with a brush of stout spines on inner margin of each lateral arm; outer forceps almost subspherical, with numerous long hairs; inner forceps pointed apically with numerous long hairs in the basal half and a series of about 5-7 stout, comb-like spines in the distal half, anterior paramere bifurcated with short hairs on posterior side; posterior one long, slender and curved at apex; theca shorter than paraphallus, the latter much sclerotised; apical plate of paraphallus long, curved and membranous; lateral plate of paraphallus short, with thin processes; ventralia curved and serrated.

Female : Unknown.

Specimens examined : 11 ♂ ♂, West Bengal; Nadia; Hijli Forest (Ramaghat), 3.viii.1974, coll. B.C.Nandi; 7 ♂ ♂, Calcutta, Eden Garden, 25.viii.1975, coll. B.C.Nandi; 1 ♂, Calcutta, Zoo-Garden, 21.iii.1975, coll. B.C.Nandi; 1 ♂, Bankura, Panchubaga, 22.xi.1974, coll. B.C.Nandi; 1 ♂, Purulia, Sahebbandh, 18.xi.1974, coll. B. C. Nandi; 8 ♂ ♂, Purulia, Dulmi West, 14.xi.1973, coll. B.C.Nandi.

This species is being recorded for the first time from India.

Distribution : India : West Bengal : Nadia, Calcutta, Bankura, Purulia, Sri Lanka.

Bionomics : Nothing is known. The specimens described were collected from flowering plants.

Iranihindia futilis (Senior-White, 1924)

// Plate XXXX, Figs. 1-8 //

Sarcophaga futilis Senior-White, 1924, Rec. Ind. Mus., 26(3) : 246.

Iranihindia futilis (Senior-White), Rohdendorf, 1961, Stuttg. Beitr. Naturk., 88 : 2.

Male : Body length 9-11 mm.

Head : Width of frons about two-fifths that of eye; frontal vitta black, its width at narrowest point about two times the width of parafrontal; parafrontal black, with short hairs; parafacial blackish-brown, with silvery pollen and bearing 3-10 long hairs near

the eye margin. Antennae black, reaching to about 0.8 the distance to vibrissae; 1st segment black; 2nd brown (sometimes orange at tip); 3rd black, with white pollen, about three and a half times the 2nd; arista long, plumose on basal three-fifths; facial ridge blackish-brown, with short spine near the vibrissae; vibrissae long, crossed, distance between vibrissae almost equal to parafacial width; frontal bristles 9-10, arranged in a row on parafrontal, upper 2 reclinate, lower 3 below base of antennae and reaching to about the level of half the length of 2nd antennal segment, the rest decussate and directed forwards; gena black, with silvery pollen, with numerous short, black hairs on anterior half and whitish hairs on posterior half; postgena black, with long silvery hairs; ocellar triangle black, with three to four pairs of divergent hairs. Outer vertical absent; inner one well developed; postvertical short, about two-fifths the inner vertical; ocellar and postocellar bristles stout, one pair each; 1st row of postocular setae stout and regular, 2nd row with irregular black and white hairs, the rest of the area with silvery hairs; palpi slender, light brown; proboscis black.

Thorax : Black, with three black longitudinal stripes; ac 0 + 1; dc 5 + 5 (anterior three post dc weak); ia 1 + 2; pa 1; h 3; ph 2; np 4; sa 3; pa 2; st 1 + 1 + 1; mpl 6; npl 9; upper part of ptepleura bare, black; prestigmatic and propleural bristles well developed and accompanied by short hairs; pro- and metathoracic spiracles brown; apicoscutellar and discoscutellar bristles 1 pair each, the former short (sometimes well developed and crossed); lateroscutellar bristles 2 pairs.

Wing : Hyaline with brown veins; R_1 bare; R_{4+5} with 9-10 short setae located dorsally and extending to three-fourths the distance from the basal node to r-m; several short setae on ventral surface of basal node of R_{4+5}; fifth sector of costa equal to the third, the former with short spines at about three-fourths its length on anterior margin; costal spines stout; epaulet black, with short spines; basicostal scale yellowish; squama white; haltere brown.

Legs : Black; fore femur with two rows on bristles on posterodorsal surface and a row of long bristles on posterior margin of ventral surface; hind tibia with 3 short bristles on the basal part of anterodorsal surface and 1 bristle on posteroventral surface at about one-third the distance from the distal end; mid femur with a row of about 3-5 short bristles along the middle of anterolateral surface, 1 short bristle each on distal part of posterodorsal and posterolateral surfaces, a row of short setae on distal half and 3-4 bristles on the basal half of anteroventral surface, a row of setae on the distal half of posteroventral surface and long bristly hairs on ventral and posteroventral surfaces on basal half; mid tibia with 2 (sometimes 3) bristles medially on anterolateral surface, 1 bristle on posterodorsal surface at about one-third the distance from the distal end, 2 short bristles posterolaterally on basal half and 1 bristle each on distal one-third of anteroventral and posteroventral surfaces;

hind femur with two rows of long bristles on the anterodorsal surface, 1 bristle each on distal part of dorsal and posterodorsal surfaces, numerous long hairs on ventral surface and 1 bristle distally on anterior margin of ventral surface and 1 bristle medially; hind tibia with a row of bristles on anterodorsal surface, 2 long bristles medially on posterodorsal surface, 1 bristle on anteroventral surface at about one-third the distance from the distal end and a row of several long hairs on anterior and posterior margins of ventral surface at about two-thirds the distance from the distal end.

Abdomen : Black with silvery checkered pattern; 2nd and 3rd abdominal tergites with well developed median marginal bristles and the former in addition with a pair of lateral marginal bristles; 4th with a pair of median and 4 pairs of lateral marginal bristles; sternites 1st to 4th each with a tuft of numerous long hairs but without bristles; 5th sternite V-shaped, each arm with spines laterally and long hairs distally; 1st genital tergite black, without marginal bristles; 2nd brownish-black, with long hairs; outer forceps with numerous long hairs distally; inner one with long hairs on basal part and with a row of about 4-5 stout, comb-like spines on distal part; anterior paramere without bifurcation, pointed and curved at apex and with hairs on posterior side; posterior one pointed and curved at apex, with two hairs on anterior side; theca shorter than paraphallus both sclerotised; apical plate of

paraphallus long and pointed; styli of glans long and slender; ventralia curved, long and serrated.

Specimens examined : 1 ♂, West Bengal : Nadia, Ranaghat, 28.xi.1974, coll. B.C.Nandi; 3 ♂ ♂, Calcutta, Eden Garden, 25.vii. 1975, coll. B.C.Nandi; 3 ♂ ♂, Calcutta, Eden Garden, 3.vii.1975, coll. B.C.Nandi.

Distribution : India : West Bengal : Calcutta, Siliguri, Purulia, Nadia; Uttar Pradesh : Dehradun, Allahabad; Maharashtra: Nagpur; Orissa: Barkuda Island; Bihar : Chapra; Assam : Gauhati; Burma; Minbu; Sri Lanka; Kandy; Harbarane.

Bionomics : Nothing is known of the bionomics of this species. The specimens studied were collected from grasses and flowering plants. They were probably attracted to nectar.

Iranihindia jamesi, sp. nov.

// Plate XXXXI, Figs.1-6 //

Male : Body length 8-10 mm.

Head : Width of frons about one-third that of eye; frontal vitta black, its width at narrowest point about twice that of parafrontal; parafrontal and parafacial black, with silvery pollen and short hairs, the latter also with 3-4 long hairs below the eye margin. Antennae deeply brown (sometimes orange), reaching to about

0.85 the distance to vibrissae; 1st segment black; 2nd orange to red; third brown with silvery pollen, about three times the 2nd; (sometimes distal part of 2nd segment and basal part of 3rd segment reddish-brown); arista long, plumose on basal three-fifths; facial ridge brown, with short spines near the vibrissae; vibrissae long, crossed, distance between vibrissae more than the parafacial width; frontal bristles 10, arranged in a row on parafrontal, upper two reclinate, lower two below base of antennae reaching to about one-third the distance of 2nd antennal segment, the rest directed forwards. Gena black, with silvery pollen and bearing numerous short, black hairs on anterior half and long greyish hairs on posterior half; postgena black, with long silvery hairs; ocellar traingle black, with four pairs of divergent hairs; outer vertical absent; inner one well developed; postvertical short, about three-fifths the inner vertical; ocellar and postocellar bristles well developed; 1st row of postocular setae stout and regular, 2nd row irregular with black and white hairs, rest of the area with silvery hairs; palpi slender, light brown; proboscis blackish-brown.

Thorax : Blackish, with three black longitudinal stripes; ac 0 + 1; dc 5 + 5 (three anterior post dc weak); ia 1 + 2; pa 1; h 3; ph 2; np 4; sa 3; pa 2; st 1 + 1 + 1; mpl 6; hpl 8; upper part of propleura bare, blackish; prostigmatic and propleural bristles well developed and accompanied by short hairs; pro- and metathoracic spiracles brown; apicoscutellar and discoscutellar bristles 1 pair each, the former crossed, the latter short; lateroscutellar bristles 2 pairs.

Wing : Hyaline, with brown veins; R_1 bare, R_{4+5} with 9 short setae located dorsally and extending to three-fifths the distance from the basal node to r-m; several short setae present on ventral surface of basal node of R_{4+5}; fifth sector of costa slightly shorter than the third, the former with short spines along three-fifths of its length on anterior margin; costal spine stout; epaulet black, with short spines; basicostal scale yellow; squama white; halčere brown.

Legs : Black; fore femur with two rows of long bristles on posterodorsal surface and a row of long bristles on posterior margin of ventral surface; fore tibia with 3 short bristles on the basal part of anterodorsal surface and 1 bristle on posteroventral surface at about one-third the distance from the distal end; mid femur with a row of about 5 short bristles medially along middle portion of anterolateral surfaces, 1 bristle each on distal part of posterodorsal and posterolateral surfaces, a row of short setae on the distal half of anteroventral and posteroventral surfaces, a row of long hairs on ventral surface and 3-4 bristles on anterolateral surface; mid tibia with 2 bristles medially on anterolateral surface, 1 bristle on posterodorsal surface at about one-third the distance from the distal end, 2 short bristles posterolaterally at about half the distance from the distal end and 1 bristle each on distal one-third of anteroventral and posteroventral surfaces; hind

femur with two rows of long bristles on anterodorsal surface, 1 bristle each on distal part of dorsal and posterodorsal surfaces, 1 bristle distally on anterior margin and several long hairs along ventral surface; hind tibia with a row of long bristles on anterodorsal surface, 2 bristles on posterodorsal surface, 1 bristle on anteroventral surface at about one-third the distance from the distal end and and several long hairs on anterior and posterior margins of ventral surface at about two-thirds the distance from the distal end.

Abdomen : Black, silvery checkered pattern; 2nd abdominal tergite with a pair of lateral marginal bristles; 3rd with a pair of well developed median and 2 pairs of lateral marginal bristles; 4th with a pair of median and 3 pairs of lateral marginal bristles; 5th with a row of about 18-20 marginal bristles; sternites 1st to 4th with numerous long hairs but without differentiated bristles; 5th V-shaped, with a brush of spines laterally and long hairs distally on each arm; 1st genital tergite black, without marginal bristles; 2nd brownish-black, with long hairs; outer forceps with numerous long hairs; inner forceps of one side with long hairs basally and a row of 6 spines distally, the other with a double row of closely placed spines in the distal half; anterior paramere pointed at apex, with short hairs on posterior side; posterior one curved, pointed at apex, with short subbasal hairs on anterior

side; theca shorter than paraphallus, both chitinous; apical plate of paraphallus membranous, curved and blunt at apex, with pointed processes; lateral plate of paraphallus short, with elongated processes; styli of glans slender, not long; ventralis curved backwards and serrated.

Holotype : 1 ♂, West Bengal : Birbhum, Gampur Forest, 10.xi.1975, coll. B.C.Nandi, Paratypes : 1 ♂, data same as that of holotype; 2 ♂ ♂, Purulia, Ketka, 14.xi.1974, coll. B.C.Nandi.

Discussion : In its external features this species closely resembles A. martellatodes (Baranov) but differs from it in having a double row of spines in the distal half of one of the inner forcep, the styli of glans being long and in the structural details of anterior paramere.

Distribution : India : West Bengal : Purulia, Birbhum.

Bionomics : These specimens were collected by sweeping bushes near following plants

Iranihindia indica, sp. nov.

// Plate XXXXI, Figs.1-5 //

Male : Body length 9-15 mm.

Head : Width of frons about one-third that of eye; frontal vitta black, its width at narrowest point of front about twice that of parafrontal; parafrontal and parafacial black, with short black

hairs, the latter besides with 4 long hairs below the eye margin. Antennae brown, reaching to about 0.8 the distance to vibrissae; 1st segment blackish-brown; 2nd reddish-brown; 3rd brown, with silvery pollen, about three times the 2nd; arista long, plumose on basal three-fifths; facial ridge light brown, with silvery pollen and with short spines near the vibrissae; vibrissae long, crossed, distance between vibrissae more than the parafacial width; frontal bristles 9-11, arranged in a row on parafrontal, upper one reclinate, lower two below base of antennae and reaching and about one-third the length of 2nd antennal segment, the rest directed forwards; gena and postgena black, with silvery pollen and black hairs; ocellar triangle black, with four to five pairs of divergent hairs; outer vertical short; inner one well developed; postvertical short, less than half the inner one; ocellar and postocellar moderately developed; only one row of postocular setae present, which is black and regular, the rest of the area with black and white hairs but without differentiated setae; palpi slender, light brown; probescis black.

Thorax : Black, with three longitudinal stripes; ac 0 + 1; dc 5 + 5 (anterior three post dc weak); ia 1 + 3; pa 1; h 3; ph 2; np 4; sa 3; pa 2; mpl 7; hpl 9-11; upper part of propleura bare, black; prostigmatic and propleural bristles well developed and accompanied by short hairs; pro- and metathoracic spiracles black-

ish brown; apicoscutellar and discoscutellar bristles 1 pair each, the former short, crossed; lateroscutellar bristles 2 pairs.

Wing : Hyaline with brown veins; R_1 bare; R_{4+5} with 8-9 short setae located dorsally and extending to two-thirds the distance from the basal node to r-m; several short setae present on ventral surface of basal node of R_{4+5}; fifth sector of costa shorter than the 3rd, the former with short spines along two-thirds its length on anterior margin; costal spines stout; epaulet black, with short spines; basicostal scale yellowish; squama whitish; haltere brown.

Legs : Black; fore femur with two rows of long bristles on posterodorsal surface and a row of long bristles on posterior margin of ventral surface; fore tibia with 3 short bristles on the basal part of anterodorsal surface and 1 bristle on posteroventral surface at about one-third the distance from the distal end; mid femur with a row of about 5 short bristles along middle portion of posterodorsal and posterolateral surfaces, a row each of short setae on the distal half of anteroventral and posteroventral surfaces, a row of bristles on basal half of anterodorsal surface and a row of short and long hairs on basal half of posteroventral surface; mid tibia with 3 bristles medially on anterolateral surface, 1 bristle on posterodorsal surface at about one-third the distance from the distal end, 1 short bristle posterolaterally at about one-third the distance from the distal end and 1 short bristle

each on distal one-third of anteroventral and posteroventral surfaces; hind femur with two rows of long bristles on anterodorsal surface, 1 bristle each on distal part of dorsal and posterodorsal surfaces, several long hairs on anterior and posterior margins of ventral surface and 1 long and 3 short bristles on anterior margin of ventral surface on one-third the distance from the distal end; hind tibia with a row of long bristles on anterodorsal surface, 2 bristles medially on posterodorsal surface, 1 bristle on anteroventral surface at about one-third the distance from the distal end and a row of several long hairs on anterior and posterior margins of ventral surface at about two-thirds the distance from the distal end.

Abdomen : Black, silvery checkered pattern; 2nd and 3rd abdominal tergites without median but the former with 1 and the latter with 2 pairs of lateral marginal bristles; 4th with a pair of median and 3 pairs of lateral marginal bristles; 5th with a row of about 16 marginal bristles; sternites 1st to 4th each with a tuft of numerous long hairs but without differentiated marginal bristles; 5th V-shaped, with a brush of spines laterally and hairs distally on each arm; 1st genital tergite brownish-black, without marginal bristles; 2nd black, with long hairs; outer forceps somewhat spherical, with numerous long hairs; inner one with long hairs

on basal half and with one row of about 3 spines on distal half; anterior paramere bifurcated and hook-shaped at apex, with short hairs on posterior side; posterior one long, pointed, curved, with hairs on anterior side; theca shorter than paraphallus; apical plate of paraphallus membraneus, with backwardly curved processes; lateral plate of paraphallus with unequal processes, one of which is elongated and gradually pointed while the other is short, broad at base and abruptly pointed; styli of glans long and slender; ventralia curved and serrated.

Holotype : 1 ♂, West Bengal : Birbhum, Panchubaga, 22.xi.1974, coll. B.C.Nandi, Paratype 1 ♂, data same as that of holotype; 2 ♂♂ Midnapore, Salbani, 28.xi.1974, coll. B.C.Nandi; 1 ♂, Birbhum, Chandrapur Forest, 9.xi.1974, coll. B.C.Nandi.

Discussion : *L. indica* resembles *mertellateides* (Baranov) from which it differs in the processes of lateral plate of paraphallus being unequal and the styli of glans being comparatively long.

Distribution : India : West Bengal : Birbhum, Midnapore.

// SECTION - II //

SALIENT FEATURES OF SARCOPHAGID LARVAE

Larvae of different size and shape generally white in colour but in some cases reddish to brown; body segmented, cylindrical, tapering anteriorly and blunt posteriorly, and with or without spines or tubercles; spinose bands generally present on anterior and posterior borders; three pairs of dorsal and four pairs of ventral tubercles always present on last segment; outer ventral tubercle always smaller than the middle one; anterior spiracles present, except in 1st stage larvae, paired; posterior spiracles paired, always situated in a deep depression on the posterior plate; spiracular slits slender; peritreme open, divided into four arcs, the ends of inner arcs are of two types-one tapering or without a swollen end and the other with a swollen end - the inner arcs are straight or slightly curved; button absent; mouth hook separated, symmetric, articulates with H-shaped hypostomal sclerites; accessory sclerite absent; parastomal sclerite present; dorsal cornu distinctly longer than the ventral cornu, the former always with long and wide window. // Plate XXXXIII, Figs. 1-5 // (Typical immature forms)

KEY TO THE IMMATURE FORMS OF SARCOPHAGID LARVAE FROM WEST BENGAL

Key to Larval Instars

1.	Anterior spiracles present	... 2
	Anterior spiracles absent	... First instar
2.	Posterior spiracles with two slits each	... Second instar
	Posterior spiracles with three slits each	... Third instar

Key to First instar

1. Anterior spine bands on segment 12 confined only to ventral surface ... 2

   Anterior spine bands on segment 12 confined only to ventral and ventrolateral surfaces ... 4

2. Upper part of dorsal cornu well pigmented throughout; ventral cornu bifurcated at end ... 3

   Upper part of dorsal cornu only pigmented on lower part; ventral cornu pointed at end ... albiceps (Meigen)

3. Spine bands on segment 2 very broad on ventral surface ... ruficornis (Fabricius)

   Spine bands on segment 2 not broad on ventral surface ... orchidea (Böettcher)

4. Posterior spine bands on segments 5 to 6 confined to ventral and ventrolateral surface ... brevicornis (Ho)

   Posterior spine bands on segments 5 to 6 confined to ventral surface ... dux (Thomson)

Key to Second instar

1. Openings of anterior spiracles arranged in a single row ... 3

   Openings of anterior spiracles arranged in double or irregular rows ... 2

2. Distance between posterior spiracles about half to one-third the width of one spiracle; upper part of pharyngeal sclerite less pigmented ... 4

Distance between posterior spiracles about one-fourth the width of one spiracle; upper part of pharyngeal sclerites well pigmented ... dux (Thomson)

3. Posterior spiracles with well developed inner area ... rufiscrnis (Fabricius)

Posterior spiracles with ill developed inner area ... brevicornis (Ho)

4. Openings of anterior spiracles arranged in double rows ... orchidea (Boettcher)

Openings of anterior spiracles arranged in irregular rows ... albiceps (Meigen)

Key to Third Instar

1. Openings of anterior spiracles arranged in single row ... 2

Openings of anterior spiracles arranged in double or irregular rows ... 3

2. Window of dorsal cornu short and narrow; upper and lower margins of pharyngeal sclerite heavily pigmented ... 4

Window of dorsal cornu long and wide; upper and lower margins of pharyngeal sclerite poorly pigmented ... dux (Thomson)

3. Ventral arc prominently long and heavily pigmented; incision between cornua shallow ... albiceps (Meigen)

Ventral arc not so long, poorly pigmented; incision between cornua deep ... orchidea (Boettcher)

4. Ventral are long; ventral cornu about half the length of dorsal cornu ... ruficornis (Fabricius)

Ventral are short; ventral cornu two-thirds the length of dorsal cornu ... brevicornis (He)

Paragarcophaga (s.str.) albiceps (Meigen)

// Plate XXXXIV, Figs.1-8 //

First stage larva : White, muscidiform; length 2 to 2.3 mm., and diameter 0.6-0.8 mm; cuticle smooth; spines on segments prominent, dark brown; segments 1 to 11 each bordered anteriorly by a complete band of spines; anterior band of spines on segment 12 confined to ventral surface; band on segment 2 very broad; segments 6 to 14 each bordered posteriorly by a complete band of spines, posterior band on segments 5 to 6 confined to ventral and ventrolateral surface; larva metapneustic; prothoracic spiracles not functional but may be seen beneath the integument, especially before moult; posterior part of each spiracle, with two elongated spiracular openings lying side by side is situated in a hollow cavity; peritreme absent; posterior tubercles weakly developed.

Cephalopharyngeal skeleton : Labial sclerite long and heavily pigmented, about one-fourth as long as the pharyngeal sclerite; hook part as long as basal part, extending forwards slightly curved and pointed; basal piece elongated and almost blunt; hypostomal sclerite

long, broad posteriorly and pointed anteriorly; dental sclerite not separated from basal part of labial sclerite; parastomal sclerite broad and blunt at end; pharyngeal sclerite moderately developed and mostly pigmented on lower part; incision between dorsal and ventral cornua very broad; dorsal and ventral cornua pointed posteriorly, divergent and without any window; anterodorsal process of pharyngeal sclerite long, pointed, curved downwards.

Second stage larva : White, muscidiform, amphipneustic; length 6 to 8 mm., and diameter 0.7 to 1.5 mm.; cuticle smooth; spines on segments brown, not so prominent; anterior and posterior bands on segments 2 to 11 same as in first stage larva.

Anterior spiracles : Anterior spiracles located near posterior margin of 2nd segment; openings of the spiracle, with 20 to 24 branches, arranged in irregular rows, each terminating in a small oval spiracular opening.

Posterior spiracles : Posterior spiracles large, paired, higher than wide, each composed of two slit-like openings situated in a deep cavity just above the anal opening; inner projections of peritreme well developed; button absent; distance between posterior spiracles about one-fourth the width of one spiracle; ventral are curved and pointed.

Cephalopharyngeal skeleton : Labial sclerite long, heavily pigmented, about one-fourth as long as the pharyngeal sclerite; basal piece of mouth-hook four cornered, about two-thirds of hook part; hook part pointed and curved backwards; dental sclerite short, with pointed end; posterodorsal process of basal part long; hypostomal sclerite roughly rectangular, slightly narrowed, blunt anteriorly and pointed below; subhypostomal sclerite narrow and pointed; parastomal sclerite short and pointed; incision between cornua deep, not so broad; upper part of pharyngeal sclerite less pigmented on upper sides; ventral cornu almost two-thirds the dorsal cornu, the latter with long, wide longitudinal window; ventral cornu short and with long window; anterodorsal process of pharyngeal sclerite straight and pointed at apex.

Third stage larva : White, musciform; length 13 to 17 mm., and diameter 2 to 3 mm.; segments 3rd to 12th entirely covered with poorly pigmented spines; microtubercles on 3rd to 12th segments very small, knob-shaped, generally equal in size; tubercles on the last segment prominent and fleshy; inner and outer tubercles small and horn-shaped, middle one very small, one-fourth the outer dorsal tubercle; middle ventral tubercles more prominent and less pointed; inner and outer tubercles equal, conical in shape; anal tubercles stout, finger-like, longer than the tubercles of the last segment, surrounded by short spines; inner pair of ventral tubercles on upper border of anal segment separated by a distance almost equal to the distance between inner and outer tubercles.

Anterior spiracles : Anterior spiracles broad with 20 to 24 branches; openings of spiracles arranged in irregular rows.

Posterior spiracles : Posterior spiracles D-shaped, large, situated in a deep cavity, higher than wide; peretreme thin and open, with well developed projections between slits; slits long; button absent; inner are relatively straight and with loop-shaped tail not touching the inner slits; ventral are well developed and pointed; posterior spiracles separated by a distance one-third the width of one spiracle.

Cephalopharyngeal skeleton : Labial sclerite strongly developed and heavily pigmented; basal piece of mouth-hook four-cornered; hook part well developed, longer than basal part, pointed sharply downwards; posterodorsal process short and blunt; dentral sclerite strongly developed and pointed at end; hypostomal sclerite roughly rectangular, more narrowed anteriorly; parastomal sclerite almost pointed; subhypostomal sclerite nearly oval; upper margin of pharyngeal sclerite poorly pigmented; window of dorsal cornu long; ventral cornu less than half the dorsal cornu, with a short, weakly developed ventral window; the length of labial sclerite about one-fifth that of pharyngeal sclerite.

Puparium : Length 6 to 9 mm., and diameter 2.5 to 3 mm.; cylindrical in shape with tapering both ends; colour light brown; anterior spiracles with short stalks; posterior spiracles situated in

a deep cavity; spine bands on segments not so much prominent; no transverse bands are found between the segments.

Paragreophaga (s.str.) orchidea (Böettcher)

// Plate XXXXV , Figs. 1-5 //

First stage larva : White, muscidiform, metapneustic; length 2 to 3 mm., and diameter 0.5 to 0.6 mm.; cuticle smooth; spines on segments prominent, dark brown; segments 2 to 11 each bordered anteriorly by a complete band of spines; anterior band of spines on segment 12 confined to ventral surface; band on segment 2 not so broad; segments 6 to 11 each bordered posteriorly by a complete band of spines; posterior bands on segments 5 to 6 confined to ventral and ventrolateral surfaces; prothoracic spiracles not functional;posterior spiracles are situated in a hollow cavity and each consists of two elongated spiracular openings laying side by side; peritreme absent; posterior tubercles not so developed.

Cephalopharyngeal skeleton : Labial sclerite long, heavily pigmented, about one-fourth as long as pharyngeal sclerite; hook part, long, longer than the basal part, pointed and curved sharply; basal piece long and slightly pointed; hypostomal sclerite long, broad posteriorly and narrow anteriorly; dental sclerite pointed ventrally, not separated from basal part of labial sclerite; parastomal sclerite narrow, slightly pointed at apex; pharyngeal sclerite moderately developed and pigmented on the lower part; incision between dorsal and ventral cornua very broad; dorsal cornu pointed posteriorly; both are

convergent; anterodorsal process of pharyngeal sclerite long, pointed and slightly curved upwards.

Second stage larva : White, musciform, amphipneustic; length 6 to 8 mm., and diameter 1.5 to 2 mm.; cutiele almost smooth; spines on segments same as in first stage larva.

Anterior spiracles : Anterior spiracles near posterior margin of 2nd segment; openings of each anterior spiracle arranged in double rows with 28 to 30 branches, each terminating in a short oval opening.

Posterior spiracles : Posterior spiracles large, paired, each composed of two slit-like openings situated in a deep cavity, higher than wide; inner projections of peretreme short; distance between the posterior spiracles a little more than half the width of each spiracle; ventral arc not differentiated; inner arc almost straight.

Cephalopharyngeal skeleton : Labial sclerite very long, heavily pigmented, about one-fourth as long as the pharyngeal sclerite; basal piece of mouth-hook four-cornered and about two-thirds of hook part, pointed and slightly curved; dental sclerite short, with pointed apex distally; hypostomal sclerite roughly rectangular, slightly narrow anteriorly; subhypostomal sclerite narrow and slender; parastomal sclerite narrow and pointed; incision between cornu deep; upper part of pharyngeal sclerite less pigmented; ventral cornu about three-fourths the dorsal cornu, the former with a short and the latter with a long and wide window; anterior process of pharyngeal sclerite straight and pointed at apex.

Third stage larva : White, muscidiform; length 14 to 16 mm., and diameter 3 to 3.5 mm.; segments 3rd to 12th entirely covered with poorly pigmented spines; microtubercles on the 3rd to 11th segments conical and equal; tubercles on the last segment fleshy; each outer dorsal tubercle horn-shaped, large, more pointed and two times longer than the inner one and three times the middle one, middle ventral tubercles prominent and stout; outer ventral tubercles more pointed and conical; inner ventral tubercles on the upper margin of anal segment is separated by a distance equal to the distance between the inner and outer tubercles; anal tubercles long and pointed, longer than the rest of the tubercles on the last segment and surrounded by short spines.

Anterior spiracles : Anterior spiracles bread each with 28 to 30 branches; opening of spiracles are terminating in long oval spiracular openings and arranged in two rows.

Posterior spiracles : Each posterior spiracle D-shaped, large, situated in a deep cavity, higher than wide; peretreme thin, open and with well developed projections between slits; slits not so long; button absent; inner are long, straight and with loop-shaped tail not touching the inner slits; ventral are poorly pigmented; posterior spiracles separated by a distance about half the width of one spiracle.

Cephalopharyngeal skeleton : Labial sclerite strongly developed and heavily pigmented; basal piece of mouth-hook roughly four-cornered, hook part well developed, longer than basal part, pointed and curved backwards; posterodorsal process blunt; dental sclerite long and pointed at apex; hypostomal sclerite triangular almost pointed ventrally; parastomal sclerite long, blunt at apex and curved dorsally; subhypostomal sclerite long, pointed; upper margin of pharyngeal sclerite poorly pigmented; window of dorsal cornu very long and wide; ventral cornu about two-thirds the dorsal one, poorly pigmented ventrally, its ventral window long; anterodorsal process of dorsal cornu long, pointed and with bifurcated apex; the length of labial sclerite about one-fourth that of pharyngeal sclerite.

Puparium : Length 8 to 10 mm., and diameter 2.5 to 3 mm.; cylindrical in shape with more tapering on the posterior end than the anterior end; colour very light brown; anterior spiracles with short stalks; posterior spiracles situated in a deep cavity; spine bands on segments are prominent; transverse bands are not so much prominent between the segments.

Paraesarcophaga (Liosarcophaga) dux (Thomson)

// Plate XXXVI, Figs.1-8 //

First stage larva : White, muscidiform, metapneustic; length 2 to 2.5 mm., and diameter 0.4 to 0.5 mm.; spines on segments dark brown; segments 2 to 11 each bordered anteriorly by a complete band of spines; anterior band of spines on segment 12 confined to ventral

and ventrolateral surfaces; band on segment 2 is only broad ventrally; segments 5 to 11 each bordered posteriorly by a complete band of spines; posterior band on segments 5 and 6 confined to ventral surface; prothoracic spiracles not functional but may be seen beneath the integument especially before moult; posterior pair of spiracles situated in a hollow cavity, each consists of two elongated spiracular openings lying side by side; peritreme absent; posterior tubercles weakly developed.

Cephalopharyngeal skeleton : Labial sclerite large and heavily pigmented throughout; hook part as long as basal part, extending forwards, not so pointed and slightly curved; basal piece blunt; hypostomal sclerite short and curved posteriorly; dental sclerite short and curved, parastomal sclerite broad and blunt at apex; pharyngeal sclerite well developed and heavily pigmented; dorsal and ventral cornua pointed posteriorly, convergent; incision between the two broad; dorsal cornu with long longitudinal slits; anterodorsal process of pharyngeal sclerite long, pointed and curved ventrally.

Second stage larva : White; muscidiform, amphineustic, length 7 to 9 mm., and diameter 1 to 2 mm.; cuticle smooth; anterior and posterior bands on segments 2 to 11 same as in first stage larva.

Anterior spiracles : Anterior spiracles are arranged near posterior margin of 2nd segment; openings of anterior spiracles each with 16 branches and each terminating in an oval spiracular opening; spiracular openings are arranged in a row.

Posterior spiracles : Posterior spiracles large, paired, higher than wide, each composed of two slit-like openings situated in a deep cavity above the anal opening; inner projections of peretreme well developed; button absent; distance between the posterior spiracles about one-third the width of one spiracle; ventral are short; inner are long, curved and pointed.

Cephalopharyngeal skeleton : Labial sclerite very long, heavily pigmented about one-fourth as long as the pharyngeal sclerite; basal piece of mouth-hook four cornered its length half that of hook part, the latter pointed, curved backwards; dental sclerite curved and pointed at both ends; hypostomal sclerite roughly rectangular and narrowed anteriorly; subhypostomal sclerite narrow and pointed, parastomal sclerite long and blunt; incision between cornua not so broad; upper part of pharyngeal sclerite well pigmented; ventral cornu about two-thirds the dorsal cornu, the former with a short and the latter with a long longitudinal window; anterodorsal process of pharyngeal sclerite long, pointed at apex.

Third stage larva : Milky white, muscidiform; length 13 to 15 mm., and diameter 3.5 to 4 mm.; spine bands on anterior margin of segments 3 to 11 encircled completely; bands on 12 segment restricted to ventral surface; posterior margins of segments 5 to 11 each bordered by a complete band of spines; 5th and 6th in addition with a row on ventral surface and 7th and 8th on ventral and ventrolateral surfaces; tubercles on the last segment prominent and fleshy; inner and middle dorsal

tubercles blunt and short; outer dorsal tubercles long, two times the inner ones; ventral tubercles horn-shaped, equal to inner dorsal tubercles; inner ventral tubercles are placed on the upper border of anal segment, and one shorter than the middle ones; anal tubercles long, longer than the rest of the tubercles of the last segment and are surrounded by short spines.

Anterior spiracles : Anterior spiracles bread each with 16 branches, their openings are arranged in regular rows.

Posterior spiracles : Posterior spiracles D-shaped, large, nearly as wide as high, situated in a deep cavity; peritreme thin, open and with well developed projections between slits; slits not so long; button absent; inner are long, bifurcated at one end, with loop-shaped tail touching the inner slits; ventral are well developed and blunt at apex; posterior spiracles separated by a distance about one-fourth the width of one spiracle.

Cephalopharyngeal skeleton : Labial sclerite strongly developed and heavily pigmented; basal piece of mouth-hook three-cornered; hook part well developed, longer than the basal part, pointed and curved backwards; posterodorsal process present but not well developed; dental sclerite strongly developed, U-shaped; hypostomal sclerite roughly triangular, blunt at apex; parastomal sclerite triangular and blunt at end; subhypostoral sclerite long and slender; upper and lower

margins of pharyngeal sclerite poorly pigmented; window of dorsal cornu narrow; ventral cornu slightly longer than half the length of dorsal cornu and with a narrow window; the length of labial sclerite about one-fourth that of pharyngeal sclerite.

Puparium : Length 9 to 11 mm., and diameter 2.5 to 3 mm.; cylindrical in shape with tapering both ends; colour brown; anterior spiracles with short stalks; posterior spiracles situated in a deep cavity; spine bands on segments not so much prominent; numerous transverse bands are found between the segments.

Parasarcophaga (Liosarcophaga) brevicornis (He)

// Plate XXXVII, Figs. 1-8 //

First stage larva : White, muscidiform, metapneustic; length 2 to 2.3 mm., and diameter 0.5 to 0.7 mm.; cutiele smooth; spines on segments prominent, dark brown; segments 2 to 11 each bordered anteriorly by a complete band of spines; anterior band of spines on segment 12 confined to ventral and ventrolateral surfaces; band on segment 2 not so broad; segments 5 to 11 each bordered posteriorly by a complete band of spines; segments 5 and 6 in addition with a band on ventral and ventrolateral surfaces and segment 11 on dorsal and dorsolateral surfaces; prothoracic spiracles not functional but may be seen beneath the integument before moult; posterior pair of spiracles situated in a hollow cavity, each with two elongated spiracular openings lying side by side; peritreme absent; posterior tubercles weakly developed.

Cephalopharyngeal skeleton : Labial sclerite long, heavily pigmented, its length nearly one-third that of pharyngeal sclerite; hook-part as long as basal part, extended forwards and pointed abruptly at apex, basal piece elongated and pointed; hypostomal sclerite long and slender; dental sclerite short; parastomal sclerite not so broad, blunt at apex; pharyngeal sclerite less developed but well pigmented on lower part; dorsal and ventral cornua convergent, not so pointed, incision between the two wide, the dorsal with a wide longitudinal strip and the ventral bifurcated; anterodorsal process of pharyngeal sclerite not long, curved and pointed backwards.

Second stage larva : White, muscidiform, amphipneustic; length 7 to 9 mm., and diameter 1.5 to 2 mm.; cuticle smooth; spines on segments slightly brown, prominent; anterior and posterior spine bands on segments 2 to 11 same as in first stage larva.

Anterior spiracles : Anterior spiracles located near posterior margin of 2nd segment; openings of each anterior spiracle with 16 branches arranged in a single row, each terminating in a small oval spiracular opening.

Posterior spiracles : Posterior spiracles large, paired higher than wide, each composed of two slit-like openings situated in a deep cavity; inner projections of peritreme not developed; button absent; distance between posterior spiracles about one-third the width of one spiracle; ventral are absent.

Cephalopharyngeal skeleton : Labial selerite moderately long heavily pigmented, its length about one-fifth that of pharyngeal selerite; basal piece of mouth-hook three-cornered, about two-thirds the hook part; hook part not so pointed, slightly curved backwards; dental selerite short and nut shaped; posterodorsal selerite roughly triangular, broad anteriorly; subhypostomal selerite narrow and curved; parastomal selerite pointed; accessory selerite pointed and curved backwards; incision between cornu deep; upper part of pharyngeal selerite less pigmented; dorsal cornu with a long longitudinal window; ventral one with a short window; anterodorsal process of pharyngeal selerite curved and pointed at apex.

Third stage larva : White, muscidiform, amphipneustic; length 13 to 16 mm., and diameter 2 to 3 mm.; 2 to 11 with a complete band of spines on anterior border; bands on 12th segment restricted to ventral surface; posterior border of segments 7 to 11 encircled completely; segments 5 to 6 with the spines on posterior border restricted to ventral surface; tubercles on the last segment fleshy; inner and middle dorsal tubercles knob-shaped; outer dorsal tubercles large and conical; outer ventral tubercles not so pointed; middle ventral tubercles conical; microtubercles on segments 3 to 11 quite obscure on the dorsal surface but large on ventral and lateral surfaces; distance between inner tubercles is more than the distance between inner and outer tubercles.

Anterior spiracles : Anterior spiracles broad, each with 16 branches; openings of the spiracle arranged in a single row.

Posterior spiracles : Medium size, D-shaped higher than wide, situated in a deep cavity; peritreme relatively thin, open, with short projections between slits; slits not so long; inner are almost straight with loop-shaped tail not touching the inner slits; ventral are absent; posterior spiracles separated by a distance almost equal to the width of one spiracle.

Cephalopharyngeal skeleton : Labial sclerite strongly developed and heavily pigmented; basal piece of mouth-hook three-cornered; hook part well developed, long, pointed, length almost equal to that of the basal part; posterodorsal process blunt; dental sclerite short; hypostomal sclerite roughly rectangular, broad anteriorly; parastomal sclerite short and blunt; subhypostomal sclerite long and pointed; upper and lower margins of pharyngeal sclerite poorly pigmented; window of dorsal cornu long; ventral cornu about two-thirds the dorsal cornu and with a short window; the length of labial sclerite about one-fourth that of pharyngeal sclerite.

Puparium : Length 7-9 mm., and diameter 2.5 to 3 mm.; cylindrical in shape with tapering on posterior end and slightly rounded at anterior end; colour dark brown; anterior spiracles with long stalks; posterior spiracles situated in a deep cavity; spine bands on segments prominent; numerous transverse striations are found between the segments.

Parasarcophaga (Liopygia) ruficornis (Fabricius)

// Plate XXXXVIII, Figs. 1-8 //

First stage larva : White, muscidiform, metapneustic; length 2 to 2.4 mm., and diameter 0.4 to 0.6 mm.; cuticle smooth; spines on segments brown; segments 2 to 11 each bordered anteriorly by a complete band of spines; anterior band of spines on segment 12 confined to ventral surface; band on segment 2 very broad on ventral surface; segments 5 to 11 each bordered posteriorly by a complete band of spines; segments 5 to 7 in addition with a band on ventral surface; prothoracic spiracles not functional, posterior pair of spiracles situated in a deep cavity, each with two elongated spiracular openings placed side by side; peritreme absent; posterior tubercles weakly developed.

Cephalopharyngeal skeleton : Labial sclerite long, heavily pigmented, its length about one-fourth that of pharyngeal sclerite; hook part longer than basal part, extending forwards, pointed and curved abruptly backwards; basal piece elongated and pointed; hypostomal sclerite long, broad at posterior end and pointed anteriorly; dental sclerite not separated from basal part of labial sclerite, pointed ventrally; parastomal sclerite well developed; pharyngeal sclerite less pigmented specially on the dorsal side; dorsal cornu pointed posteriorly, ventral one bifurcated, both convergent and without any window; anterodorsal process of pharyngeal sclerite long and almost pointed.

Second stage larva : White, muscidiform, amphipneustic; length 5 to 7 mm., and diameter 1.5 to 2 mm.; anterior and posterior bands on segments 2 to 11 same as in first stage larva.

Anterior spiracles : Anterior spiracles are located near the posterior margin of 2nd segment; openings of each spiracle with 11 to 12 branches arranged in a single row, each branch terminating in an oval spiracular opening.

Posterior spiracles : Posterior spiracles large, paired higher than wide each composed of two slit-like openings situated in a deep cavity just above the anal opening; inner projections of peretreme short; button absent; distance between posterior spiracles about half the length of each spiracle; ventral are short; inner are long, curved and pointed at apex.

Cephalopharyngeal skeleton : Labial sclerite very long, heavily pigmented; basal piece of mouth-hook three-cornered, its length more than two-thirds that of hook part, hook part pointed and curved ventrally; posterodorsal process of basal part long and pointed; hypostomal sclerite rectangular, blunt at apex; subhypostomal sclerite narrowed posteriorly; parastomal sclerite long and pointed; incision between cornu deep and wide; upper part of pharyngeal sclerite less pigmented; ventral cornu about half the dorsal cornu, the latter with a short longitudinal window; window of ventral cornu not differentiated; anterodorsal process of pharyngeal sclerite pointed and hook-like.

Third stage larva : White, muscidiform, amphipneustic; length 14 to 17 mm., and diameter 4 to 4.5 mm.; each segment entirely covered with poorly pigmented spines; tubercles on the last segment fleshy; inner dorsal tubercles longer than the middle ones, both pairs horn-shaped; outer dorsal tubercles pointed, longer than the other two pairs, about two times the middle ones; inner ventral tubercles shorter than the middle ones; the distance between the inner ones less than that between the inner and outer ventral tubercles; outer and middle and ventral tubercles equal, the former longer than the inner ones and more pointed; anal tubercles long, pointed, surrounded by short spines.

Anterior spiracles : Anterior spiracles broad with 11 to 12 branches; openings of spiracles arranged in a single row.

Posterior spiracles : Posterior spiracles D-shaped, large, higher than wide and situated in a deep cavity; peritreme thin and open with well developed projections between slits; slits long and slender; button absent; inner arc long, straight, with a loop-shaped tail which does not touch the inner slits; ventral arc well developed and pointed; posterior spiracles separated by a distance of about one-eighth the width of one spiracle.

Cephalopharyngeal skeleton : Labial sclerite strongly developed and heavily pigmented; basal piece of mouth-hook three-cornered; hook part well developed longer than the basal part, pointed and

curved backwards; posterodorsal process short and almost blunt; hypostomal sclerite roughly triangular, more narrowed anteriorly; parastomal sclerite short and slender; upper and lower margins of pharyngeal sclerite poorly pigmented, with long black striations; window of dorsal cornu narrow; ventral cornu with a short weakly developed ventral window, its length about half that of dorsal cornu; the length of labial sclerite about one-fourth that of pharyngeal sclerite.

Puparium : Length 8 to 11 mm., and diameter 3 to 3.5 mm.; cylindrical in shape with tapering more on the anterior end than the posterior end; colour light brown; anterior spiracles with short stalks; posterior spiracles situated in a deep cavity; spine bands on segments prominent; no transverse striations are found between the segments.

V. SUMMARY

Distinguishing features of 15 genera, dealt with in this work, are given. Out of these Robineauella Enderlein, Keslevea Rohdendorf and Sinonipponia Rohdendorf are recorded for the first time from India.

Detailed description of 12 new species viz. Keslevea lopesi, Sarcophaga (Parkerimyia) indica, Sarcophaga (Parkerimyia) rohdendorfi, Seniorwhitea lopesi, Boettcheriosa bengalensis, Parasarcophaga (Liosarcophaga) josephi, Parasarcophaga (Curranea) kalimpongensis, Robineauella (Jantiella) kanoi, Sinonipponia bengalensis, Lioprotia midnaporensis, Iranihindia indica, I. jamesi are given.

The following 12 species are recorded for the first time from West Bengal : Pierretia (Asapletella) calcifera (Böettcher), Leucomyia cinerea (Fabricius), Sarcophaga (Parkerimyia) nathani Lopes and Kano, S. (Parkerimyia) crinita (Parker), Seniorwhitea krameri (Böettcher), Tricholioprotia flavinervis (Walker), T. pusana (Senior-White), Boettcheriosa nathani Lopes, Parasarcophaga (s.str.) hirtipes (Wiedmann), Parasarcophaga (Curranea) scoparifermis (Senior-White), Robineauella (Jantiella) cooi Rohdendorf, Iranihindia martellateides (Baranov).

Out of these S. (Parkerimyia) crinita (Parker), P. (Curranea) scoparifermis (Senior-White), R. (Jantiella) cooi Rohdendorf and I. martellateides (Baranov) are being recorded for the first time from India also.

Females of the following 9 species are described : T. pygmaea (Senior-White), B. haemorrhoidalis (Fallén), P. (s.str.) knabi (Parker) P. (s.str.) orchidea (Beettcher), P. (s.str.) albiceps (Meigen), P. (Liopygia) ruficornis (Fabricius), P. (Lioscrophaga) dux (Thomson), P. (Lioscrophaga) brevicornis (He), T. marmellata (Senior-White).

22 species are redescribed and their synonyms are given wherever necessary.

Bionomics of most of the species and their distributional records from world are included. Also included are Photographic plates of important body parts of 34 new and known species and the immature forms of 5 species.

A check list of the Indian species and their distributions has been given. Keys to and descriptions of the immature forms of the following 5 species are included, viz. P. (s.str.) orchidea (Beettcher) P. (s.str.) albiceps (Meigen), P. (Lioscrophaga) dux (Thomson), P. (Lioscrophaga) brevicornis (He) and P. (Liopygia) ruficornis (Fabricius).

All the references used in the text on the Taxonomy of the group are appended.

List of publications of the following species are included in a addenda : viz. Sarcophagomorpha (Parkerimyia) indica Nandi, S.(Parkerimyia) rohdendorfi Nandi, S. (Parkerimyia) nathani Lopes and Kano, S. (Parkerimyia) crinita (Parker) and Kosloves lopesi Nandi.

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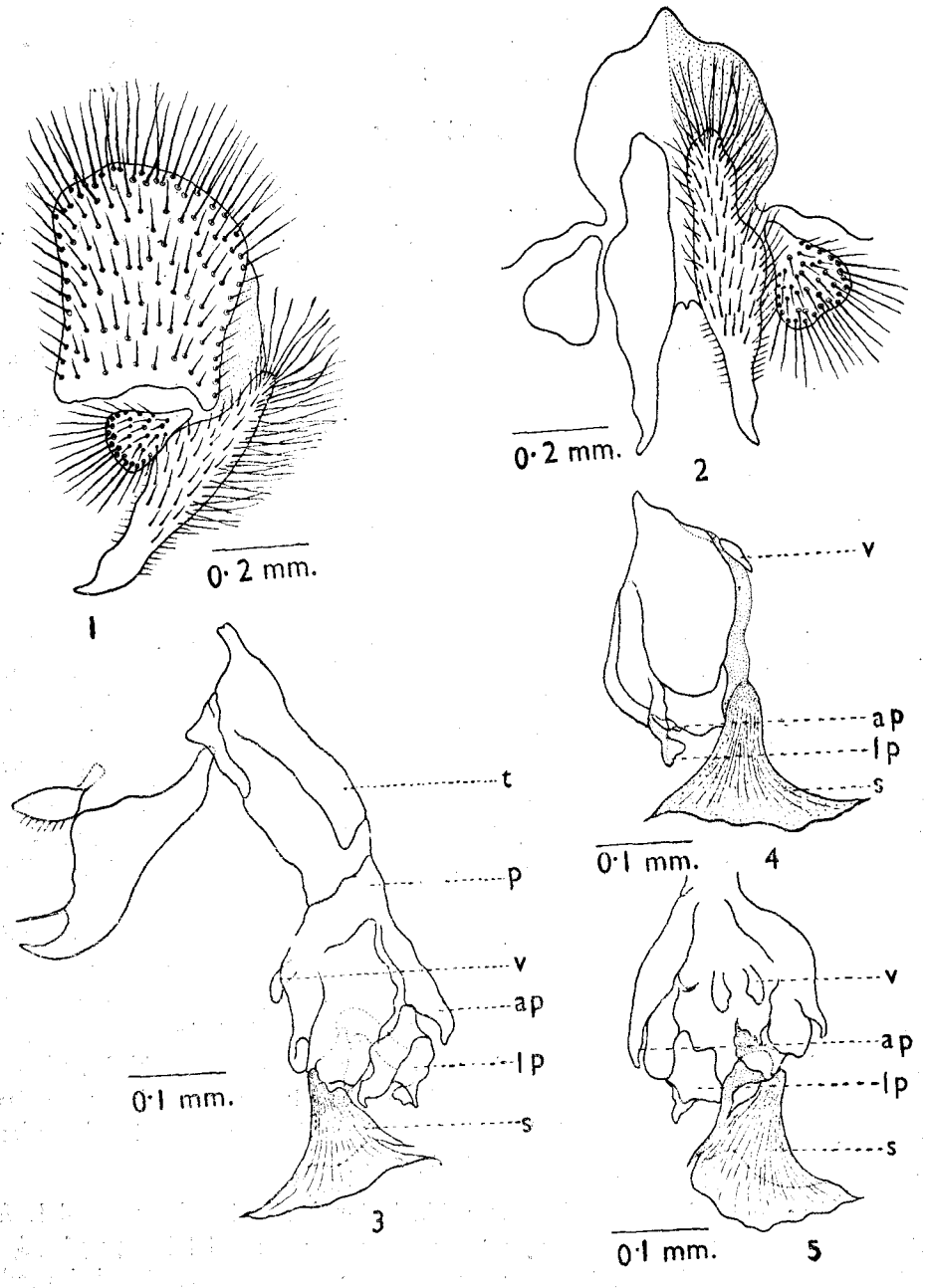
VII. LIST OF PUBLICATIONS OF THE AUTHOR

i. Two new species of *Sarcogelomenia* from India (Diptera : Sarcophagidae). *Oriental Ins.*, *10*(1) : 11-17 (Addendum-2)

ii. A new species of *Kuglerea* from North-West Himalaya (Diptera : Sarcophagidae). *Oriental Ins.*, *10*(3) : 369-372 (Addendum - 1)

// ADDENDUM - 1 //



Figs. 1-5. *Kozloveo lopesi*, sp. nov. : **1**, inner and outer forceps, lateral view; **2**, same, posterior view; **3**, penis, left side view; **4** same, right side view; **5** same, ventral view. (*ap*. apical plate of paraphallus, *lp*—lateral plate of paraphallus, *p*.—paraphallus, *s*—styli of glans, *t*—theca of penis, *v*—ventralia of penis).

Vol. 10 (3) : 369-372 ORIENTAL INSECTS September 1976

A NEW SPECIES OF *KOZLOVEA* FROM NORTH-WEST HIMALAYA (DIPTERA : SARCOPHAGIDAE)

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ABSTRACT. A new species, *Kozlovea lopesi*, is described. The genus is new to India.

Kozlovea Rohdendorf is hitherto known by only one species, *K. tshernovi* Rohdendrof, from South Mongolia. One new species is described here. This is also the first record of the genus from India. It appears that *Sarcophaga peshelicis* Senior-White may rightly belong to *Kozlovea*, but I do not commit myself to a definite decision till I see the type-specimen which is in the British Museum.

Type-specimen is deposited in the collection of the Zoological Survey of India.

Kozlovea lopesi, sp. nov. (Figs. 1-5)

Length : ♂, 10 mm.

Head : Frons about two-fifths the width of eye; frontal vitta brownish-black, at narrowest point of front more than twice the width of each frontal; parafrontal and parafacial blackish with silvery pollen and numerous irregularly scattered short black hairs, the latter with long hairs near the eye. Antennae black; 1st and 2nd segments black with short black hairs; 3rd light black with silvery pollen, length 2.5× that of the 2nd and reaching about 0.8 distance to vibrissae; arista long plumose on basal two-thirds. Vibrissae long, distance between vibrissae more than parafacial width; facial ridge black with white pollen and short black hairs; gena black with numerous black hairs; postgena black with long grayish hairs. Frontal bristles 13, arranged in a row on parafrontal, lower 7 inclinate, convergent of which the lowest 4 below base of antennae, lowermost one reaching about the tip of 2nd antennal segment, upper 6 reclinate. Ocellar triangle black with many long diverging black hairs; outer vertical present, inner ones well developed, post vertical short, one third the inner vertical; ocellar and post ocellar moderately developed; 1st row of post occular setae black and regular, behind which are irregular black and white hairs. Palpi slender, dark brown; proboscis black.

Thorax : Blackish-grey with three black longitudinal stripes; *ac* 0+1; *dc* 4+3; *ia* 1+2; *ps* 1; *h* 4 (1 short); *ph* 2; *np* 4; *sa* 4; *pa* 2; *st* 1+1+1; *mpl* 7; *hpl* 11; propleura brownish-black, bare; prostigmatic and propleural bristles well

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Published November 1976

ACKNOWLEDGMENTS. I am thankful to Dr. S. Khera, Jt. Director-in-charge and Shri K.S. Pradhan, of the Zoological Survey of India, Calcutta, for facilities for work. Dr. H.S. Lopes, Academia Brasileria de Ciencias, Rio de Janeiro, Brazil, very kindly confirmed the identity of the genus. I am grateful to Dr. B. Dasgupta, Prof. and Head of the Dept. of Zoology, Presidency College, Calcutta, for guidance and Dr. P.T. Cherian for going through the manuscript. The research Fellowship granted to the author by the Dept. of Science and Technology, Govt. of India is also duly acknowledged.

Abbreviations used in the text

ac—acrostichal bristles, *dc*—dorso central bristles, *h*—humeral bristles, *hpl*—hypopleural bristles, *ia*—intra—alar bristles, *mpl*—mesopleural bristles, *np*—notopleural bristles, *pa*—postalar bristles, *ph*—post humeral bristles, *ps*—presutural bristles, *sa*—supra-alar bristles, *st*—sternopleural bristles.

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BOOK-REVIEWS

1. AGRICULTURAL PESTS OF INDIA AND SOUTHEAST ASIA .*By* **A.S. Atwal. 1976. Published by Kalyani Publishers, Delhi & Ludhiana. Pp. i—x+1-502.**

Price Rs. 50.00

This book has been written primarily for students of Applied Zoology and Agricultural Entomology, as one giving concise account of the role of insects in Indian Agriculture and also for the benefit of agricultural students and workers in Southeast Asia. Apart from discussing the principles and methods of pest control, the biology, life-cycle and behaviour of individual pests are also given crop-wise. The integrated method of pest control has been emphasized and information given about cultural practices and natural enemies to minimise crop losses. There are chapters dealing with stored grain pests, house-hold pests, pests of farm animals and mammals and birds as pests of crops.

The book is well written and printed and should find a place on the shelves of all students of Agriculture and Entomology.

Continued on p. 376

developed and accompanied with small hairs; apicoscutellar and discoscutellar bristles 1 pair each, lateroscutellar bristles 2 pairs; pro-and meso-thoracic spiracles brown. *Wings :* Hyaline with blackish veins; R_1 bare; R_{4+5} with 8 short setae dorsally extending less than half the distance from the basal node to r-m and several short setae on ventral surface of basal node; 3rd section of costa about one and half times the length of the 5th, the latter with short spines about half its length proximally; basicostal scale yellowish-brown; costal spine not so stout; epaulet black with many short spines; squamma whitish; haltere brown. *Legs :* Black; fore femur with two rows of bristles on posterodorsal surface and a row of long bristles along posterior margin of ventral surface; fore tibia with 2 short bristles each at about basal one-third on the anterodorsal and posterodorsal surfaces; mid femur with a row of bristles on anterolateral surface medially, 2 bristles on posterodorsal and 1 bristle on posterolateral surfaces distally and a row of long bristles along basal half of anterior and posterior margins of ventral surface; mid tibia with 2 bristles each almost medially on anterolateral and posterolateral surfaces and with tuft of hairs on anterior and posterior margins of ventral surface; hind femur with two rows of long bristles on anterodorsal surface, 1 bristle on dorsal surface at one-fourth the distance from the distal end, numerous hairs and long bristles on anteroventral surface and a rows of short and long hairs on posteroventral surface; hind tibia with a row of bristles on anterodorsal surface, 2 bristles each on one-third and two-thirds distance from the basal end on posterodorsal surface and with tuft of hairs on anterior and posterior margins of ventral surface.

Abdomen : Black with silvery checkered pattern; median marginal bristles on 2nd and 3rd abdomninal tergites absent but with well developed lateral marginal bristles, 4th and 5th tergites only with a row of marginal bristles; sternites 1st to 3rd with black hairs, 4th with a row of apical bristles; 1st genital tergite brownish-black with a well developed row of 10 marginal bristles and with short hairs, 2nd genital tergites blackish without marginal bristles, but with tufts of long hairs; outer forcep somewhat elongated, inner ones with curved and pointed apex; anterior paramere short and blunt, posterior ones with curved and pointed apex; styli of glans long, bell shaped, membranous and apically situated; theca is shorter than the paraphallus, both much scalerotised; ventralia very small; apical plate of paraphallus reduced and curved, lateral plate chitinous and well developed.

Female : Unknown.

Holotype ♂, INDIA : H. P.: Chhatru, Spiti Valley in N.W. Himalya, 11,000 ft, Coll. A.P. Kapur, 16.vi.1955. (Type in Z. S. I., Calcutta).

Kozlovea lopesi differs from *tshernovi* Rohdendrof the only known species of the genus in the detailed structures of the ♂ genitalia. Moreover in *lopesi* there is a row of well developed marginal bristles on the 1st genital tergite which is lacking in *tshernovi.* The species is named after Dr. H. S. Lopes of Brazil.

// A D D E N D U M - 2 //

Vol. 10(1) : 11-17 ORIENTAL INSECTS March 1976

TWO NEW SPECIES OF *SARCOSOLOMONIA* FROM INDIA (DIPTERA : SARCOPHAGIDAE)

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ABSTRACT. Two new species, *Sarcosolomonia (Parkerimyia) rohdendorfi* and *S. (Parkerimyia) indica*, are described. *S. (Parkerimyia) crinita* (Parker) is recorded for the first time from India. A key to all the known Indian species is given.

Sarcosolomonia Baranov is a comparatively lesser known genus. Only one species *Sarcosolomonia (Parkerimyia) nathani* Lopes and Kano was hitherto known from India. Two new species are described here and *S. (Parkerimyia) crinita* (Parker) is recorded for the first time from India. A key to all the known Indian species is also added.

The type specimens are being deposited in the collection of the Zoological Survey of India, Calcutta.

Sarcosolomonia Baranov

Sarcosolomonia Baranov, 1938, *Veter. Arch. Zagreb*, **8** : 173. Type : *Sarcosolomonia tulagiensis* Baranov.

Bezziola Lopes, 1958, *Ins. Micron.*, **13** (2) : 24. Type : *Sarcophaga stricklandi* Hall and Bohart.

The genus has the following characters : Frontal bristles divergent anteriorly; parafacialia hairy or with bristles; propleura bare; presutural and anterior acrostichals differentiated, the latter sometimes short; distinct bristles present on abdominal sternites in both sexes; apical plate of paraphallus curved; styli of glans with elongated and slender lateral processes, protected by the apical projection of the paraphallus; ventralia well developed and membranous.

Sarcosolomonia (Parkerimyia) Lopes and Kano

Parkerimyia Lopes and Kano, 1969, *Pacif. Ins.*, **11**(1) : 181. Type : *Sarcophaga crinita* Parker.

The subgenus has the following characters : Median marginal bristles on 3rd abdominal tergite always absent; very much sclerotised ventralia; cerci with bifid apices, without subapical spines.

Published March 1976

KEY TO THE INDIAN SPECIES OF THE SUBGENUS *PARKERIMYIA*

1. R_1 bare, lateral plate of paraphallus reduced. . . . . 3. **rohdendorfi**, sp. nov.
   R_1 hairy, lateral plate of paraphallus well developed. 2
2. Ventralia short, with one lobe . . . . . 1. **crinita** (Parker)
   Ventralia elongated and trilobed. 3
3. Styli of glans shorter than the apical plate of paraphallus. . . . . 2. **nathani** Lopes and Kano
   Styli of glans longer than the apical plate of paraphallus. . . . . 4. **indica**, sp. nov.

1. Sarcosolomonia (Parkerimyia) crinita (Parker)

Sarcophaga crinita Parker, 1919, *Proc. U.S. Natl. Mus.*, **54** : 92.

Sarcosolomonia (Parkerimyia) crinita : Lopes & Kano, 1969, *Pacif. Ins.*, **11** (1) : 181.

INDIA : West Bengal : 24-Parganas, Baruipur, from grass sweeping, 1 ♂, 22.viii.1974, B.C. Nandi. This species is being recorded for the first time from India. Previously known from the Philippines.

2. Sarcosolomonia (Parkerimyia) nathani Lopes and Kano

Sarcosolomonia (Parkerimyia) nathani Lopes and Kano, 1969, *Pacif. Ins.*, **11** (1) : 184.

INDIA : Nilgiri Hills; West Bengal. I have three additional specimens of this species, all collected from West Bengal : Birbhum? Chandrapur Forest, from bush sweeping, 3♂♂, 9.xi.1974, B.C. Nandi.

3. Sarcosolomonia (Parkerimyia) rohdendorfi, sp. nov. (Figs. 1-3)

Male : Body length 8 to 10 mm.

Head : Frons about 0.28 of the width of head; frontal vitta black, at narrowest point of front about twice as broad as each frontal; parafrontals and parafacials light black with silvery pollen, the former with scanty black hairs near the eye margin and the latter with several black hairs on lower surface; antennae brown, reaching about 0.9 of the distance to vibrissae, lst segment blackish, 2nd brownish-black with black hairs, 3rd brownish with silvery pollen, length 3 times that of the 2nd, arista long plumose in the basal three-fifths; gena and post gena black, silvery pollinose, the former with black and the latter with numerous long yellowish hairs; frontal bristles 9-11, situated in a row on parafrontal, lower 3 below base of antennae reaching about the basal half of 2nd antennal segment, upper 3 reclinate, the rest directed inwards, divergent; ocellar and post ocellar bristles somewhat long, ocellar triangle with many divergent black hairs; outer vertical weak, inner vertical very stout, post vertical weak; back of head with two rows of cilia besides post ocular cilia which are prominent; palpi slender blackish-brown. *Thorax :* Grey, silvery pollinose, with three longitudinal black stripes; *ac* 5+1; *dc* 4+4; *ia* 1+3; *h* 3; *ph* 2; *np* 4; *sa* 3; *pa* 2; *st* 1+1+1; *mpl* 7; *hpl* 8; prostigmatic and propleural bristles well developed and accompanied by small hairs; apicoscutellar and

discoscutellar bristles 1 pair each, well developed; lateroscutellar bristles 2 pairs; propleura white, bare; mesothoracic spiracles brownish-black; metathoracic spiracles chocolate. *Wings :* Hyaline with brown veins; R_1 with short black setae extending almost the whole of the basal half dorsally; R_{4+5} with 10 short setae dorsally extending three-fifths the way from the basal node to r-m and several setae on the ventral surface of the basal node; 3rd section of costa slightly shorter than the 5th, the latter with short spines about three-fifths its length proximally; basicostal scale yellowish-brown; costal spine stout; epaulet black; squama whitish; haltere brown. *Legs :* Black; fore femur with two rows of long bristles on the posterodorsal surface and a row of bristles on the ventral surface; fore tibia with 3 short bristles on the basal part of anterodorsal surface, 3 bristles on the dorsal surface distally and 1 bristle posterolaterally at two-thirds the way from the basal end; mid femur with 4 short bristles along the middle portion of anterolateral surface, 3 bristles along the basal half of anteroventral surface, a row of bristles along the basal half of posteroventral surface and 2 bristles on distal part of posterolateral surface; mid tibia with 2 bristles medially on the anterodorsal surface, 2 bristles on one-third and 1 pair of bristles on two-thirds the distance from the basal end posterodorsally and 1 bristle on two-thirds the distance from the basal end posteroventrally; hind femur with two rows of bristles on anterodorsal surface (upper row with long and the lower with short bristles), several long bristles both on anterior and posterior margins of ventral surface and 2 bristles each on distal part of posterodorsal and posterolateral surfaces; hind tibia without tuft of cilia but with a row of 2 long and several short bristles on anterodorsal surface, 2 bristles on posterodorsal surface and 2 bristles (1 short) on anteroventral surface. *Abdomen :* Black, silvery checkered pattern, without median marginal bristles on 3rd tergite; several pairs of marginal bristles on 4th and 5th tergites well developed; 2nd, 3rd and 4th tergites with well developed lateral marginal bristles; 4th sternite with numerous long black hairs, others with short hairs; genital tergites black brown with black hairs but without marginal bristles; 5th sternite V- shaped, with 3 to 4 bristles on hind margin of each lateral arm and small spines on inner margin of each arm; cerci with a nearly bifid apex of which one lobe is very blunt, almost inconspicous, while the other is well developed and pointed at tip, subapical spine absent; apical plate of paraphallus long, nearly pointed apically, with subbasal membranous processes; lateral plate of paraphallus short; styli of glans long and slender; ventralia small, very much sclerotised, not lobed; parameres without hairs.

Female : Unknown.

Holotype ♂, INDIA : WEST BENGAL : 24-Parganas, Hijli Forest, from bush sweeping near flowering plants, 28.ix.1974, B.C. Nandi; ♂ genitalia mounted on triangular paper board attached to the same pin. *Paratypes* 3♂♂, same data as the holotype. (In Z.S.I., Calcutta).

Distribution : India : West Bengal.

This species closely resembles *Sarcosolomonia* (*Parkerimyia*) *crinita* (Parker) from which species it differs in the presence of well developed acrostichal bristles and in the structural details of the 5th sternite and the genitalia. Moreover in this species R_1 is with hairs.

This species is named after Prof. B.B. Rohdendorf.

4. Sarcosolomonia (Parkerimyia) indica, sp. nov. (Figs. 4-6)

Male: Body length 10mm.

Head: Frons about 0.24 of the width of head; frontal vitta blackish-brown and at narrowest point of front almost half the frontal; parafrontals and parafacials black with silvery pollen and scattered black hairs; antennae brownish-black, reaching about 0.8 the distance to vibrissae, first two segments black, the latter with black hairs, 3rd brownish-black with silvery pollen, length 2.5 times that of the 2nd, arista long plumose in the basal half; gena and post gena black, silvery pollinose, the former with black and the latter with long silvery whitish hairs; frontal bristles 11, situated in a row on parafrontal, lower 4 below base of antennae, reaching the level of the end of 2nd antennal segment, upper 2 reclinate, the rest directed inwards, divergent: ocellar and post ocellar bristles long, ocellar triangle with four pairs of divergent black hairs; outer vertical absent, inner vertical very stout, post vertical slender; back of head with two rows of cilia besides postocular cilia; palpi slender, black. *Thorax:* Shiny greyish-black, silvery pollinose with three longitudinal black stripes; *ac* 5+1; *dc* 4+4; *ia* 1+3; *h* 3; *ph* 2; *np* 4; *sa* 3; *pa* 2; *st* 1+1+1 (middle one short); *mpl* 7; *hpl* 10; prostigmatic and propleural bristles well developed and accompanied by small hairs; apicoscutellar and discoscutellar bristles 1 pair each, well devleped; lateroscutellar bristles 2 pairs; propleura white, bare; mesothoracic spiracles brownish-black; metathoracic spiracle black. *Wings:* Hyaline with dark brown veins; R_1 without hairs or setae; R_{4+5} with about 9 short setae dorsally extending three-fifths the way from the basal node to r-m and a few setae on the ventral surface of the basal node; 3rd section of costa shorter than the 5th, the latter with short spines in the basal half; basicostal scale yellow; costal spine stout; epaulet black; squama white; haltere brown. *Legs:* Black; fore femur with two rows of long bristles on the posterodorsal surface and a row of bristles on the ventral surface; fore tibia with 2 short bristles on the basal part of anterodorsal surface, 2 bristles on the dorsal surface distally and 1 bristle posterolaterally at two-thirds the way from the basal end; mid femur with 4 bristles along the middle portion of anterolateral, 4 bristles along the basal half of anteroventral, a row of bristles along the basal half of posteroventral and 2 bristles on distal part of posterolateral surfaces; mid tibia with 1 bristle medially on the anterodorsal surface, 1 bristle each on one-third and two-thirds the distance from the basal end posterodorsally and 1 bristle each two-thirds from the basal end on the

posteroventral and anteroventral surfaces; hind femur with two rows of bristles on anterodorsal surface (upper row with long the lower with short bristles), several long bristles both on anterior and posterior margins of ventral surface and 2 long bristles each on distal part of posterodorsal and posterolateral surfaces; hind tibia without tuft of cilia but with a row of 3 long and several short bristles on anterodorsal surace, 2 bristles each on one-third and two-thirds distance from the basal end on the posterodorsal surface and 1 long and several short bristles on middle part of anteroventral surface. *Abdomen :* Black, silvery checkered pattern, without median marginal bristles on 3rd tergite; several pairs of marginal bristles on 4th and 5th tergites well developed; 2nd, 3rd and 4th tergites with well developed lateral marginal bristles; sternites with long black hairs; genital tergites black-brown, without marginal bristles but with black hairs; 5th sternite V- shaped, with 2 long bristles on hind margin of each lateral arm and with somewhat stout spines on inner margin of each arm; cerci curved, without spine at the apex, apex bifid; apical plate of paraphallus with long and pointed apex and with subbasal membranous processes; lateral plate of paraphallus long and pointed; styli of glans very long, slender, and whip-like; ventralia much sclerotised, with 3 arms; anterior paramere without hairs, posterior ones with long hairs basally.

Female : Unknown.

Holotype ♂, INDIA : WEST BENGAL : Midnapore, Arabari Forest, from bush-sweeping, 26.xi.1974, B.C. Nandi; ♂ genitalia mounted on triangular paper board attached to the same pin.

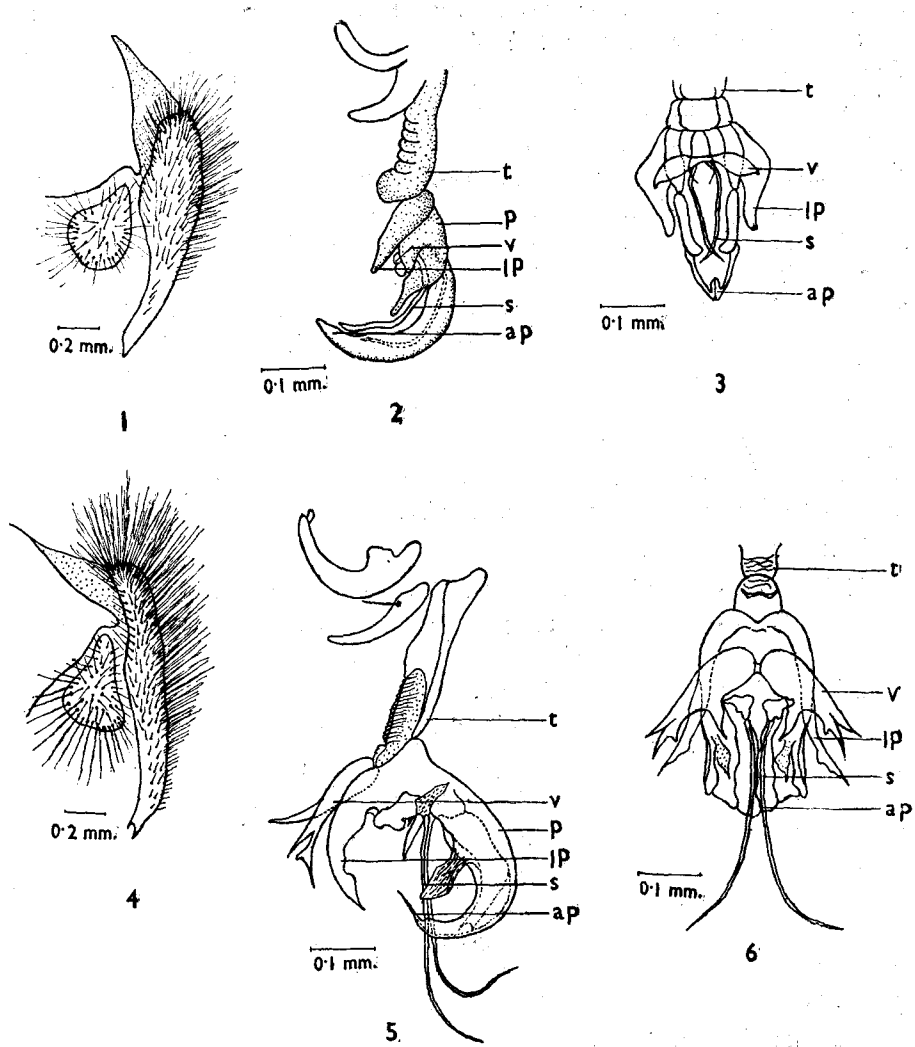
Distribution : India : West Bengal.

This species closely resembles *Sarcosolomonia (Parkerimyia) nathani* Lopes and Kano, but differs in the colour of antennae and the structural details of ventralia and the lateral plate of paraphallus. Moreover in this species the styli of glans are longer and whip-like.

ACKNOWLEDGMENTS. I am extremely grateful to Dr. B. Dasgupta, Prof. and Head of the Dept. of Zoology, Presidency College, Calcutta for the very valuable guidance received at all stages of the work. I express my gratitude to Dr. S. Khera, Deputy Director-in-Charge and Shri K.S. Pradhan, Superintendent Zoologist, Zoological Survey of India, Calcutta for permission granted to work out the material and to Dr. H.S. Lopes, Academia Brasileira de Ciencias, Rio de Janeiro, Brasil for valuable suggestions. My sincere thanks are due to Dr. A.N.T. Joseph for manifold help and to Dr. P.T. Cherian for critically going through the manuscript. The research fellowship granted to the author by the Dept. of Science and Technology, Govt. of India is also duly acknowledged.

Abbreviations used in the text

ac-acrostichal bristles, *dc*- dorsocentral bristles, *ia*-intra-alar bristles, *h*-humeral bristles, *ph*-posthumeral bristles, *np*-notopleural bristles, *sa*-supra-alar bristles, *pa*-postalar bristles, *st*-sternopleural bristles, *mpl*-mesopleural bristles, *hpl*-hypopleural bristles.



Figs. **1-3.** *Sarcosolomonia (Parkerimyia) rohdendorfi*, sp. nov. : **1**, cercus, lateral view; **2**, penis, lateral view; **3**, penis, ventral view. Figs. **4-6.** *Sarcosolomonia (Parkerimyia) indica*, sp. nov. : **4**, cercus, lateral view; **5**, penis, lateral view; **6**, penis ventral view. *Abbreviations : ap*-apical plate of paraphallus, *lp*-lateral plate of paraphallus, *p*-paraphallus, *s*-styli of glans, *t*-theca of penis, v-ventralia of penis, lateral plate.

REVIEW

MYCOPHAGOUS TUBULIFERA OF INDIA (THYSANOPTERA). By *T.N. Ananthakrishnan*. Occasional Publication No. 2 of the Entomology Research Unit, Loyola College, Madras. 144 pp., 51 text-figs., 15 pls., Figs. A-K. Published August 1973. (Not priced).

"Mycophagous Tubulifera" is the culmination of an extensive study of fungus-feeding thrips from different parts of India by Dr. Ananthakrishnan, over the past decade and more. 135 species are treated under 60 genera.

The status of our knowledge of fungus spore-feeding thrips in India, and their ecology are discussed. Keys to the genera and species of mycophagous Tubulifera (Phlaeothripidae) are given. Under each genus a set of diagnostic features are given. Characterisation of species is given in those cases where there is only one species included in a genus. Brief diagnoses of species in polytypic genera, and a subject and species index would have been useful.

Some nomenclatural changes have been suggested : *Bactrothrips* Karny (=*Bactridothrips* Karny), *B. idolomorphus* Karny (=*serraticornis* Bagnall); *Dinothrips sumatrensis* Bagnall (=*jacobsoni* Karny, *gardneri* Moulton, *malloti* Moulton). *Bactrothrilpsuteus* is described as a new species. *Elaphrothrips crassiceps* Bagnall is transferred to *Elaphridia* Anan., and *agasthaya* Ram. is synonymised under this species. The decision however conflicts with Mound's (1968) treatment of Bagnall's species.

Dr. Ananthakrishan in the present work gives a correlated account of patterns of heterogonic growth or oedymerism in the male sex. He divides the phenomenon of oedymerism into two broad patterns, the *monophasic* (unitary) trend where only one character is affected, and the *polyphasic* (multiple) trend where positive allometric growth affects several parts of the body. The structural peculiarities of morphs of either sex associated with wing development are also discussed.

The stress is on the phenotypic plasticity of species. An obvious question that remains unanswered, however, is as to whether these structural variables represent random fluctuations in natural populations or some of these could be correlated with ecological, geographical or other factors.

It has been suggested (p. 138) that "selection will act on extreme phenotypes." If this means (as it appears) that selection weeds out extreme forms (maximum oedymerous and maximum gynaecoid), then such forms should be rare. Yet the author stresses the common occurrence of extremes in most cases where sufficient population sampling has been done ! Evidence has been brought forth from rearing work in one species (*Ecacanthothrips sanguineus*) that heterogony is equally reflected in the adults resulting from larvae reared on variable diets. The effects of environment (including food) is thus not proven, leading to the conclusion that possibly intrinsic genetic mechanisms alone are responsible for variable phenotypic expression.

There are a few inadvertent errors like "*Bactridothrips*" (instead of *Bactrothrips*) on page 8, the caption of fig. 5 (p. 25) as *Callothrips indicus* (instead of *C. ascitus*), the missing first reference on p. 125, the genus and subgenus names written with a small first letter on p. 97, etc. The name *Elaphrothrips beesoni* Ram. 1934 (p. 99) is used instead of its senior synonym *greeni* Bagnall 1914. The nomenclature of the classification of patterns of oedymerism given in the chart on p. 139 conflicts with the discussion on pages 133 and 135. The statement that "all characters of individuals of a species are highly polygenic" (p. 138) is not substantiated.

The monograph provides a useful and authentic summary of the work on Indian mycophagous Tubulifera. This work can serve as a basic framework and should give an impetus for undertaking research in this interesting field of entomology.

J.S. BHATTI

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PLATES AND

VIII. EXPLANATIONS OF THE PLATES

PLATE - 1 // Figs. 1-3 //

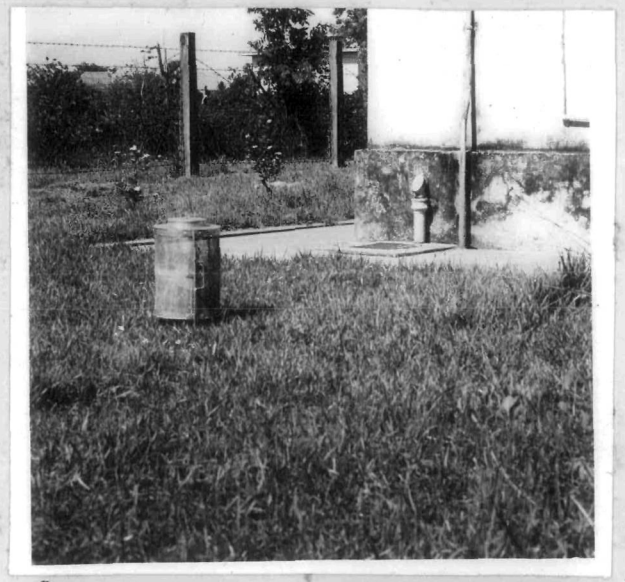
1. Map showing the collection localities in the diestricts of West Bengal, India

   1. Zoo-Garden (Calcutta), 2. Budge Budge, 3. Baruipur, 4. Canning, 4. Diamond Harbour, 5. Lakshmikantapur 7. Rudranagar (Sagar Island), 8. Bongaon, 9. Botanical Garden (Howrah), 10. Sankrail, 11. Digha Mohana, 12. Salbani, 13. Arabari Forest, 14. Ajodhya Forest, 15. Matha and Digha Forest. 16. Sahebbundh (Purulia), 17. Bishnupur, 18. Bankura 19. Susunia Forest, 20. Tarakeswar, 21. Burdwan, 22. Hijli Forest (Ranaghat), 23. Suri D.F.O. Campus, 24. Gonpur Forest, 25. Charicha Forest, 26. Berhampore C.S.R.S. Campus, 27. Hazarduari and Golapbagh, 28. Gour, 29. Malda, 30. Raiganj 31. Kernajhora, 32. Dimhata, 33. Chilapata Forest, 34. Joyanti forest, 35. Madarihat, 36. Gorumara Forest and Chalsa, 37. Rajabhatkhowa Forest, 38. Algara, 39. Teesta Bazar, 40. Nakxalbari, 41. N.B.U.Campus, 42. Dow-Hill (Kurseong), 43. Kalimpong, 44. Bijanbari, 45. Lebong, 46. Zoological Park (Darjeeling).

2. Collection spot with the help of bait trap at Berhampur, C.S.R.S. Campus.

3. Collection spot with the help of bait trap at deep forest area (Jalpaiguri).

PLATE I



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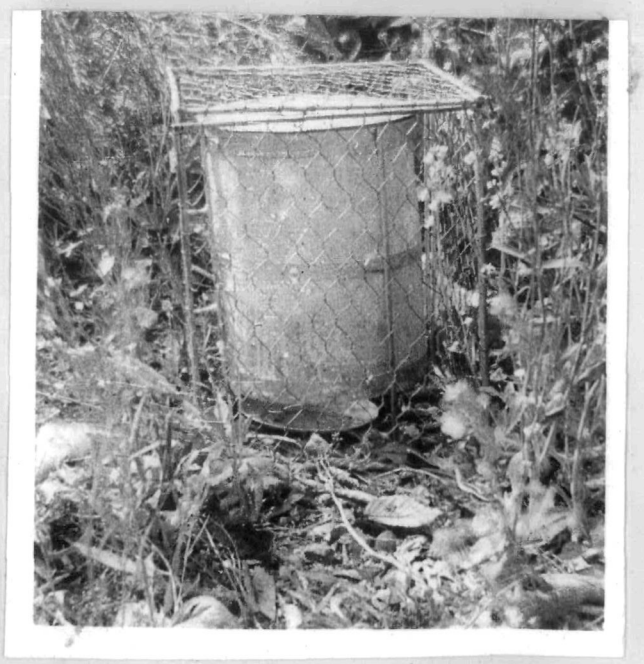

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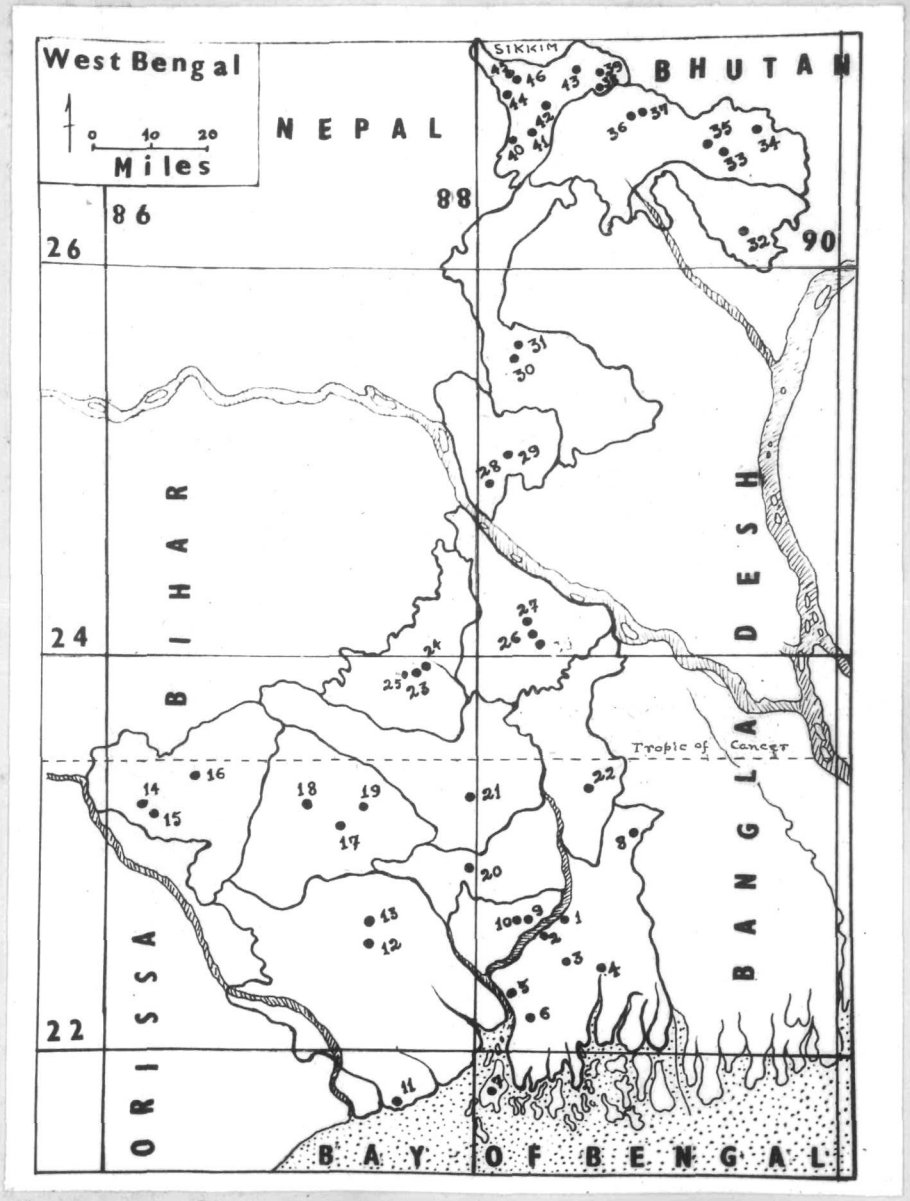


Fig 1

PLATE - 11 A // Figs. 1-4; A. //

Abbreviation used in the text and figures

1. Frontal view of male head; an. antennae, ce. compound eye; f. face; fob. fronto-orbital bristle, fr. frons, frd. facial ridge, fv. frontal vitta, g. gena, iv. inner vertical, l. lunula; ob. orbital bristle, ocr. ocellar triangle, ov. outer vertical, pfa. parafacial, pfab. parafacial bristle; pfr. parafrontal, pfrb. parafrontal bristle; pg. post gena; poc. postocellar bristle, pa. peristome, pts. ptilinal suture, pv. post vertical, v. vertex, vbr. vibrissae.

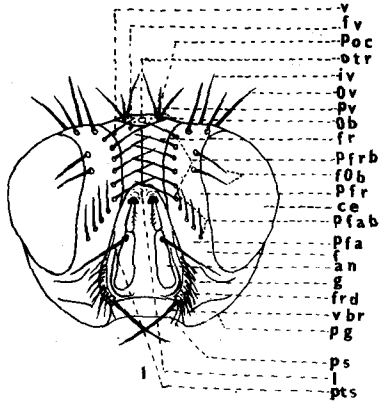
A. Adult flesh fly

2. Lateral view of male head : an_1. first antennal segment, an_2. second antennal segment, an_3 third antennal segment, ar. arista, ce. compound eye, fr. frons, g. gena, hstl. haustellum, iv. inner vertical, la. labella, ob. ocellar bristle, oc. occiput, ov. outer vertical, pa - palpi, poc. postocular cilia, pfa. parafacial, pfr. parafrontal, pg. post gena, poc. postocellar bristle, pos. postocular setae, pr. proboscis, pv. post vertical rst. rostrum, vbr. vibrissae

3. Lateral view of thorax : h. humerus, hc. haltere, hb. humeral bristle, hplb. hypopleural bristle, mpl. mesopleuron, mplb. mesopleural bristle, mtsp. metathoracic spiracle, npb. notopleural bristle, prob. propleuron, prepb. propleural bristle, prsb. prestigmatic bristle, prosp. prothoracic spiracle, psc. postscutellum, ptpl. pteropleuron, sc. scutum, sct. scutellum, splb. sternopleural bristle.

4. Dorsal view of thorax : acb. acrostichal bristle, apscb. apicoscutellar bristle, dcb. dorsocentral bristle, dscb. discoscutellar bristle, hb. humeral bristle, imb. intra-alar bristle, lscb. lateroscutellar bristle, npb. notopleural bristle, phb. post-humeral bristle, psb. presutural bristle, pab. post-alar bristle, shb. post-humeral bristle, psb. presutural bristle, sab. supra-alar bristle.

PLATE IIA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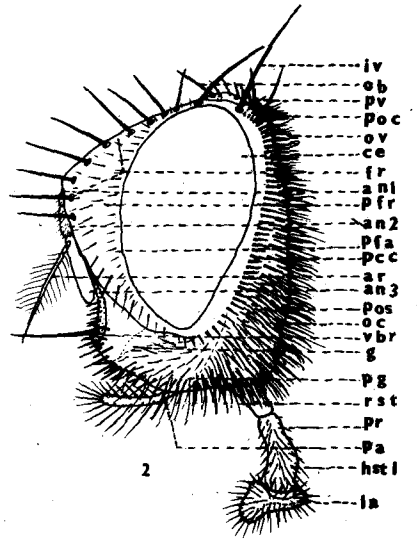
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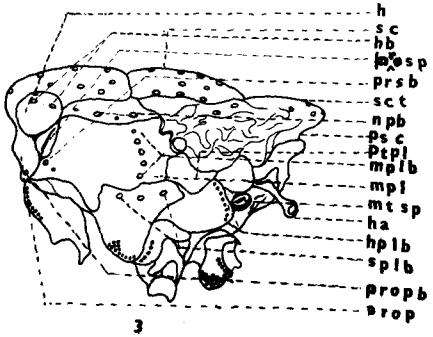
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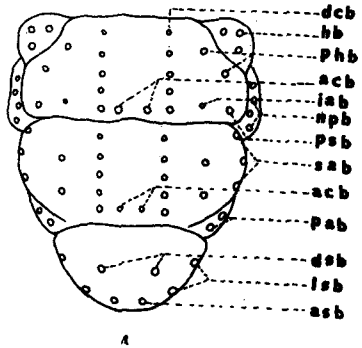
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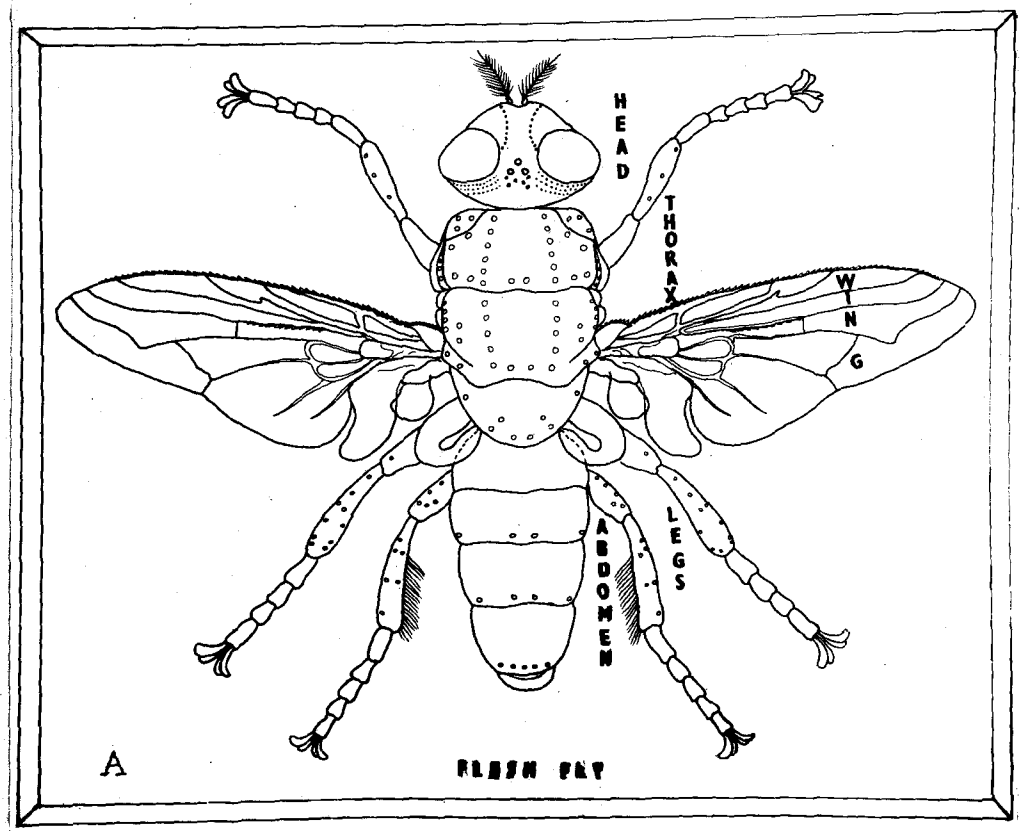

HEAD
THORAX
WING
ABDOMEN
LEGS
A
BLOW FLY

PLATE - 11 B // Figs.1-7 //

1. Male genitalia (lateral view) : AP. anterior paramere, G1. 1st genital tergite, G2. 2nd genital tergite, if. inner forcep, mb. marginal bristle, of. outer forcep, P. penis, PP. posterior paramere

2. Penis (lateral view) : AP. apical plate of paraphallus, LP. lateral plate of paraphallus, P. paraphallus, Pa. apophysis of apical plate of paraphallus, s. styli of glans, t. theca, V. ventralia

3. Penis (ventral view): same as in Fig.2.

4. 5th sternite of male : b. brush of spine, s. stout spine

5. Sternites of female abdomen (Ventral view) : S1. 1st sternite, S2. 2nd sternite, S3. 3rd sternite, S4. 4th sternite, S5. 5th sternites

6. Female genitalia (ventral view) : ag. anal sternite, f. 6th sternite, g. 7th sternite, h. 8th sternite, k. 7th tergite.

7. bh. basal half, dh. distal half

PLATE - 11 A // Figs. 8-9 //

8. 5. Wing : A. 1st anal vein, A2. 2nd anal vein, bsc. basi costal scale, c. costa, e. epaulet, III. third sector of costa, V. fifth sector of costa, hv. humeral crossvein, m. medial crossvein, r-m. radio-median cross vein, sc. subcosta, w. wing.

6. Posterior view of leg : C. coxa, db. dorsal bristle, F. femur, pdb. posterodorsal bristle, plb. posterolateral bristle, pvb. posteroventral bristle, T. trochanter, Ta. tarsus, Ti. tibia.

7. Anterior view of leg : adb. anterodorsal bristle, alb. anterolateral bristle, avb. anteroventral bristle c. coxa, db. dorsal bristle, F. femur, T. trochanter, Ta. tarsus, Ti. tibia

8. Lateral view of male abdomen : G1. 1st genital tergite G2. 2nd genital tergite, if. inner forcep, of. outer forcep, P. paraphallus, S1. 1st sternite, S2. 2nd sternite, S3. 3rd sternite, S4. 4th sternite, S5. 5th sternite, T1. 1st tergite, T2. 2nd tergite, T3. third tergite, T4. 4th tergite, T5. 5th tergite.

9. Ventral view of male abdomen : abbreviation same as in Fig.8.

PLATE IIB

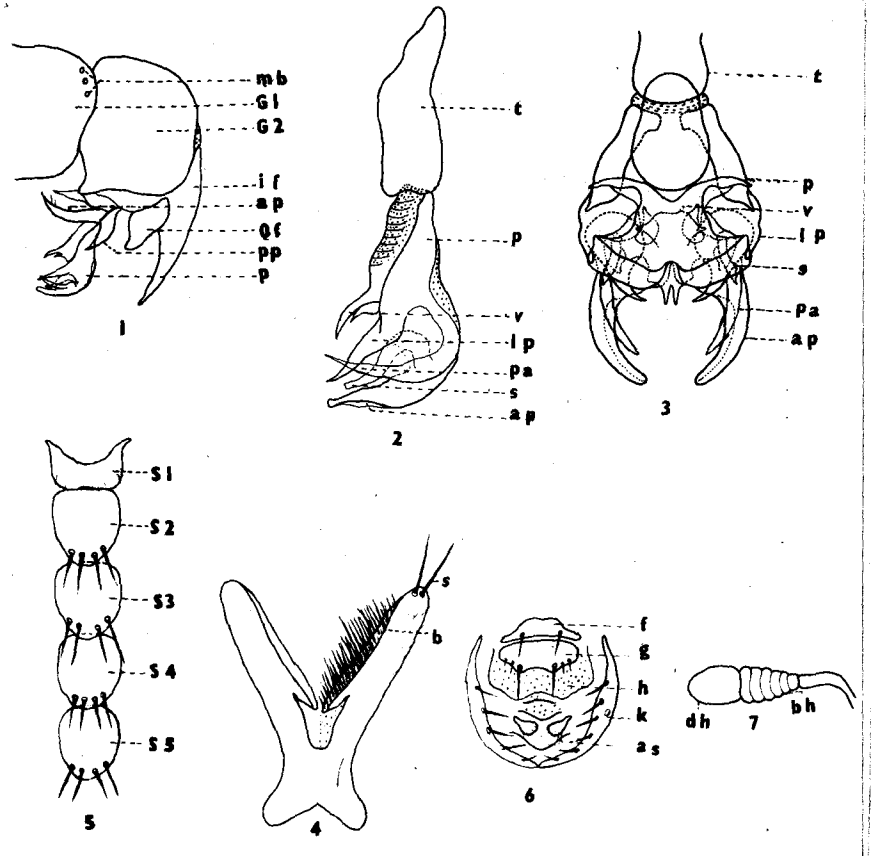


PLATE IIA

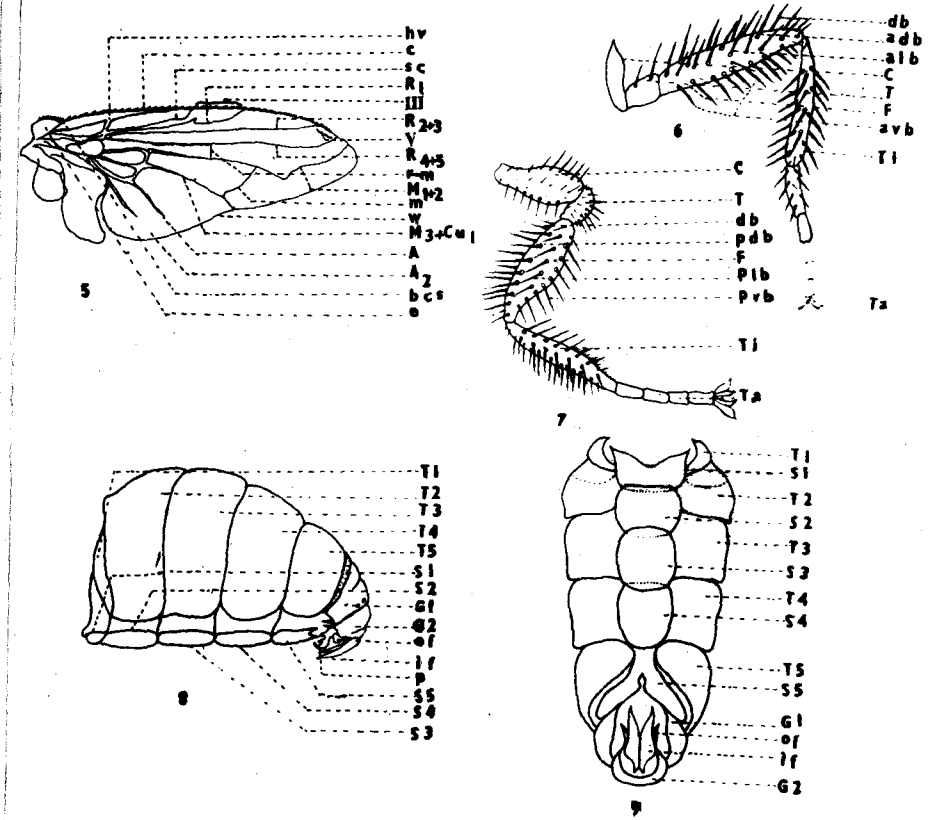


PLATE - IV // Figs.1-5 //

Pierretia (Asseletella) calicifera (Böettcher)
Male

1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Fifth sternite
4. Penis (lateral view)
5. Penis (ventral view)

PLATE - III // Figs.1-6 //

Thyrsocnema (Pseudothyrsocnema) longistylata
Shinonaga and Lopes - Male

1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Fifth sternite
4. Penis (lateral view)
5. Penis (ventral view)
6. Fourth sternite

PLATE IV

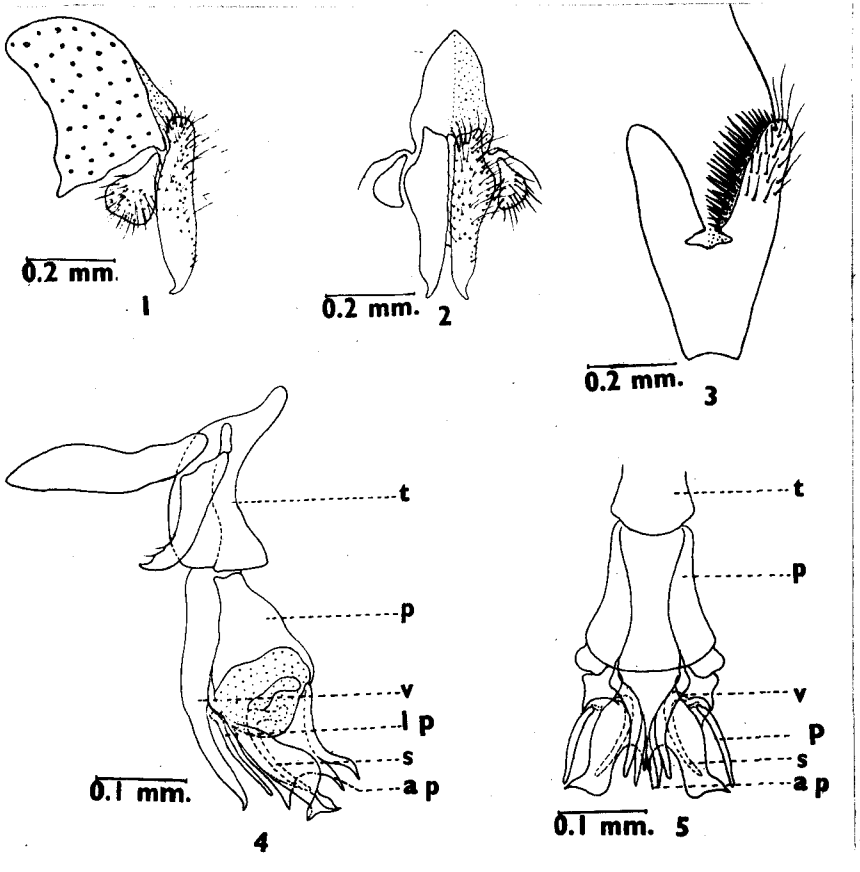


PLATE III

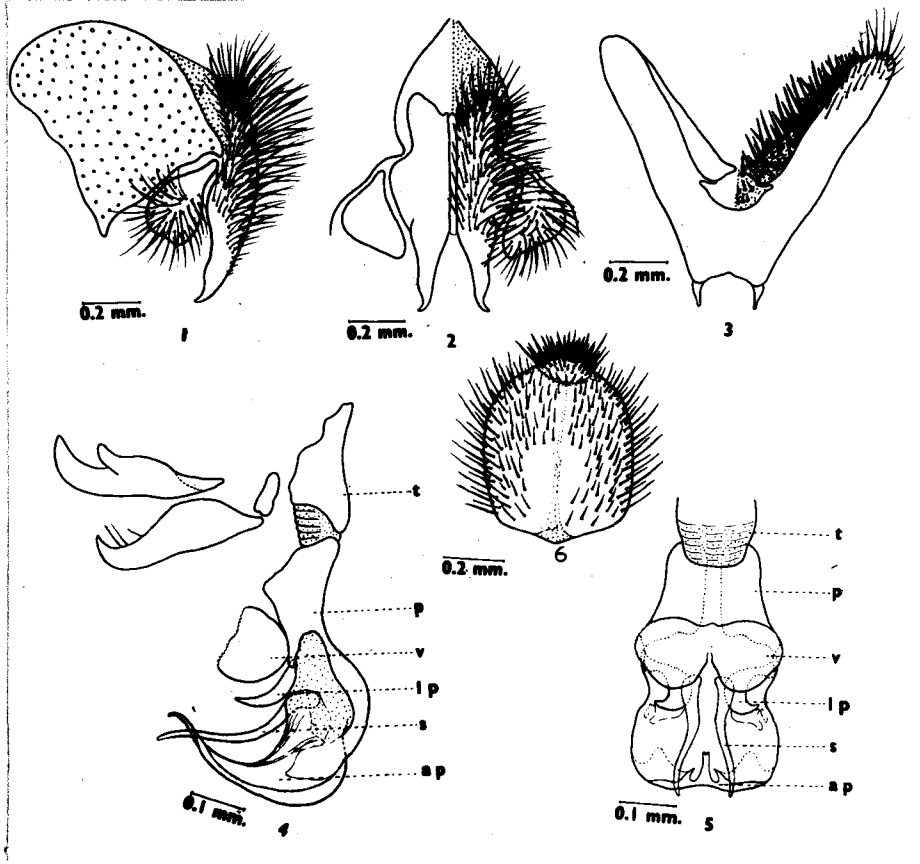


PLATE - VI // Figs. 1-6 //

Senierwhitea kremeri (Böettcher) - **M a l e**

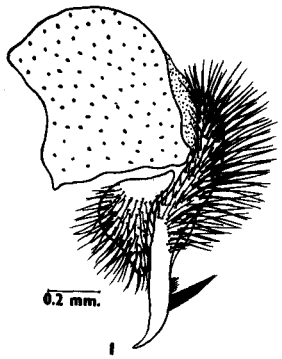
1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Fifth sternite
4. Penis (left side view)
5. Penis (ventral view)
6. Penis (right side view)

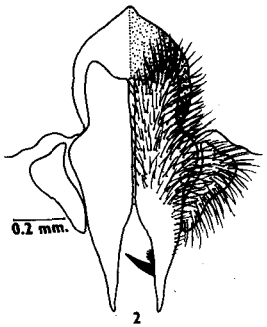
PLATE - V // Figs. 1-5 //

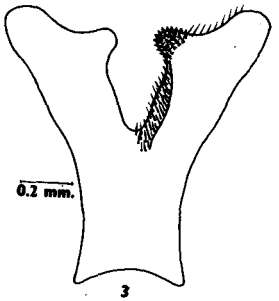
Leucomyia sinerea (Fabricius) - **M a l e**

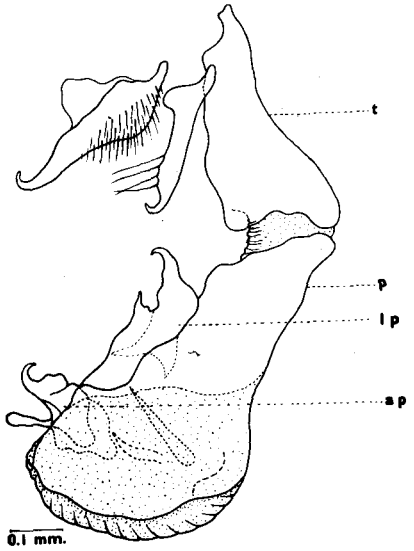
1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Fifth sternite
4. Penis (ventral view)
5. Penis (lateral view)

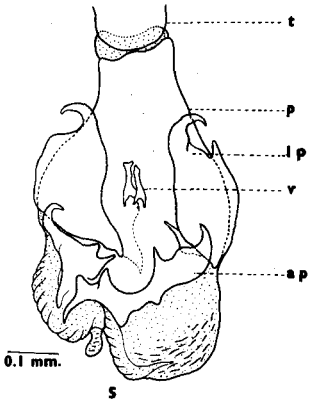
PLATE VI

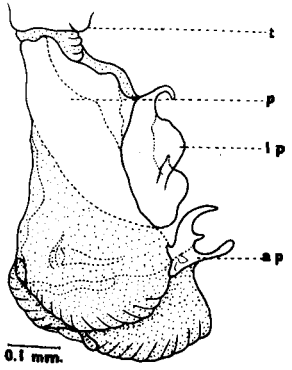












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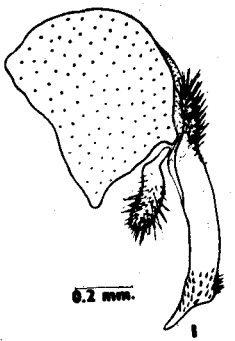
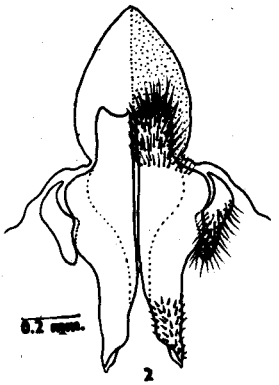
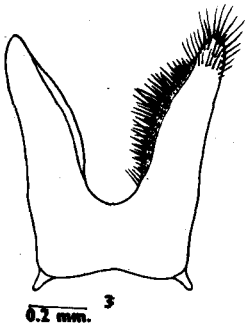
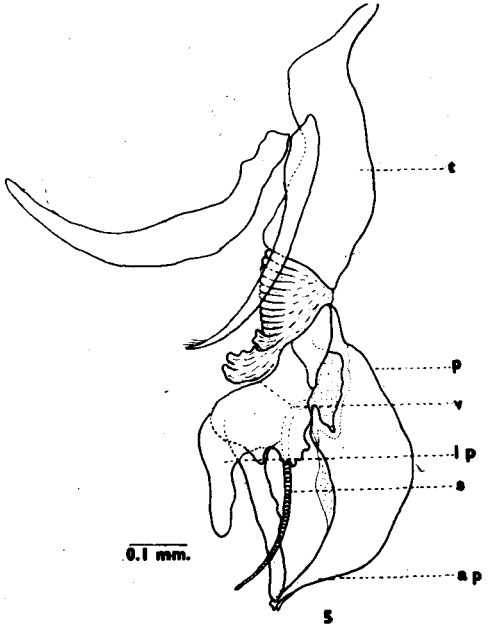








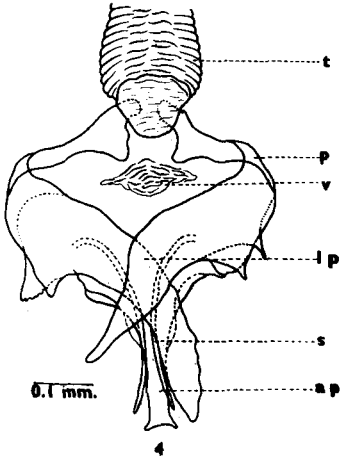


PLATE - VIII // Figs.1-6 //

Trichobioproctis flavinervis (Walker) - **Male**

1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Fifth sternite
4. Penis (lateral view)
5. Penis (ventral view)
6. Fourth sternite

PLATE - VII // Figs.1-5 //

Seniorwhitea lopezi, sp. nov. - **Male**

1. Inner and outer forceps (lateral view)
2. Inner forceps (posterior view)
3. Penis (left side view)
4. Penis (ventral view)
5. Penis (right side view)

PLATE VIII

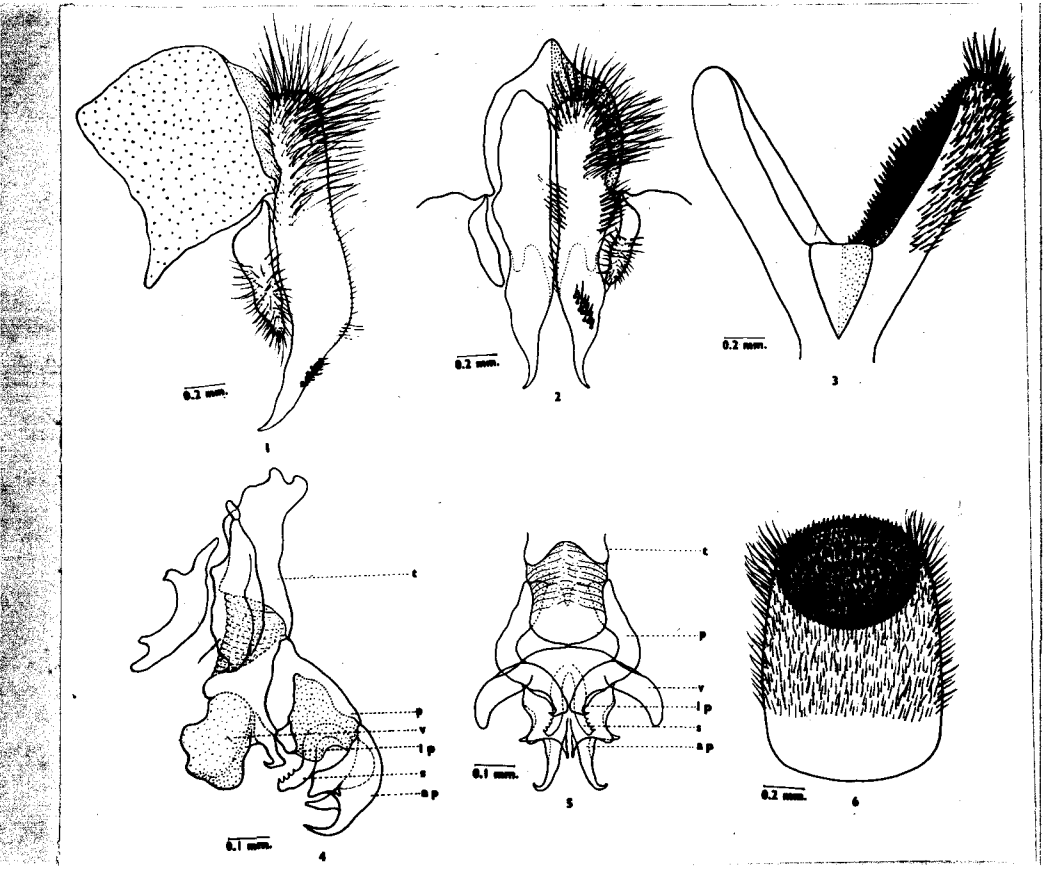


PLATE VII

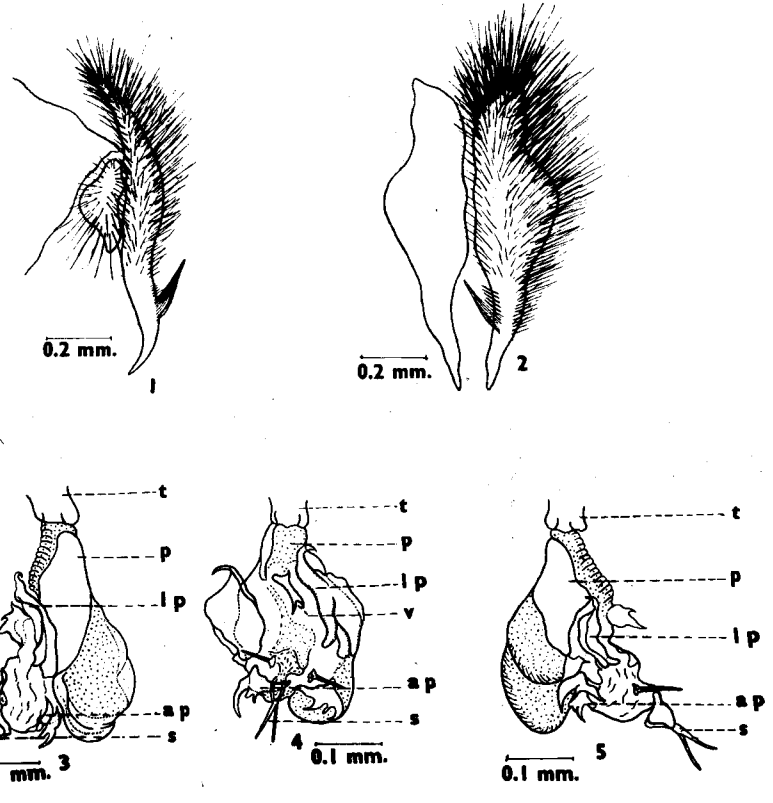


PLATE - X // Figs.1-4 //

Trichelioproctis pugana (Senior-White) - Female

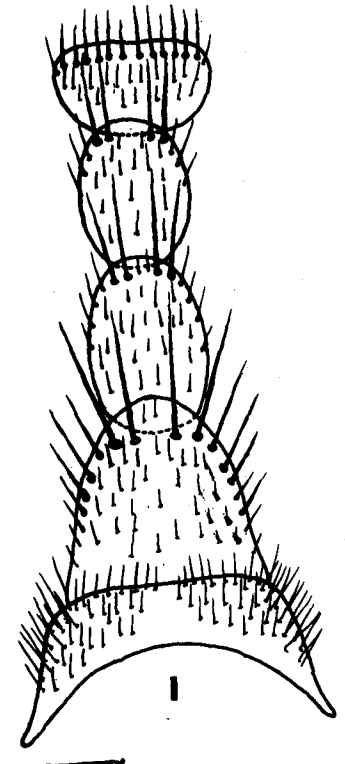
1. First to fifth sternites
2. Female genitalia
3. Anal sternite (enlarged)
4. Spermatheca

PLATE - IX // Figs.1-5 //

Trichelioproctis pugana (Senior-White)- Male

1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Fifth sternite
4. Penis (lateral view)
5. Penis (ventral view)

PLATE X



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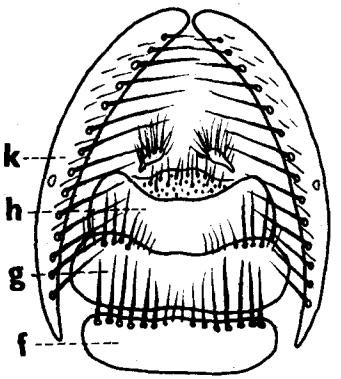
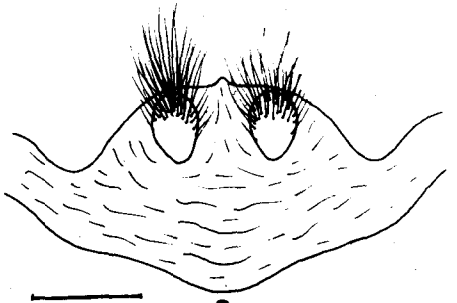
1



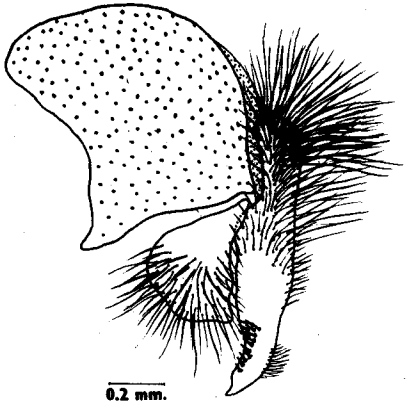
0.4 mm. 2



0.2 mm. 3

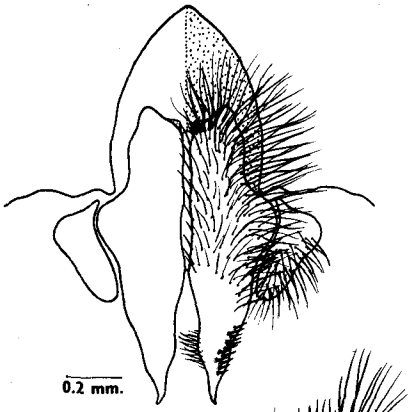
0.1 mm. 4

PLATE IX

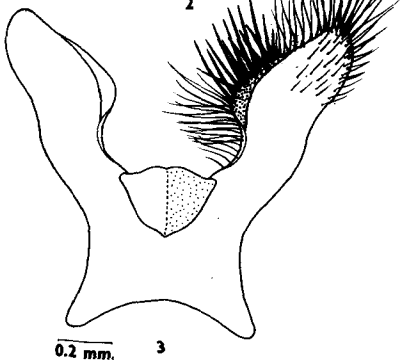


0.2 mm.

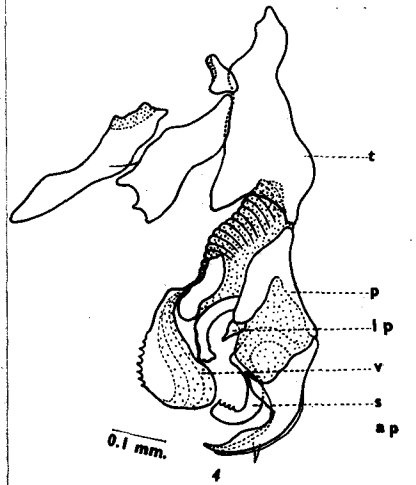
1



0.2 mm. 2



0.2 mm. 3



0.1 mm.

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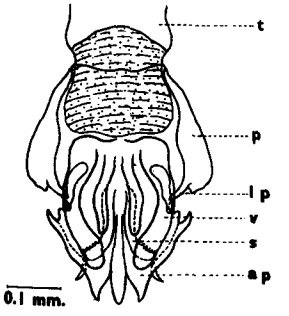


0.1 mm.

5

PLATE - XII // Figs. 1-5 //

Boeltcherisca bengalensis, sp.nov. - **M a l e**

1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Fifth sternite
4. Penis (lateral view)
5. Penis (ventral view)

PLATE - XI // Figs.1-5 //

Boeltcherisca peregrina (Robineau-Desvoidy) - **M a l e**

1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Fifth sternite
4. Penis (lateral view)
5. Penis (ventral view)

PLATE XII

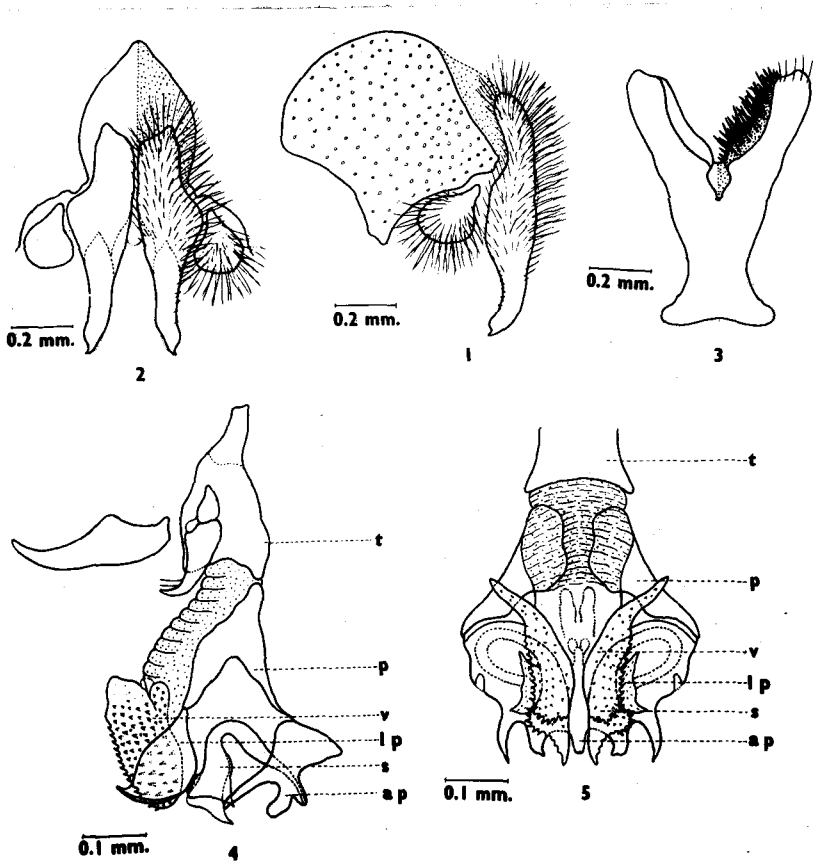


PLATE XI

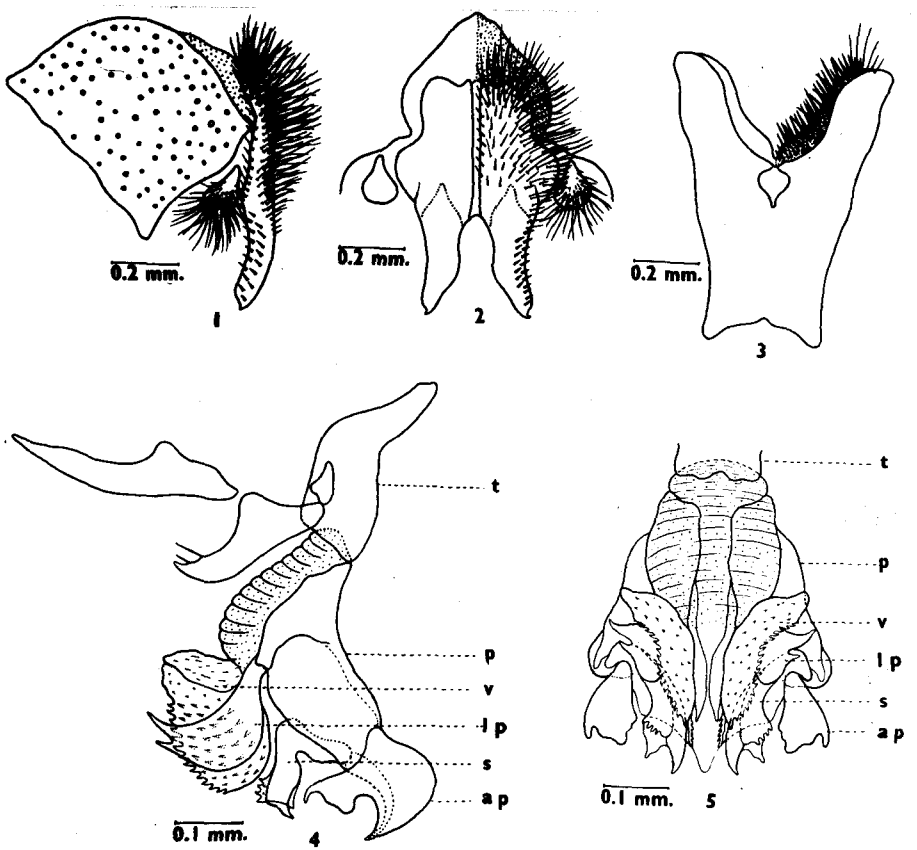


PLATE - XIV // Figs.1-5 //

Borcaea haemorrhoidalis (Fallén) - Male

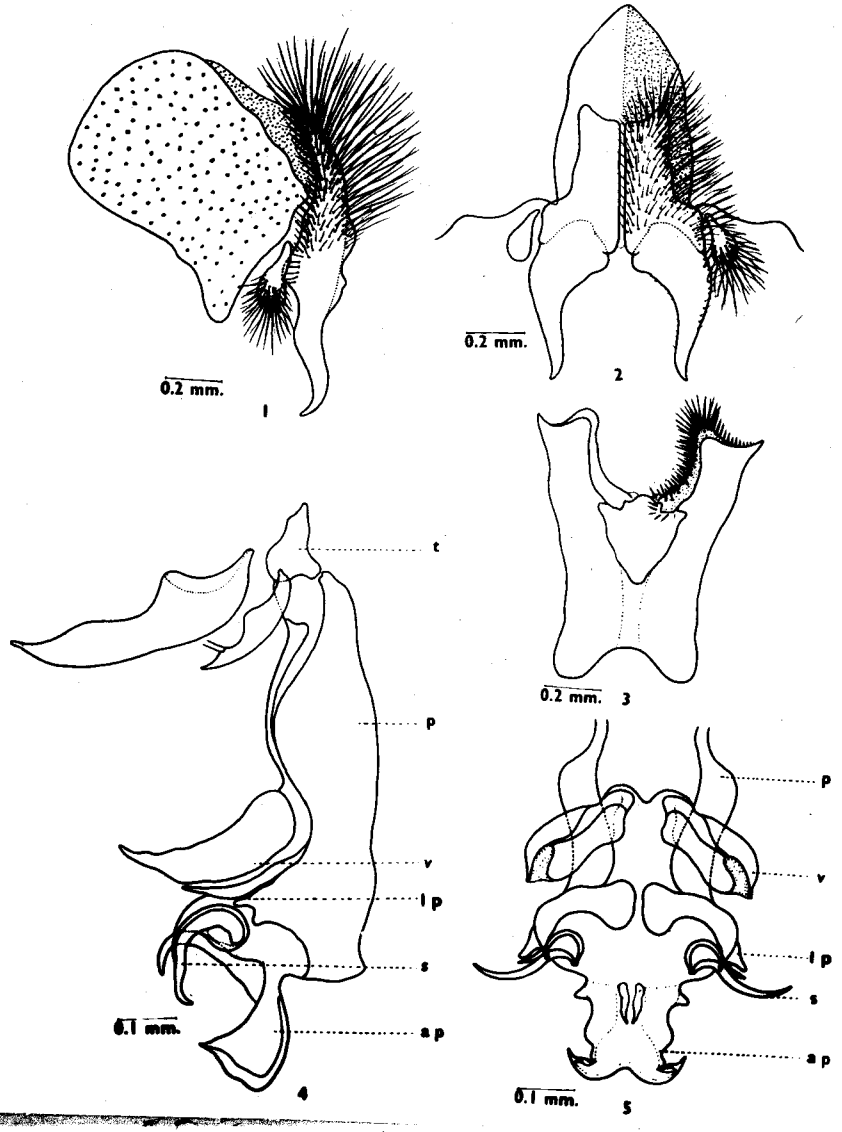
1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Fifth sternite
4. Penis (lateral view)
5. Penis (ventral view)

PLATE - XIII // Figs.1-5 //

Boeltcheriana nathani Lopes - Male

1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Fifth sternite
4. Penis (lateral view)
5. Penis (ventral view)

PLATE XIV



PLATEXIII

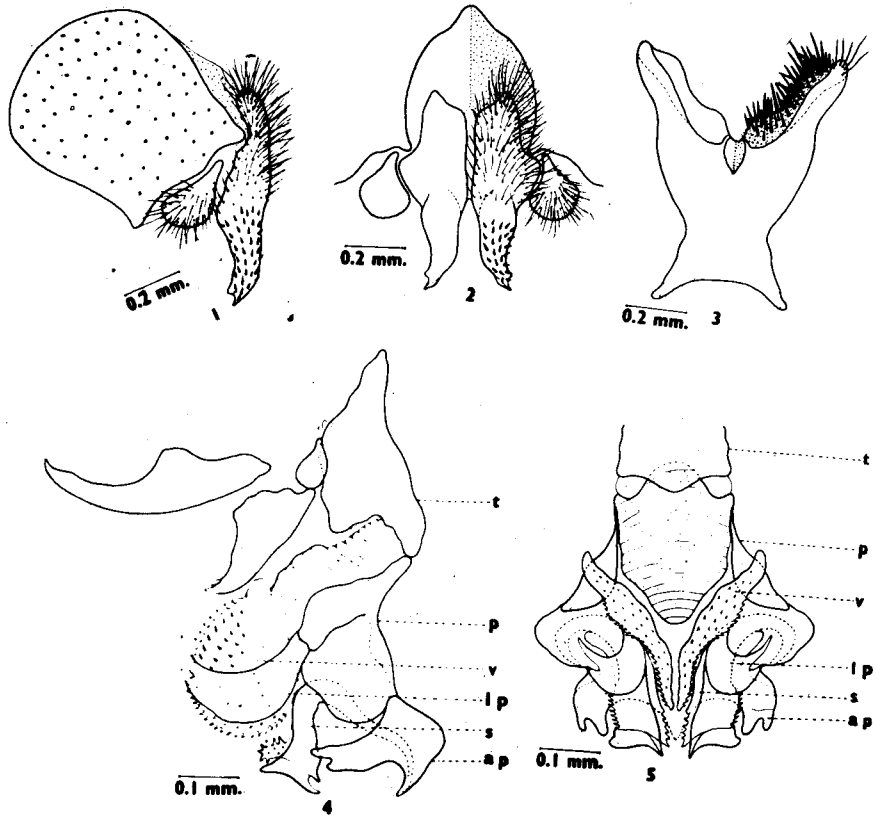


PLATE - XVI // Figs.1-6 //

Parasarcophaga (s.str.) knabi (Parker) - Male

1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Fifth sternite
4. Penis (lateral view)
5. Penis (ventral view)
6. Ventralia of penis (ventral view)

PLATE - XV // Figs.1-5 //

Boreosa haemorrhoidalis (Fallén) - ♀ Female

1. First to fifth sternites
2. Female genitalia
3. Anal sternite (enlarged)
4. Spermathecae

PLATE XVI

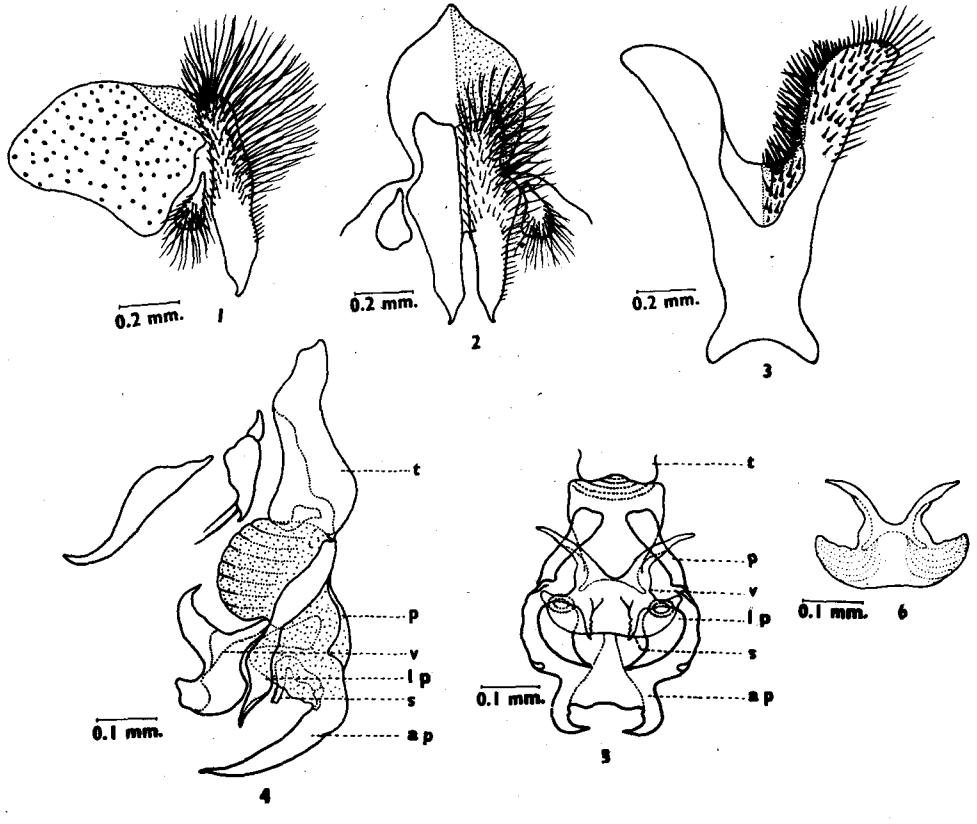


PLATE XV

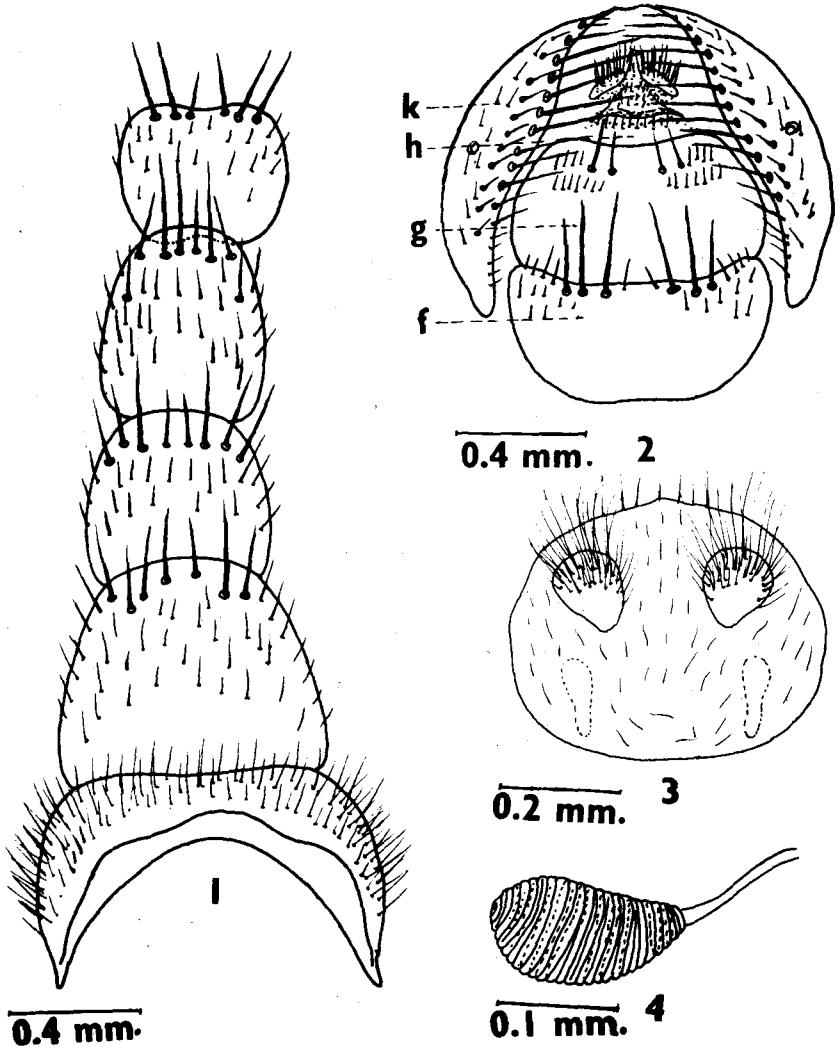


PLATE - XVIII // Figs.1-6 //

Parasarcophaga (s.str.) hirtipes (Wiedmann) - Male

1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Fifth sternite
4. Penis (lateral view)
5. Penis (ventral view)
6. Ventralia of penis (ventral view)

PLATE - XVII // Figs.1-4 //

Parasarcophaga (s.str.) knabi (Parker) - Female

1. First to fifth sternites
2. Female genitalia
3. Anal sternite (enlarged)
4. Spermatheca

PLATE XVIII

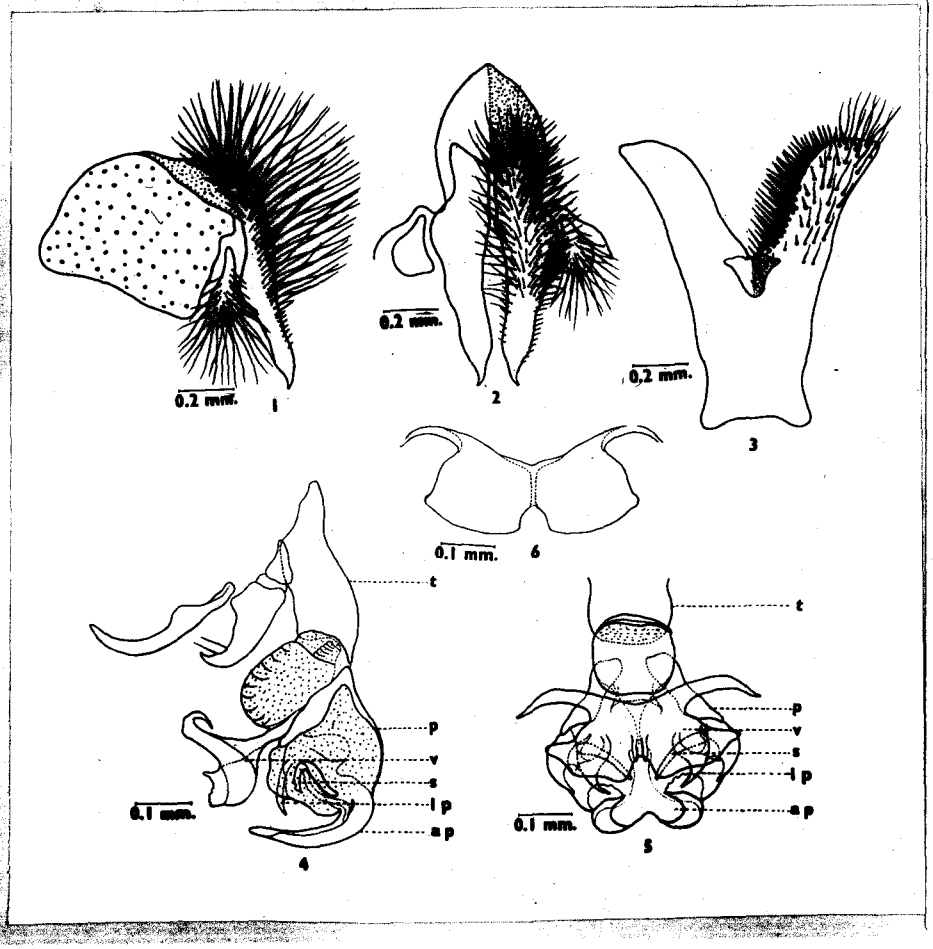
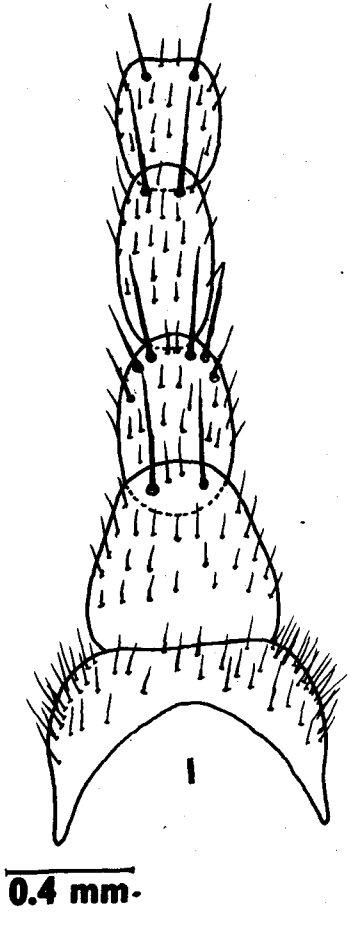
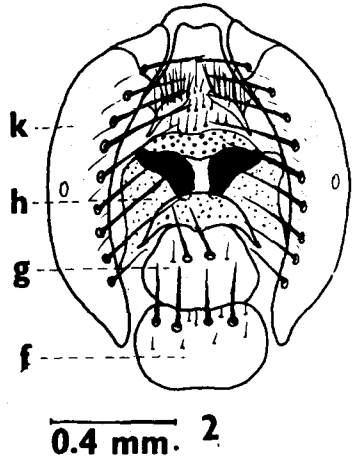
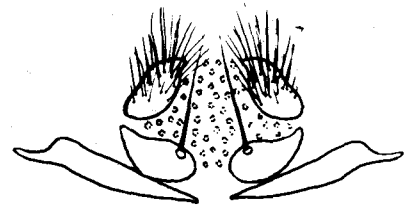


PLATE XVII







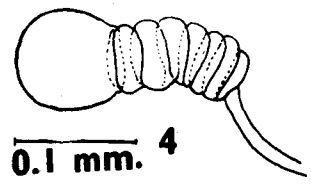


PLATE - XX // Figs.1-4 //

Parasarcophaga (s.str.) albiceps (Meigen) - Female

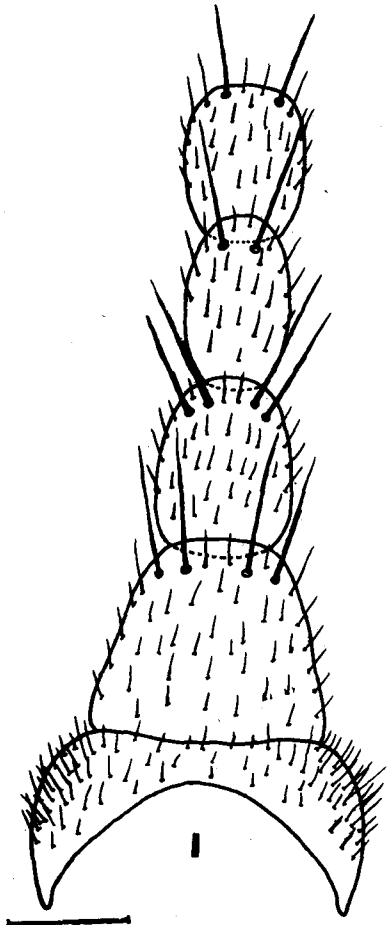
1. First to fifth sternites
2. Female genitalia
3. Anal sternite (enlarged)
4. Spermatheca

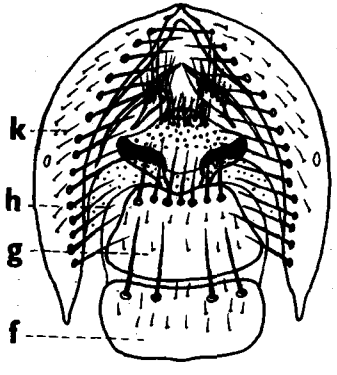
PLATE - XIX // Figs.1-6 //

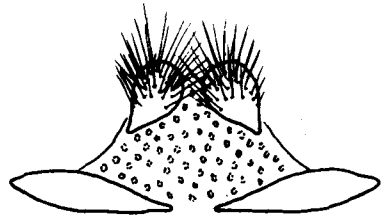
Parasarcophaga (s.str.) albiceps (Meigen) - Male

1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Fifth sternite
4. Penis (lateral view)
5. Penis (ventral view)
6. Ventralia of penis (ventral view)

PLATE XX







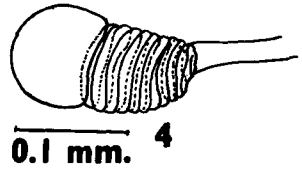
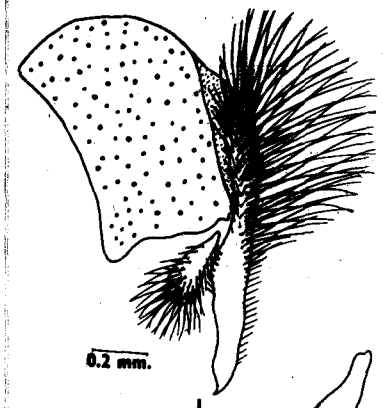
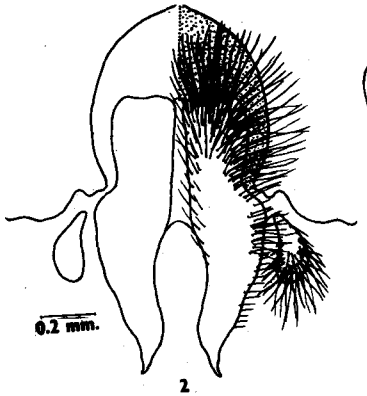
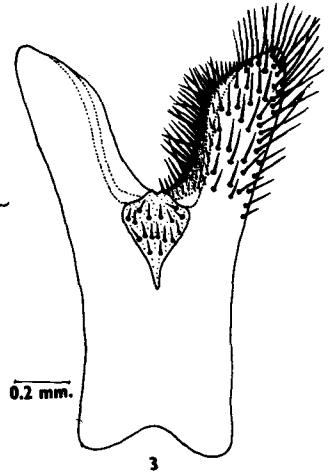
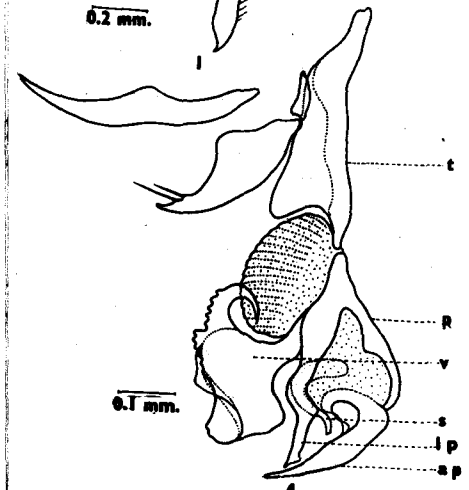


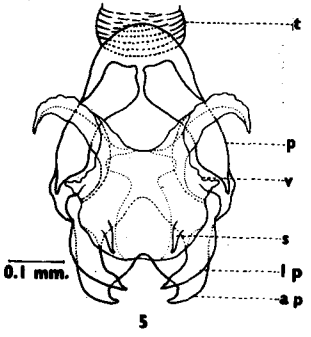
PLATE XIX











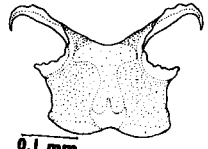


PLATE - XXII // Figs.1-4 //

Paraparcephasa (s.str.) orchidea (Beetcher) - Female

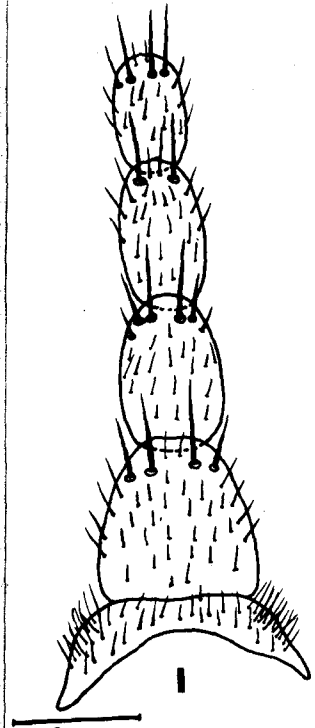
1. First to fifth sternites
2. Female genitalia
3. Anal sternite (enlarged)
4. Spermatheca

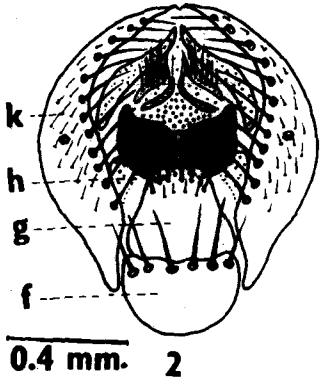
PLATE - XXI // Figs.1-6 //

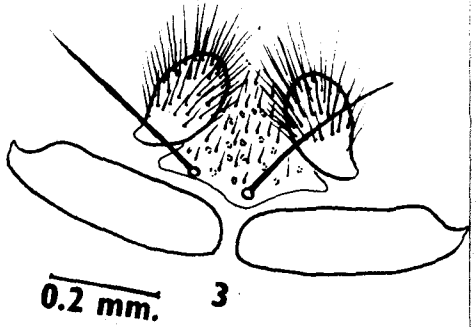
Paraparcephasa (s.str.) orchidea (Beetcher)- Male

1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (ventral view)
3. Fifth sternite
4. Penis (lateral view)
5. Penis (ventral view)
6. Ventralia of penis (Ventral view)

PLATE XXII







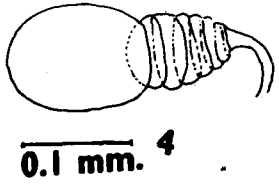
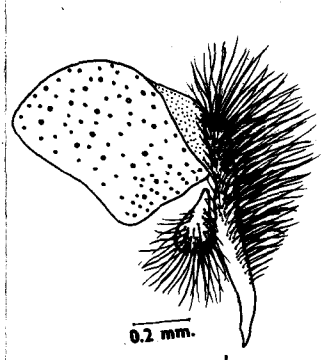
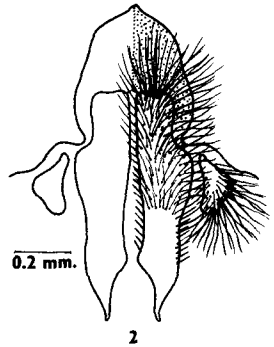
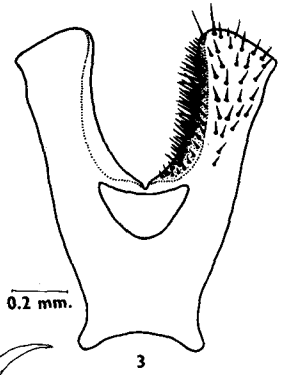
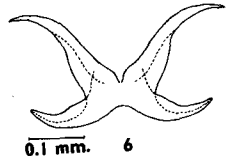


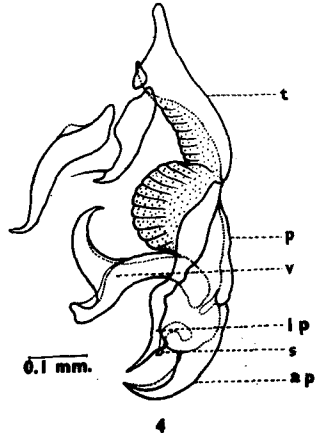
PLATE XXI











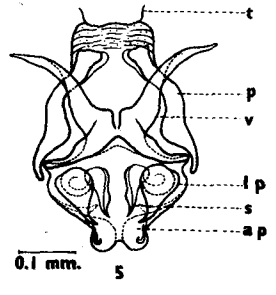


PLATE - XXIV // Figs.1-4 //

Parasarcophaga (~~[illegible]~~ Liopygia) **ruficornis** (Fabricius)

Female

1. First to fifth sternites
2. Female genitalia
3. Anal sternite (enlarged)
4. Spermatheca

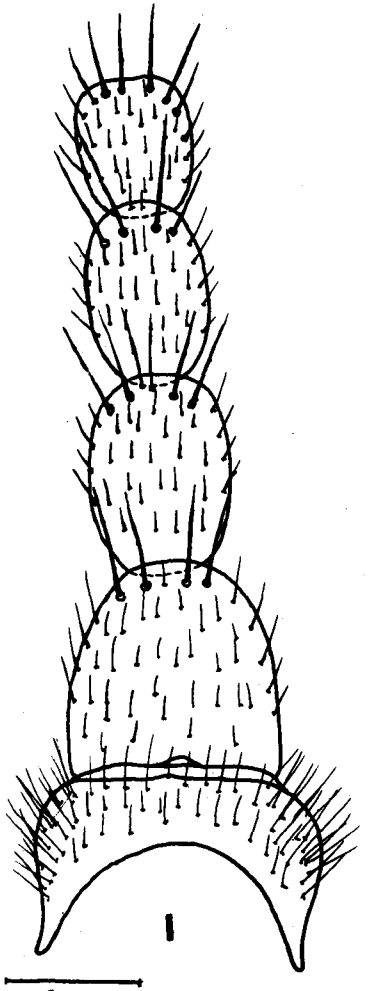
PLATE - XXIII // Figs.1-6 //

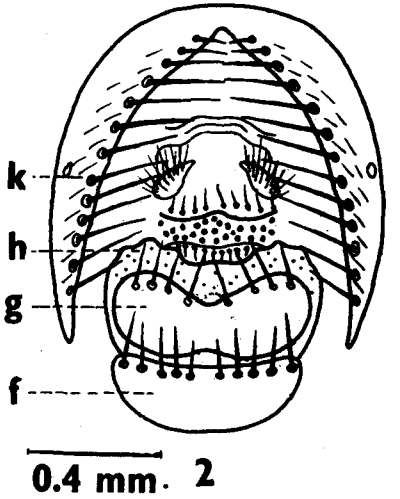
Parasarcophaga (**Liopygia**) **ruficornis** (Fabricius)

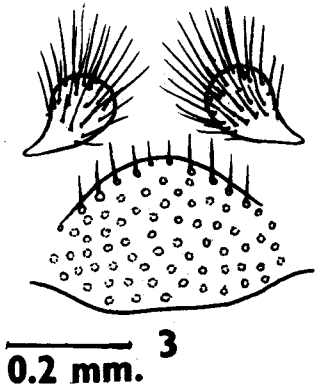
Male

1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Fifth sternite
4. Penis (lateral view)
5. Penis (ventral view)
6. Styli of glans (lateral view)

PLATE XXIV







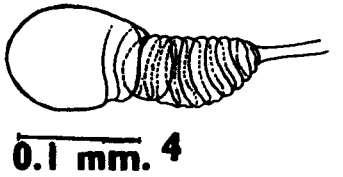


PLATE XXIII

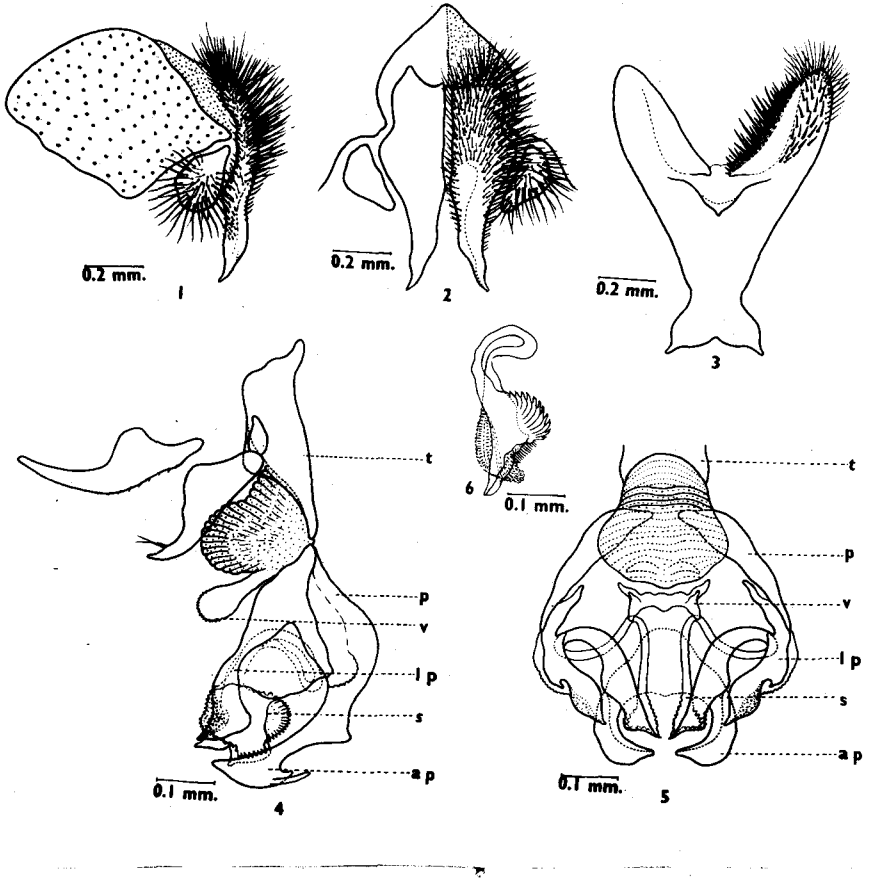


PLATE - XXVI // Figs.1-5 //

Parasarcophaga (Curranea) scopariformis
(Senior-White) // **Male**

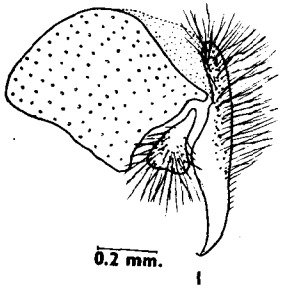
1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Fifth sternite
4. Penis (lateral view)
5. Penis (ventral view)

PLATE - XXV // Figs.1-4 //

Parasarcophaga (Curranea) kalimpongensis, sp.nov.
Male

1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Penis (lateral view)
4. Penis (ventral view)

PLATE XXVI



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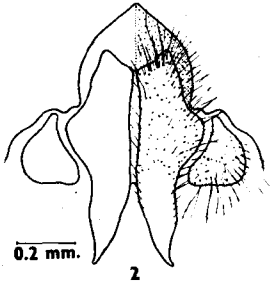

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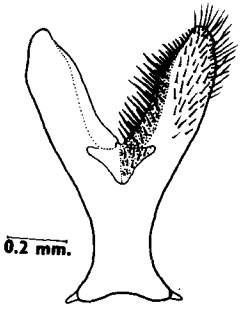

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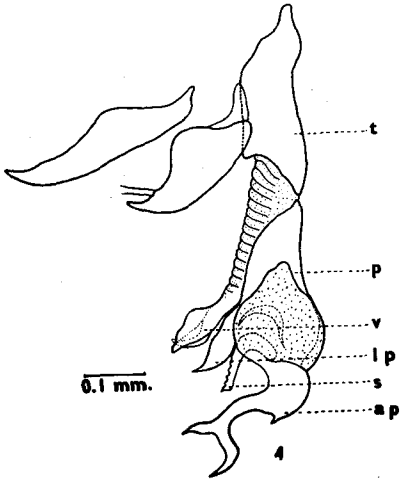

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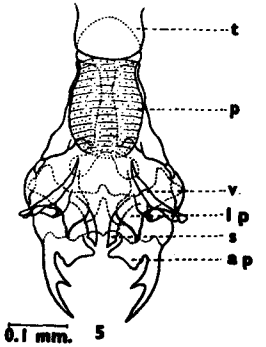

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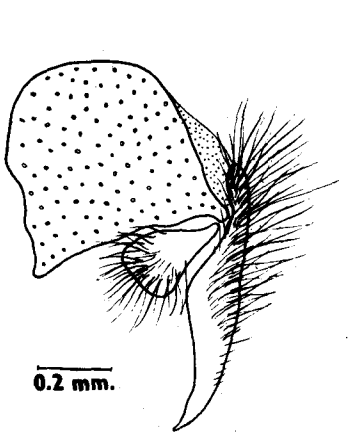
PLATE XXV



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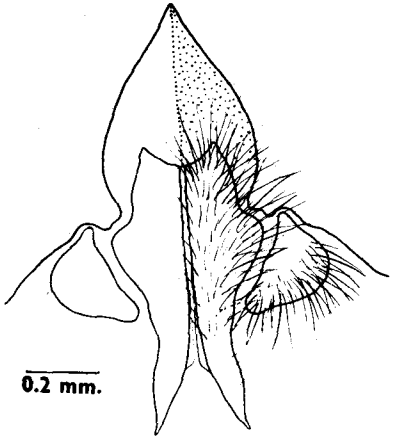

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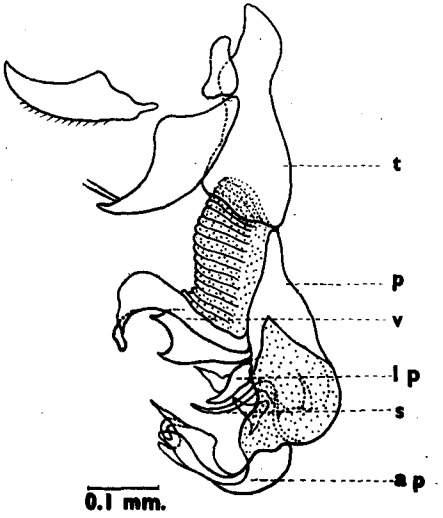

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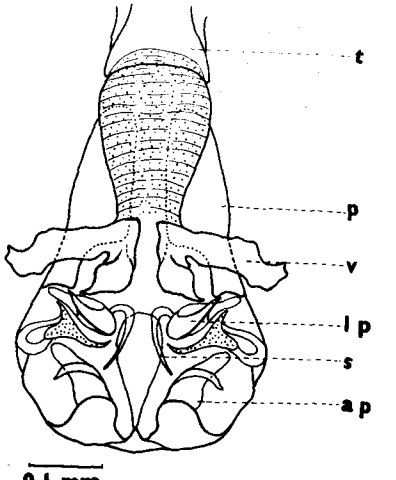


4

PLATE - XXVIII // Figs.1-5 //

Parasarcophaga (Liosarcophaga) dux (Thomson)

Male

1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Fifth sternite
4. Penis (lateral view)
5. Penis (ventral view)

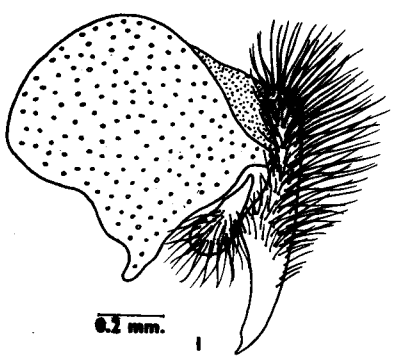
PLATE - XXVII // Figs.1-5 //

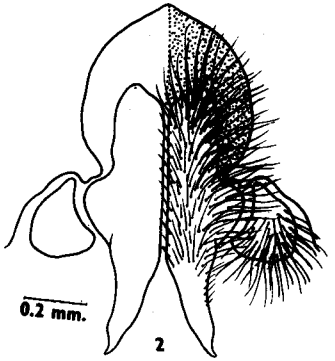
Parasarcophaga (Pandelleisca) heimbriggei (Senior-White)

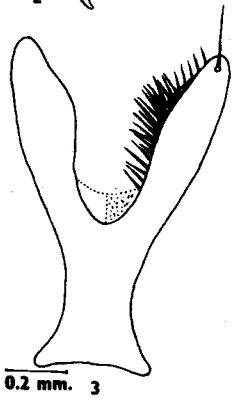
Male

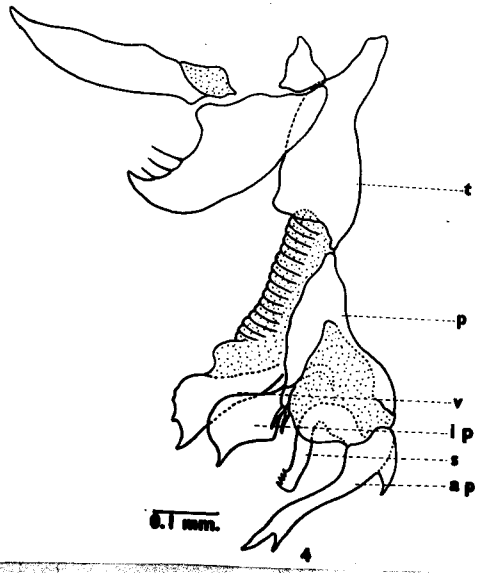
1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Fifth sternite
4. Penis (lateral view)
5. Penis (ventral view)

PLATE XXVIII









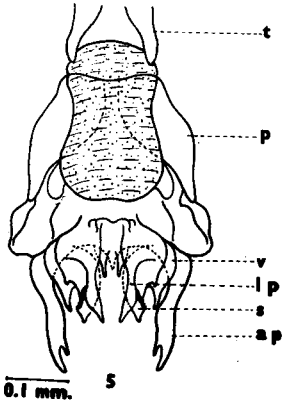
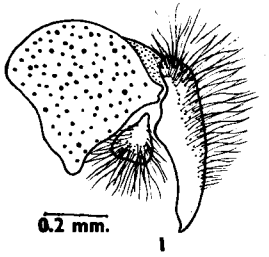
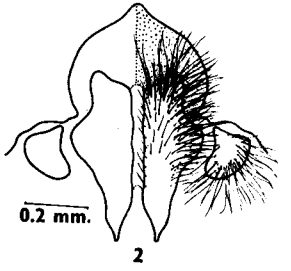
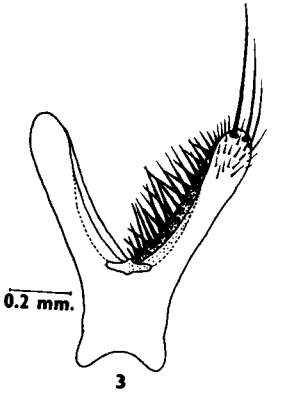
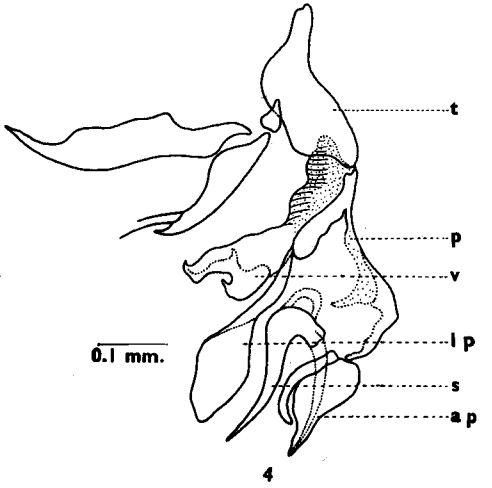


PLATE XXVII









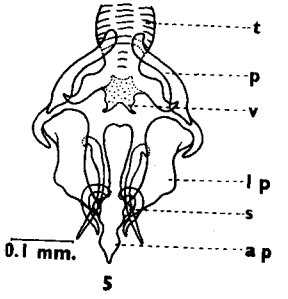


PLATE - XXX // Figs.1-5 //

Parasarcophaga (Liosarcophaga) brevicornis (Ho)

Male

1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Fifth sternite
4. Penis (lateral view)
5. Penis (ventral view)

PLATE - XXIX // Figs. 1-4 //

Parasarcophaga (Liosarcophaga) dux (Thomson)

Female

1. First to fifth sternites
2. Female genitalia
3. Anal sternite (enlarged)
4. Spermatheca

PLATE XXX

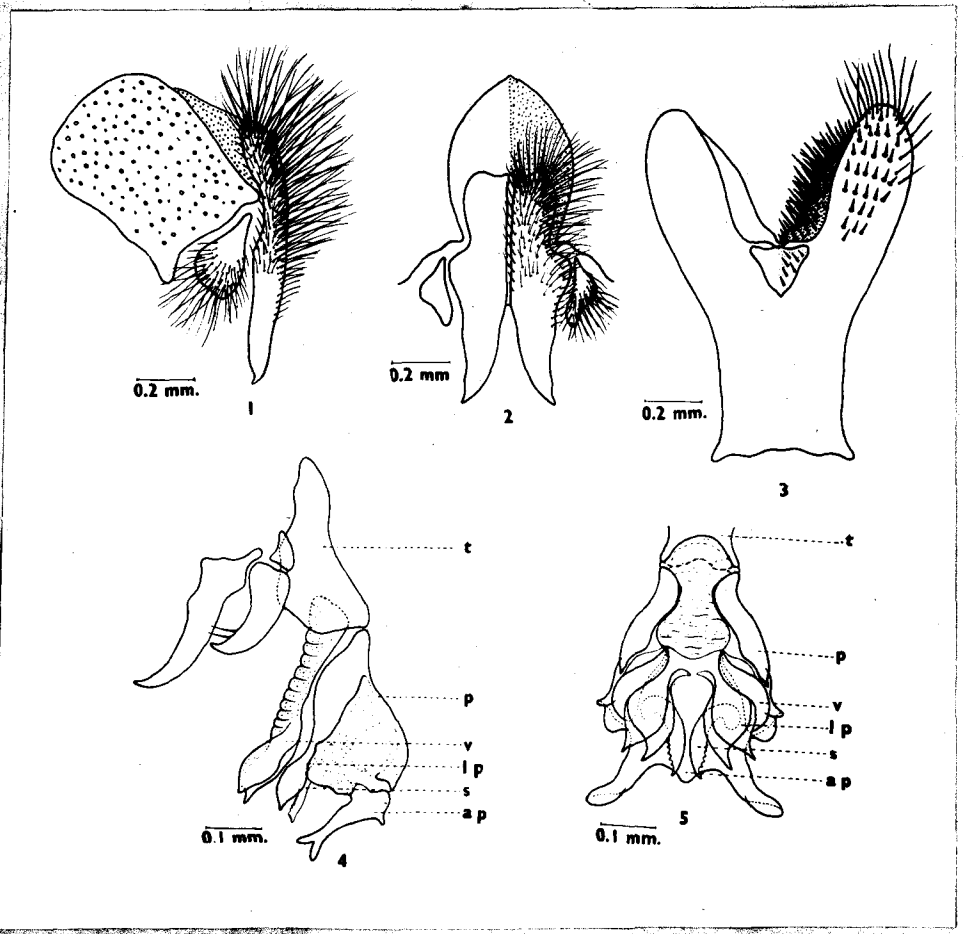
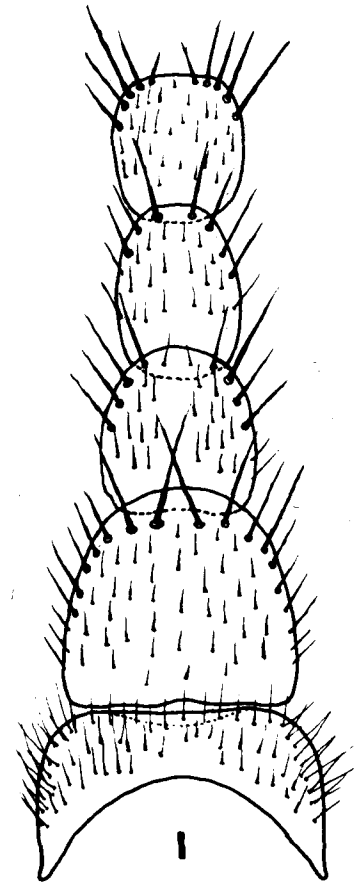


PLATE XXIX



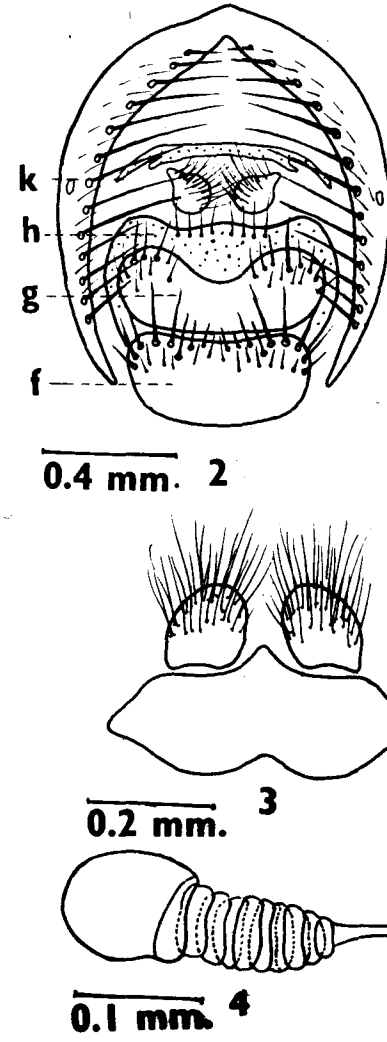


PLATE - XXXII // Figs. 1-4 //

Parasarcophaga (Liosarcophaga) josephi, sp.nov.

Male

1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Penis (Lateral view)
4. Penis (ventral view)

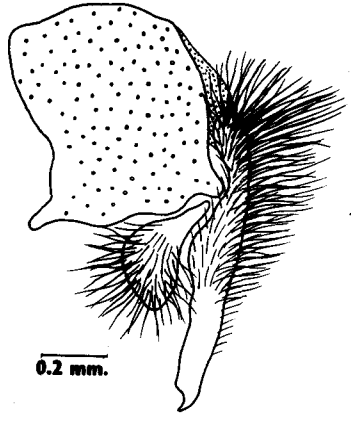
PLATE - XXXI // Figs.1-4 //

Parasarcophaga (Liosarcophaga) brevicornis (Ho)

Female

1. First to fifth sternites
2. Female genitalia
3. Anal sternite (enlarged)
4. Spermatheca

PLATE XXXII



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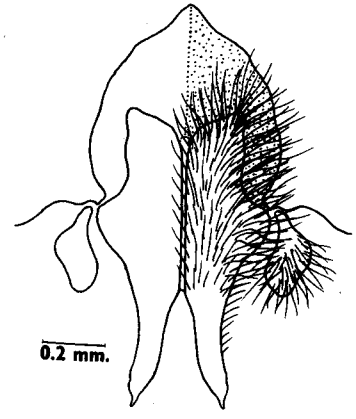

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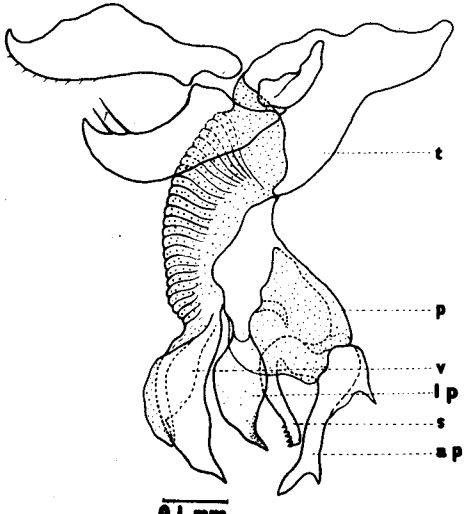

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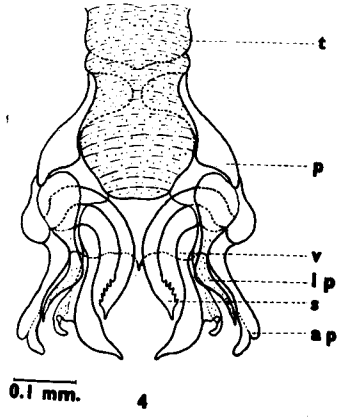

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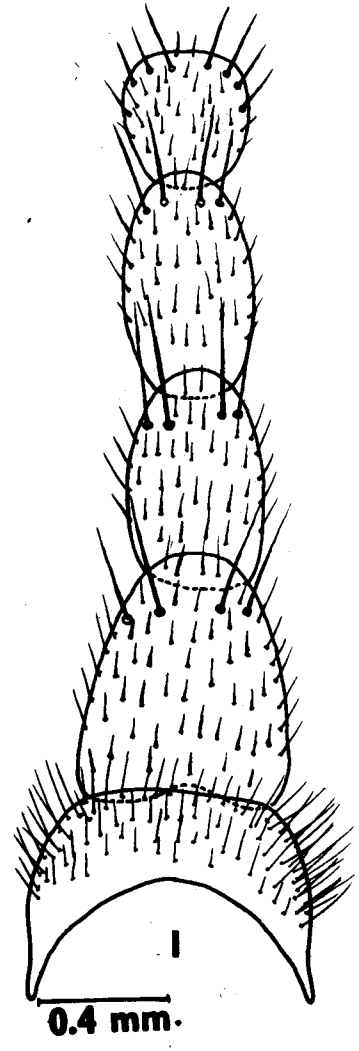
PLATE XXXI



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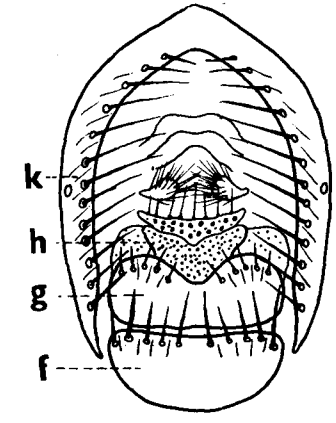

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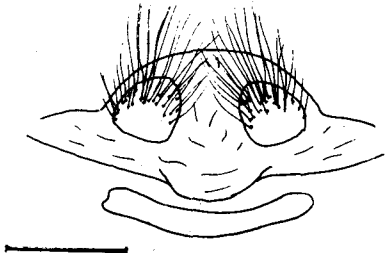

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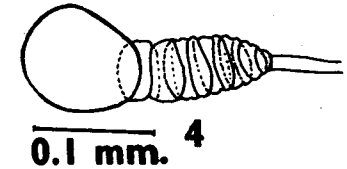


4

PLATE - XXXIV // Figs.1-6 //

Sinonipponia bengalensis, sp. nov.

Male

1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Head (lateral view)
4. Fifth sternite
5. Penis (lateral view)
6. Penis (ventral view)

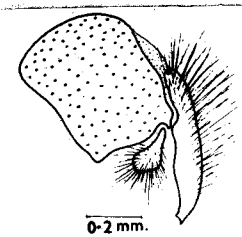
PLATE - XXXVII // Figs.1-5 //

Rhinocanella (Jantiella) kanoi, sp. nov.

Male

1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Penis (lateral view)
4. Penis (ventral view)
5. Ventralia of penis (ventral view)

PLATE XXXIV



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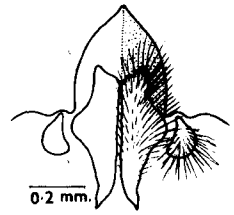

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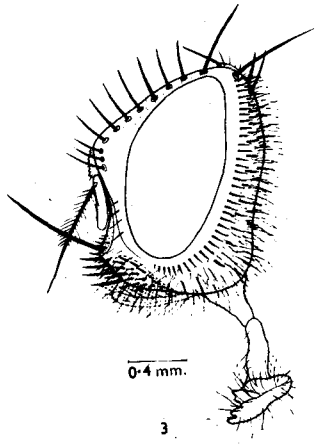

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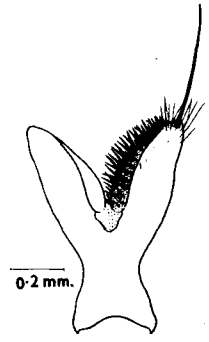

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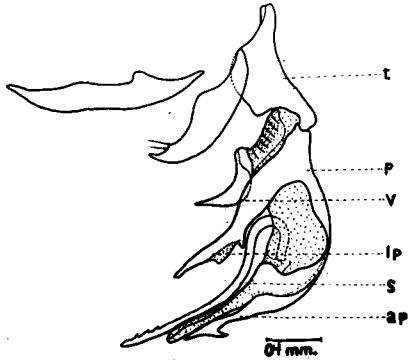

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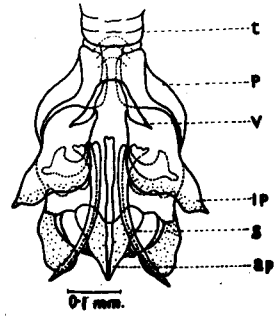

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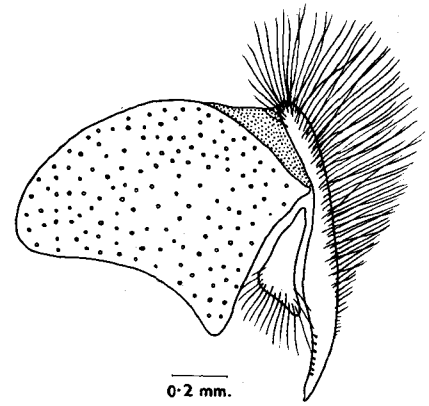
PLATE XXXIII



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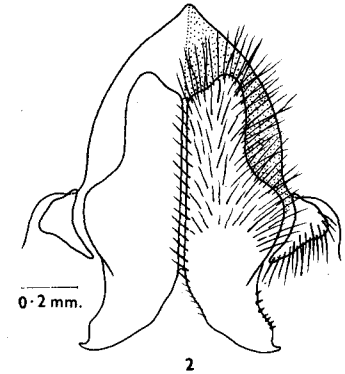

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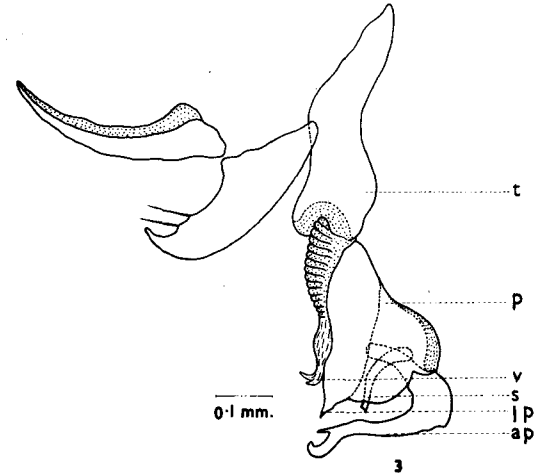

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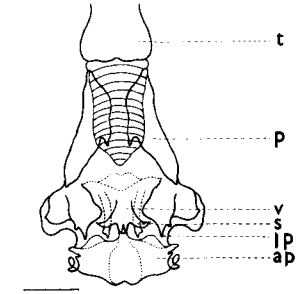

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5

PLATE - XXXVI // Figs.1-5 //

Harpagophalla kempi (Senior-White) - Male

1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Fifth sternite
4. Penis (lateral view)
5. Penis (ventral view)

PLATE - XXXV // Figs.1-5 //

Lieprestia midnaporensis, sp.nov. - Male

1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Fifth sternite
4. Penis (lateral view)
5. Penis (ventral view)

PLATE XXXVI

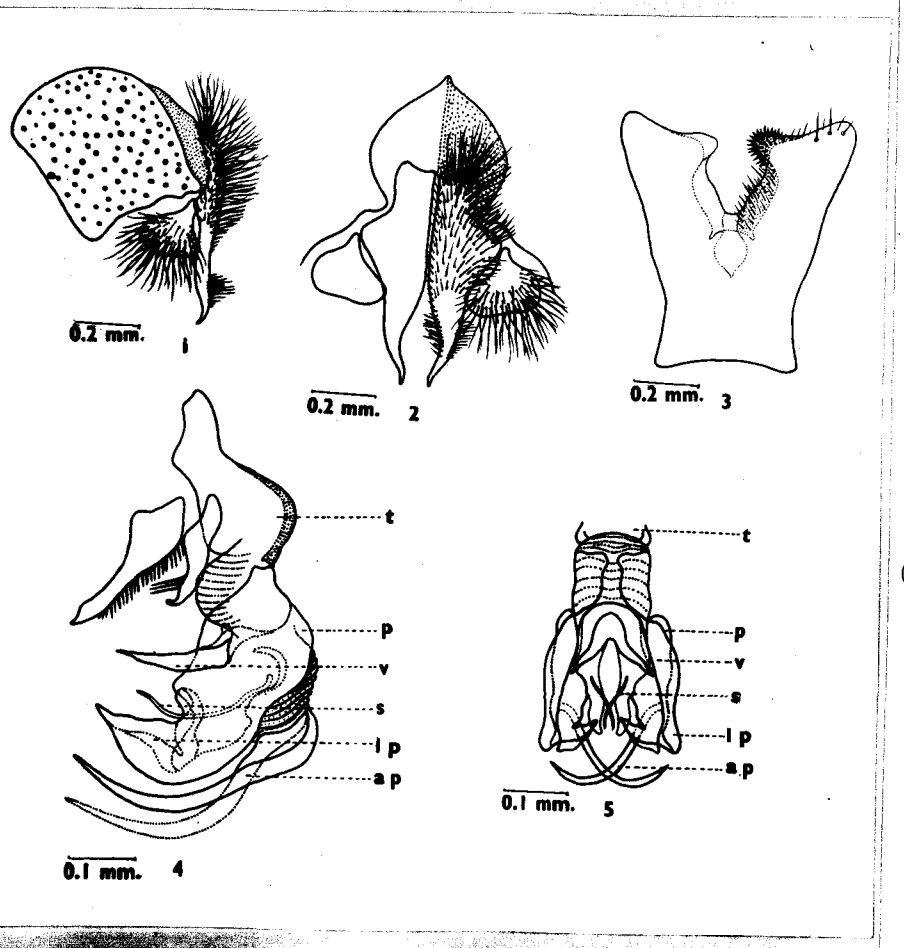


PLATE XXXV

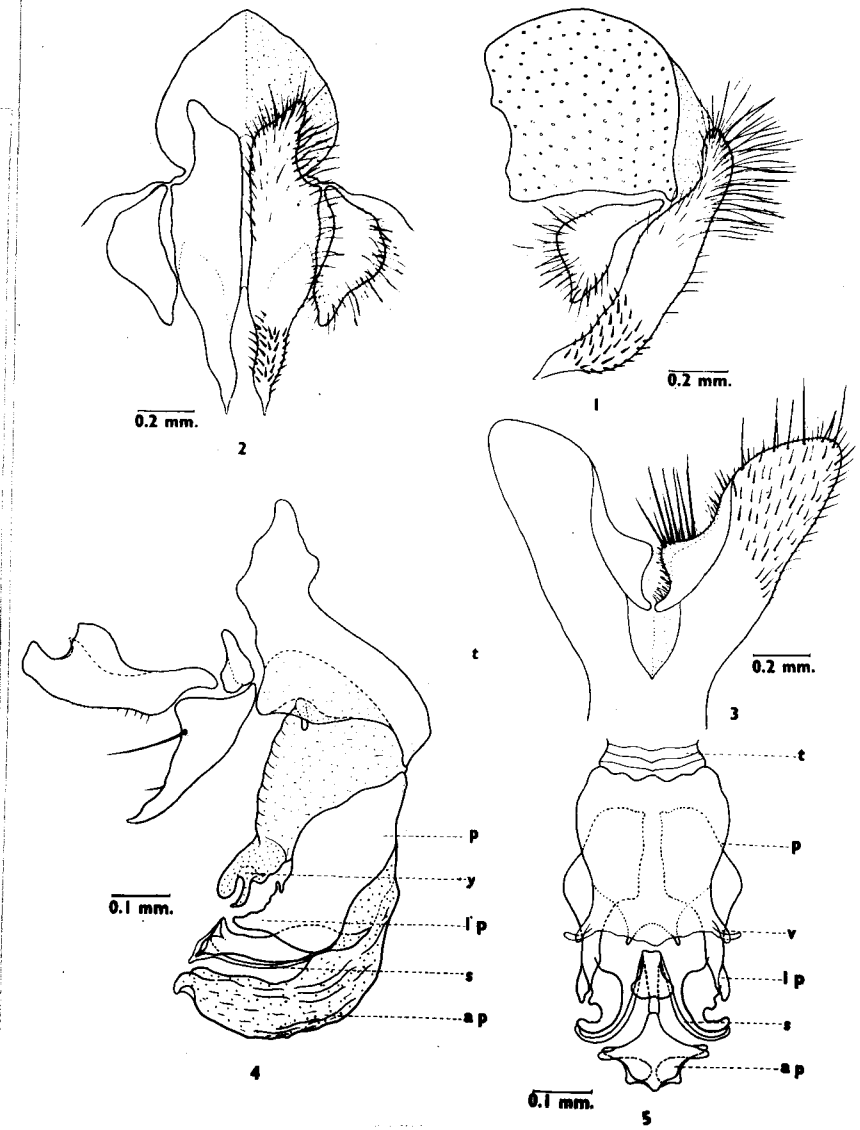


PLATE - XXXVIII // Figs.1-4 //

Iranihindia martellata (Senior-White) - Female

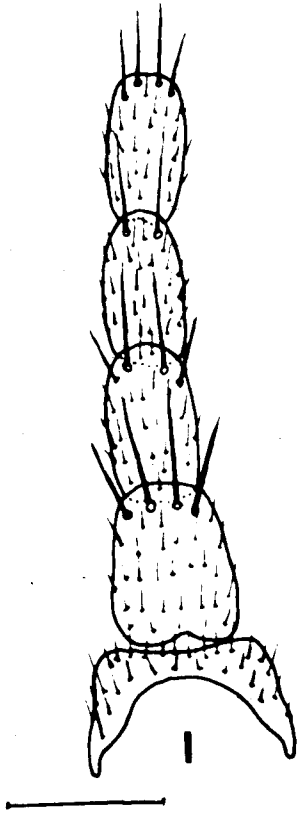
1. First to fifth sternites
2. Female genitalia
3. Anal sternite (enlarged)
4. Spermatheca

PLATE - XXXVII // Figs.1-5 //

Iranihindia martellata (Senior-White) - Male

1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Fifth sternite
4. Penis (lateral view)
5. Penis (ventral view)

PLATE XXXVIII



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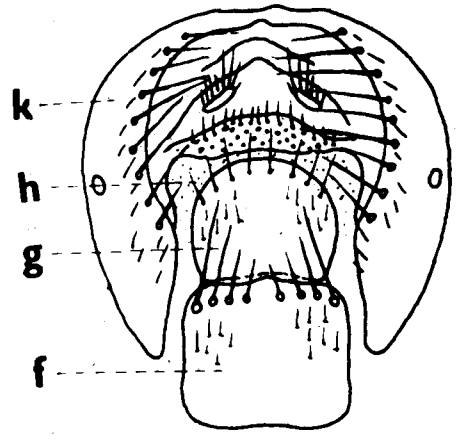
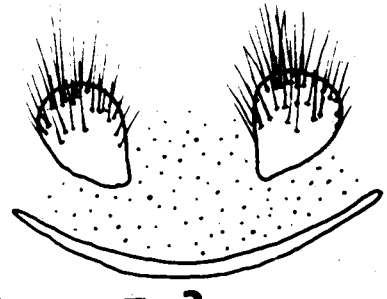
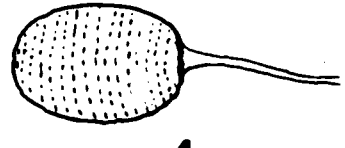


0.4 mm. 2

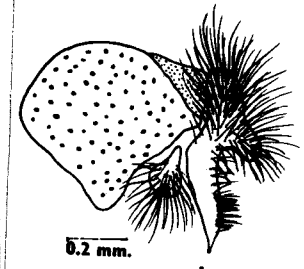


0.2 mm. 3



0.1 mm. 4

PLATE XXXVII



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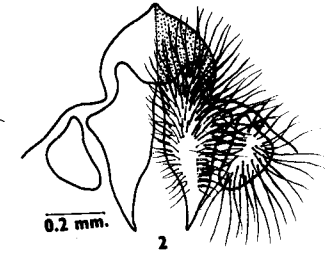

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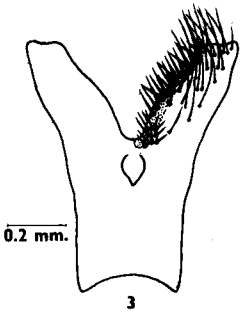
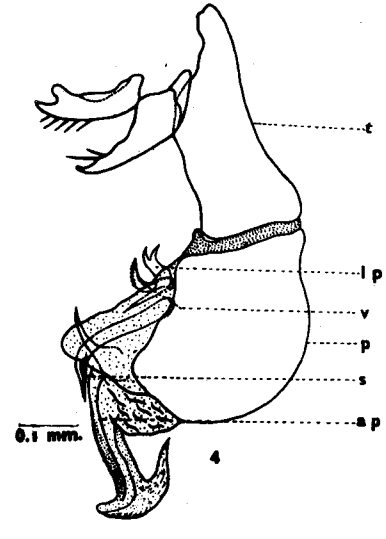


0.2 mm. 3



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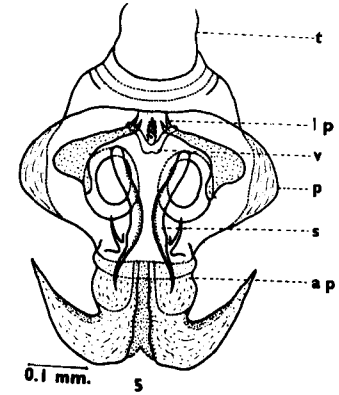


0.1 mm. 5

PLATE - XXXX // Figs.1-5 //

Iranihindia futilis (Senior-White) - Male

1. Inner and outer forceps (later view)
2. Inner and outer forceps (posterior view)
3. Fifth sternite
4. Penis (lateral view)
5. Penis (ventral view)

PLATE - XXXIX // Figs.1-5 //

Iranihindia mortellatoidea (Baramov) - Male

1. Inner and outer forceps (lateral view)
2. Inner and outer forceps (posterior view)
3. Fifth sternite
4. Penis (lateral view)
5. Penis (ventral view)

PLATE XXXX

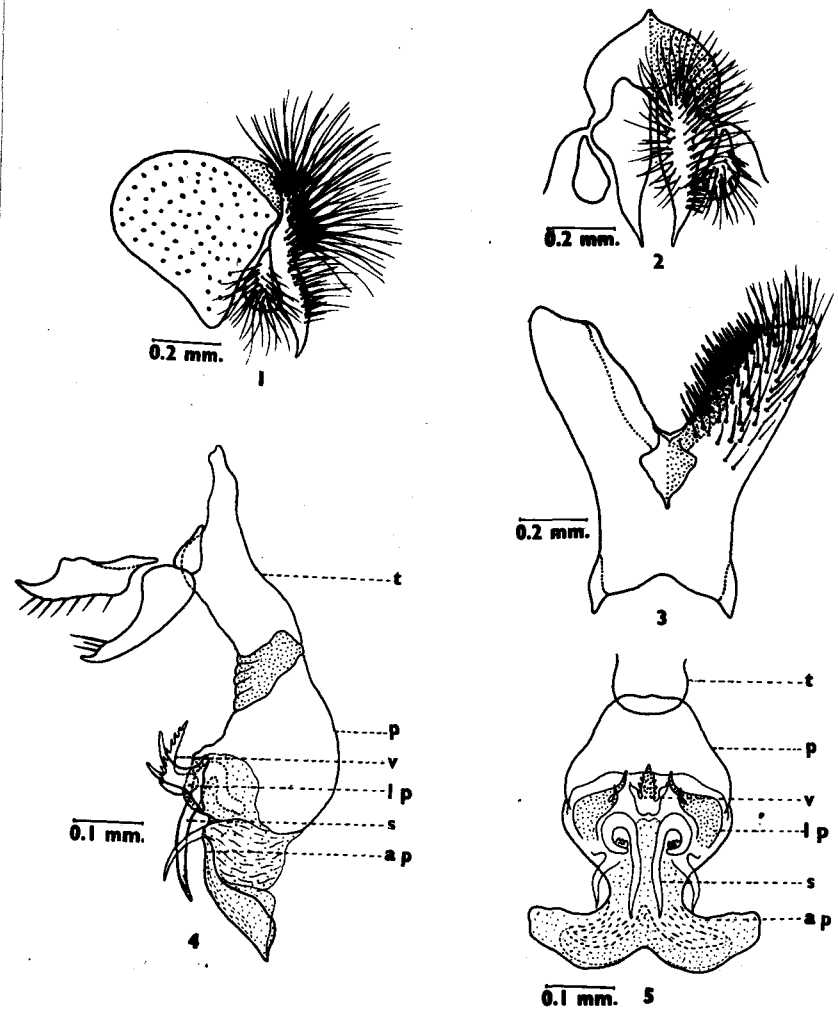


PLATE XXXIX

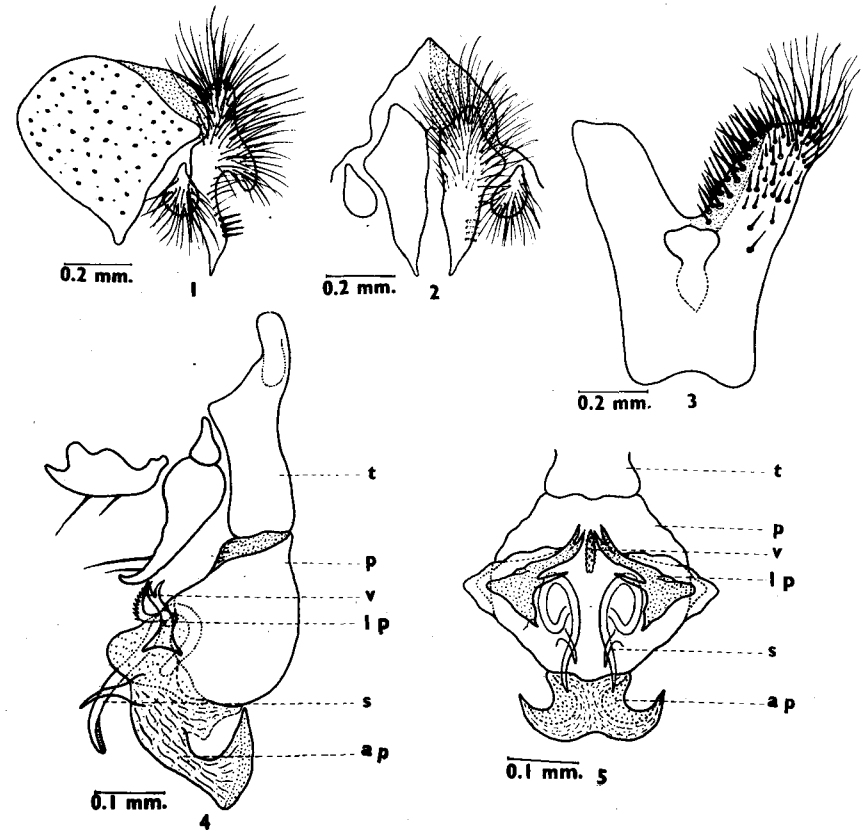


PLATE - XXXXI // Figs. 1-5 //

Iranihindia indica, sp.nov. - Male

1. Inner and outer forceps (lateral view)

2. Inner and outer forceps (posterior view)

3. Fifth sternite

4. Penis (lateral view)

5. Penis (ventral view)

PLATE - XXXXI // Figs. 1-6 //

Iranihindia jamesi, sp.nov. - Male

1. Inner and outer forceps (lateral view)

   1a. One of the inner forcep showing double row of spines (lateral view)

2. Inner and outer forceps (posterior view)

3. Fifth sternite

4. Penis (lateral view)

5. Penis (ventral view)

PLATE XXXXII

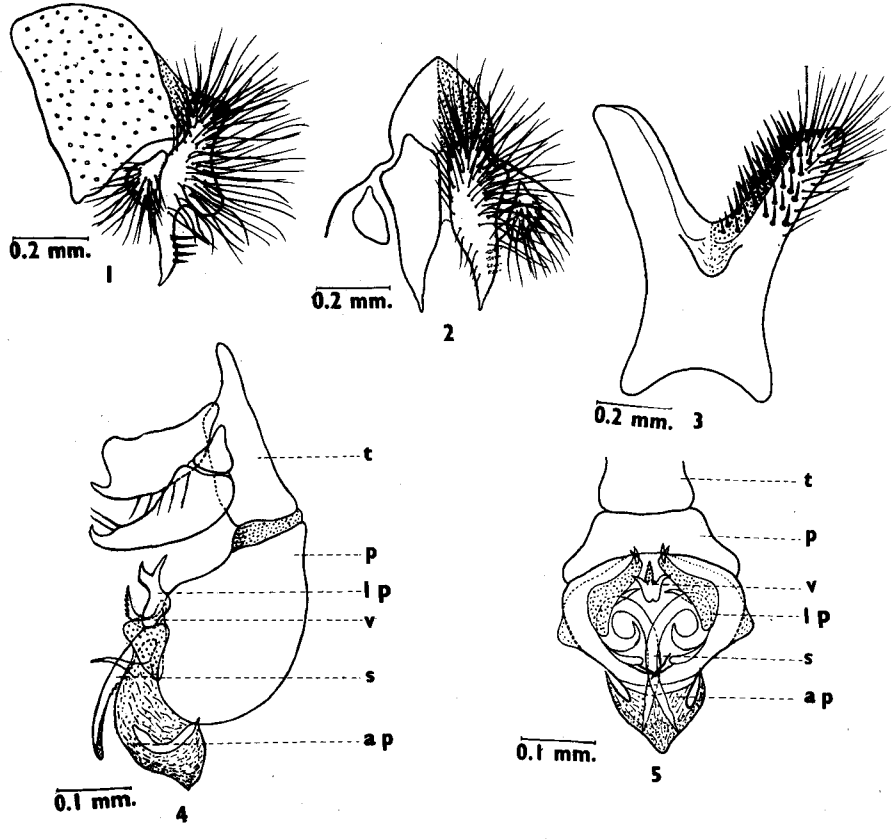


PLATE XXXXI

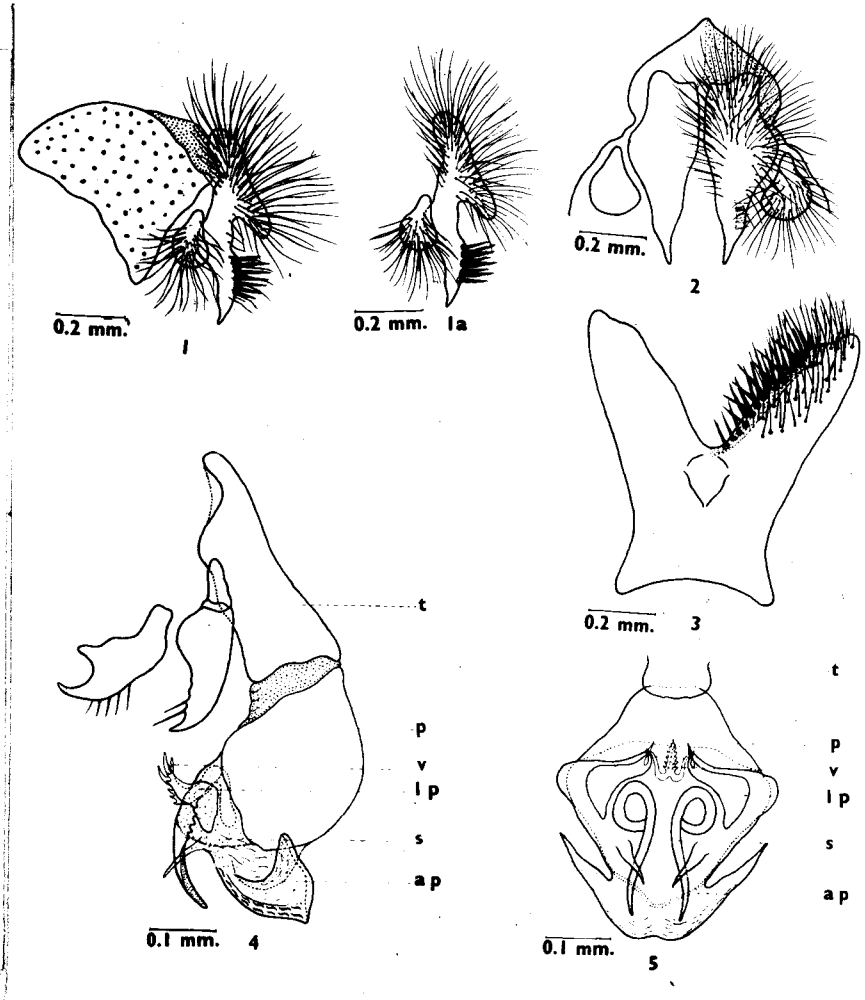


PLATE - XXXXIV // Figs.1-8 //

Paragarypha (s.str.) albiceps (Meigen) - Larva

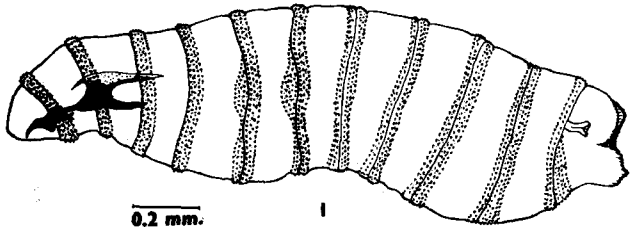
1. First instar larvae (entire)
2. Cephalopharyngeal skeleton (first instar)
3. Cephalopharyngeal skeleton (2nd instar)
4. Anterior spiracle (second instar)
5. Posterior spiracle (second instar)
6. Cephalopharyngeal skeleton (third instar)
7. Anterior spiracle (third instar)
8. Posterior spiracle (third instar)

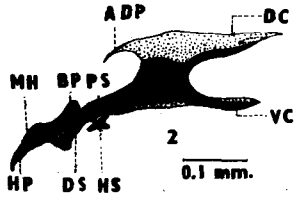
PLATE - XXXXIII // Figs.1-8 //

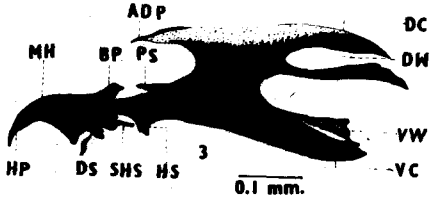
Abbreviations used in the figures

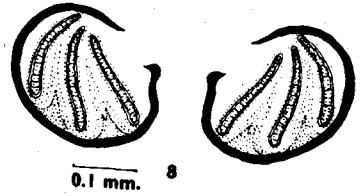
1. Lateral view of third stage larva : AS. anterior spiracle, ASB. anterior spinose band, PSB. posterior spinose band, T. tubercle, 2-12. body segment.
2. Anterior spiracle
3. Posterior view of last segment : IDT. inner dorsal tubercle, IVT. inner ventral tubercle, MDT. middle dorsal tubercle, MVT. middle ventral tubercle, ODT. outer dorsal tubercle, OVT. outer ventral tubercle, PS. posterior spiracle
4. Posterior spiracle : DA. dorsal arc, IA. inner arc, OA. outer arc, T. tail, VA. ventral arc.
5. Lateral view of cephalopharyngeal skeleton. ADP. anterodorsal process, BP. basal piece, DC. dorsal cornu, DS. dental sclerite, DW. dorsal window, HP. hook part, HS. hypostomal sclerite, MP. mouth-hook PS. parastomal sclerite, SHS. subhypostomal sclerite VC. ventral cornu, VW. ventral window

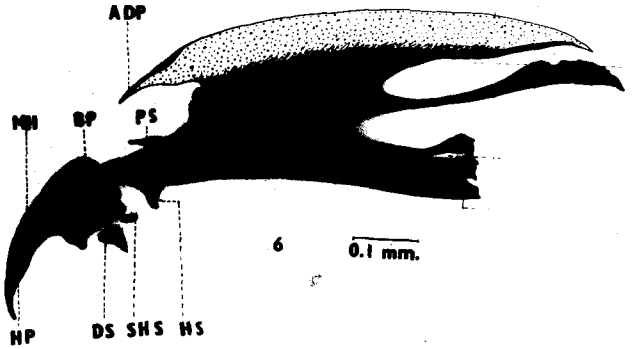
PLATE XXXXIV











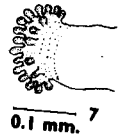
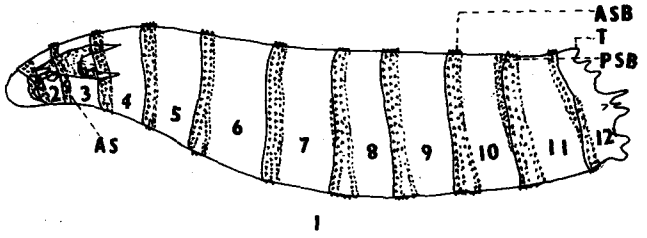
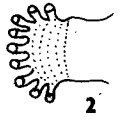
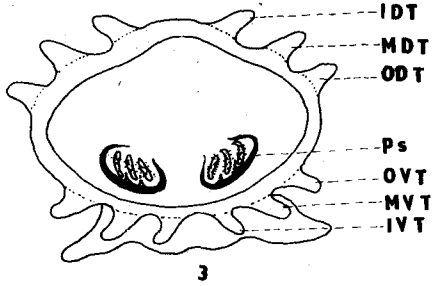
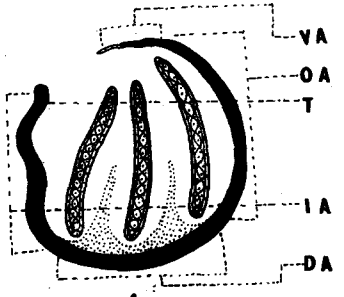


PLATE XXXXIII









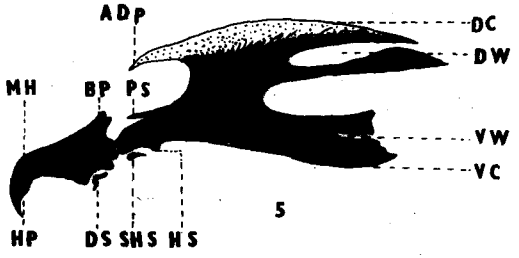


PLATE - XXXVI // Figs. 1-8 //

Paragarcophaga (Liogarcophaga) dux (Thomson) - Larva

1. First instar larvae (entire)
2. Cephalopharyngeal skeleton (first instar)
3. Cephalopharyngeal skeleton (second instar)
4. Anterior spiracle (second instar)
5. Posterior spiracle (second instar)
6. Cephalopharyngeal skeleton (third instar)
7. Anterior spiracle (third instar)
8. Posterior spiracle (third instar)

PLATE - XXXV // Figs. 1-8 //

Paragarcophaga (s.str.) orchidea (Boettcher) - Larva

1. First instar larvae (entire)
2. Cephalopharyngeal skeleton (first instar)
3. Cephalopharyngeal skeleton (second instar)
4. Anterior spiracle (second instar)
5. Posterior spiracle (second instar)
6. Cephalopharyngeal skeleton (third instar)
7. Anterior spiracle (third instar)
8. Posterior spiracle (third instar)

PLATE XXXXVI

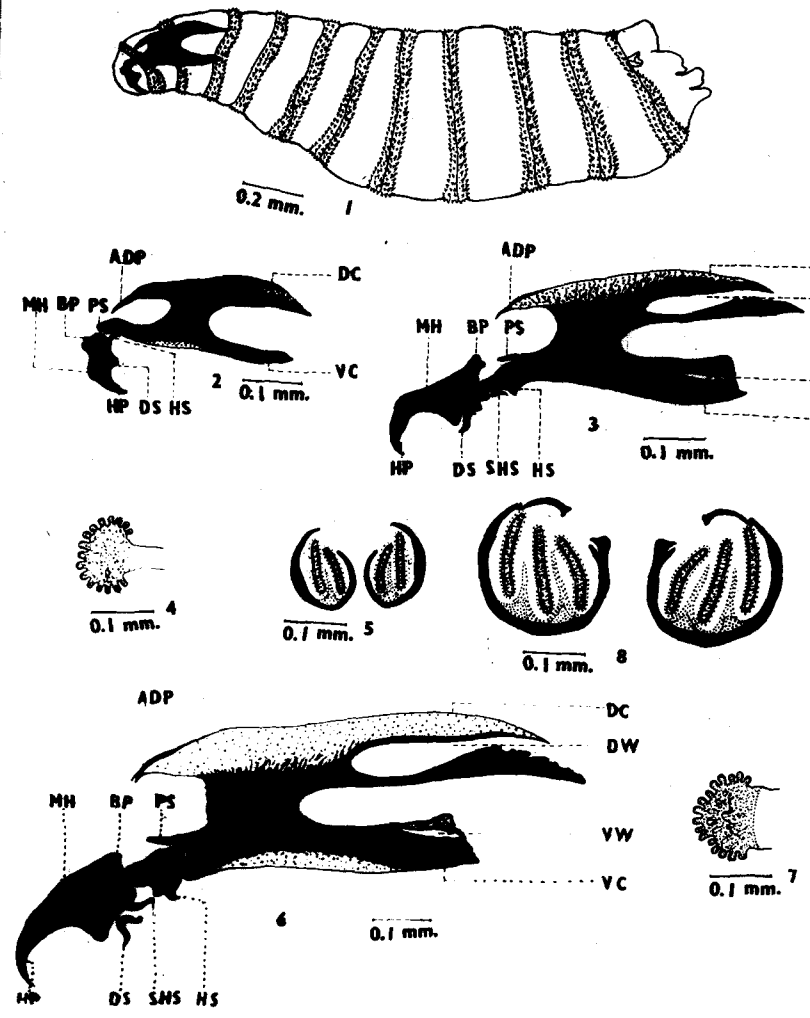


PLATE XXXXV

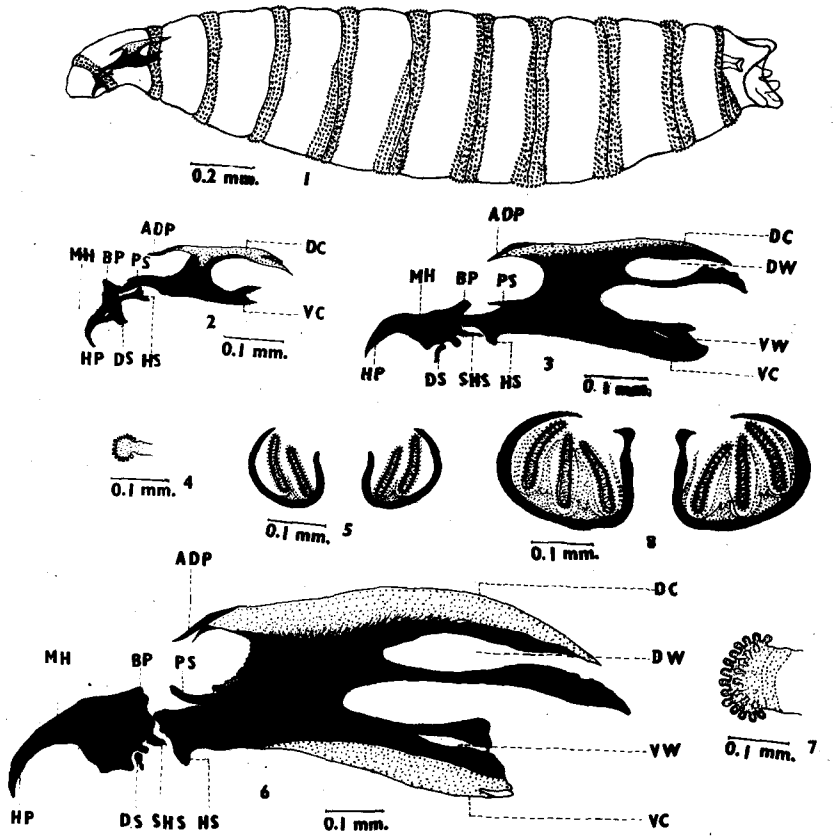


PLATE - XXXVII // Figs.1-8 //

Parasarcophaga (Liosarcophaga) brevicornis (Ho)
Larva

1. First instar larvae (entire)
2. Cephalopharyngeal skeleton (first instar)
3. Cephalopharyngeal skeleton (second instar)
4. Anterior spiracle (second instar)
5. Posterior spiracle (second instar)
6. Cephalopharyngeal skeleton (third instar)
7. Anterior spiracle (third instar)
8. Posterior spiracle (third instar)

PLATE - XXXVIII // Figs.1-8 //

Parasarcophaga (Liopygia) ruficornis (Fabricius)
Larva

1. First instar larvae (entire)
2. Cephalopharyngeal skeleton (first instar)
3. Cephalopharyngeal skeleton (second instar)
4. Anterior spiracle (second instar)
5. Posterior spiracle (second instar)
6. Cephalopharyngeal skeleton (third instar)
7. Anterior spiracle (third instar)
8. Posterior spiracle (third instar)

PLATE XXXXVII

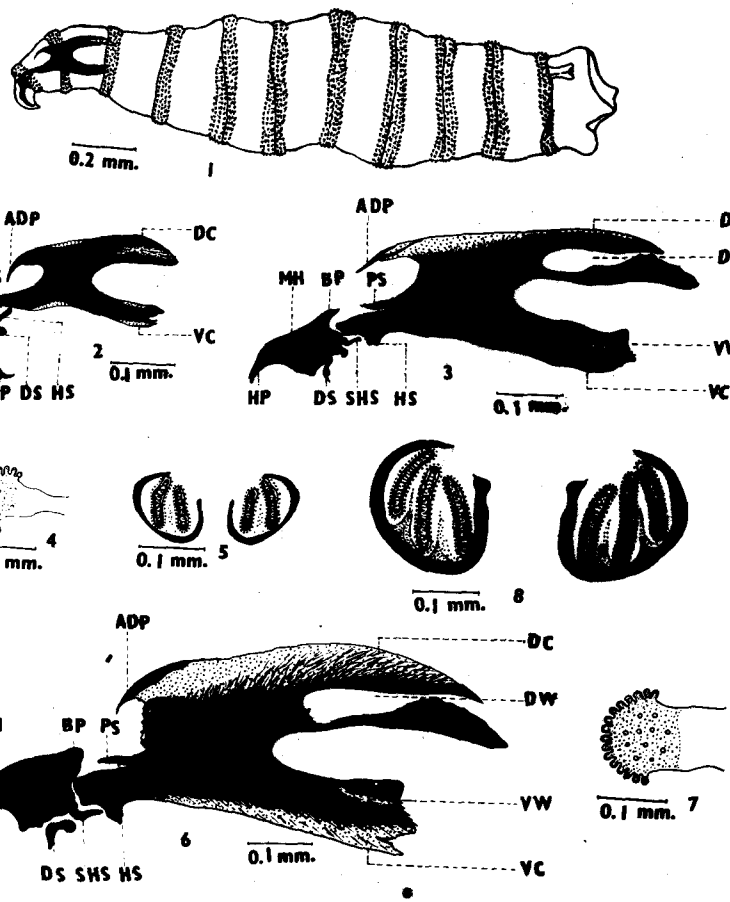
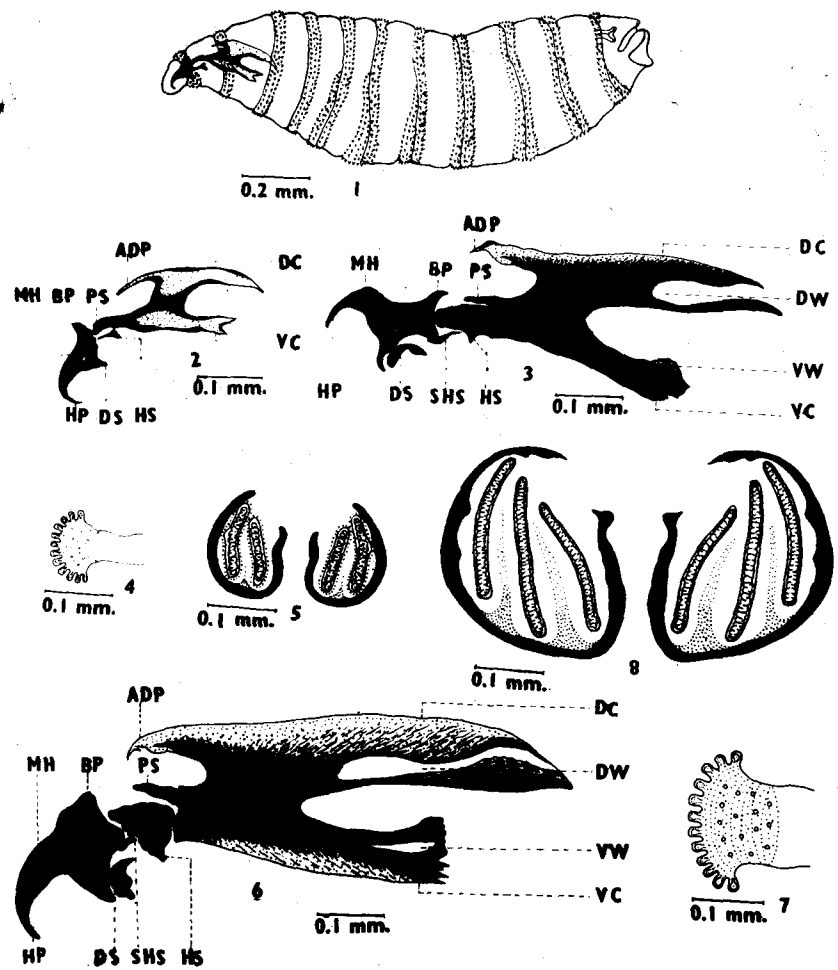



PLATE XXXXVIII